Maynooth and Environs Area Based Transport Assessment

Volume 2 – Appendices

March 2023

Maynooth and Environs ABTA

Volume 2 Appendices

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Appendix A: Baseline Report

Maynooth & Environs Area Based Transport Assessment

Part 1 - Baseline Assessment

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1. Introduction

1.1 Context

AECOM have been appointed by Kildare County Council (KCC) to prepare an Area Based Transport Assessment (ABTA) for Maynooth and its environs. The Maynooth and Environs ABTA (MEABTA) aims to secure long-lasting transport improvements in Maynooth to ensure growing use of sustainable travel modes for work, education, business, social, shopping and visitor trips. The purpose of the Baseline Assessment is to provide context for the development of the MEABTA. The Baseline Assessment reviews the policy background, the local urban area, key transport indicators, survey data and initial public and stakeholder consultation results. The Baseline Assessment considers the implications of this data to identify issues across all transport modes; road, parking, rail, bus, cycling and walking. Building on the conclusions of the Baseline Assessment, numerous options will be developed for each mode of transport and brought forward for further assessment to create the draft MEABTA.

1.2 Project Background

The population of Maynooth was 14,585 in 2016, which is an increase of 2,075 people since the 2011 Census, showing that Maynooth has experienced significant population growth in recent years. The periphery of the town has expanded in recent decades to accommodate this growth, which has increased internal trip distances from the suburbs to the town centre, university, and schools. Maynooth contains a major university, and this attracts a large volume of student and worker trips each day, which can create capacity issues for the transport system at peak times. Maynooth is located on the Royal Canal, which is part of the future greenway network, and it has access to the National Road Network via the M4 motorway to the south. Maynooth is part of the Dublin Bus network and it has train services via a station on the Dublin-Sligo railway line which is served by regular inter-city and Dublin commuter services. The central train station is an advantage in respect to sustainable travel and there is the potential to improve access to the station to promote non-car alternatives. At present, there are substantial levels of car dependency among Maynooth residents despite the range of non-car alternatives available in the town, with 66% of work trips and 26% of education trips taking place by private motor vehicle. Reducing this level of car dependency and the emissions associated with car travel will be an essential component of the MEABTA, particularly as Maynooth has been selected by Kildare County Council as a Decarbonising Zone (DZ)[1].

The MEABTA aims to provide a multi-modal framework to inform future transport infrastructure planning, investment and delivery. The MEABTA will inform the development of the Draft Maynooth and Environs Local Area Plan 2024-2030 (Joint LAP) which will be prepared by KCC in cooperation with Meath County Council, in line with the proposals in the Kildare County Development Plan 2023-2029 and relevant national and regional policy. The MEABTA is focused on sustainability, which in practice means supporting compact urban growth, encouraging modal shift from car to sustainable transport modes, improving access to the university by non-car alternatives and promoting Maynooth Town Centre as the core of economic and social activity in the settlement. The MEABTA aims to make Maynooth a more attractive town to live, work, study, visit and recreate in for residents and visitors.

1.3 Preliminary Aims of the Maynooth Area Based Transport Assessment

The preliminary aims of the MEABTA are to achieve the following:

- The MEABTA will focus on sustainability by encouraging compact growth and a modal shift away from car transport.
- The MEABTA will promote Maynooth Town Centre as the core of activity and improve its transport system, making the town centre a more attractive place to live, work, visit and recreate in.
- The MEABTA will examine all transport modes and how they interact in both the town centre and its environs. Focus will be placed on links between residential and employment areas, as well as the town centre, university and railway station.
- The MEABTA will seek to increase the number of trips to Maynooth University completed by sustainable travel modes.
- The MEABTA will prioritise walking, cycling and public transport accessibility.

[1] Each local authority in Ireland was required to identify and develop plans for one DZ as a result of an action in the 2019 Climate Action Plan. A DZ is a spatial area in which a range of climate mitigation, adaption and biodiversity measures and action owners are identified to address local low carbon energy, greenhouse gas emissions and climate needs to contribute to national climate action targets.

- The MEABTA will examine and provide recommendations for: Walking, Cycling, Public Transport, Parking and Traffic.

The Baseline Assessment will inform the development of MEABTA objectives which will be grouped by each transport mode: public transport, walking, cycling, road and parking. The MEABTA objectives will be used to assess the options created in the next stage of the ABTA process to resolve the transport issues identified in the Baseline Assessment.

1.4 Study Area

The study area boundary for the MEABTA is shown in Figure 1-1 as a red line. The study area encompasses the built-up urban area of Maynooth and some of the rural periphery which may accommodate new development areas in the future. The rural area north of the River Rye (which runs from the north of the study area to the northeast as shown in Figure 1-1) is located in County Meath. This is included in the study area because any future development in this area will impact on Maynooth and needs to be considered as part of the MEABTA.

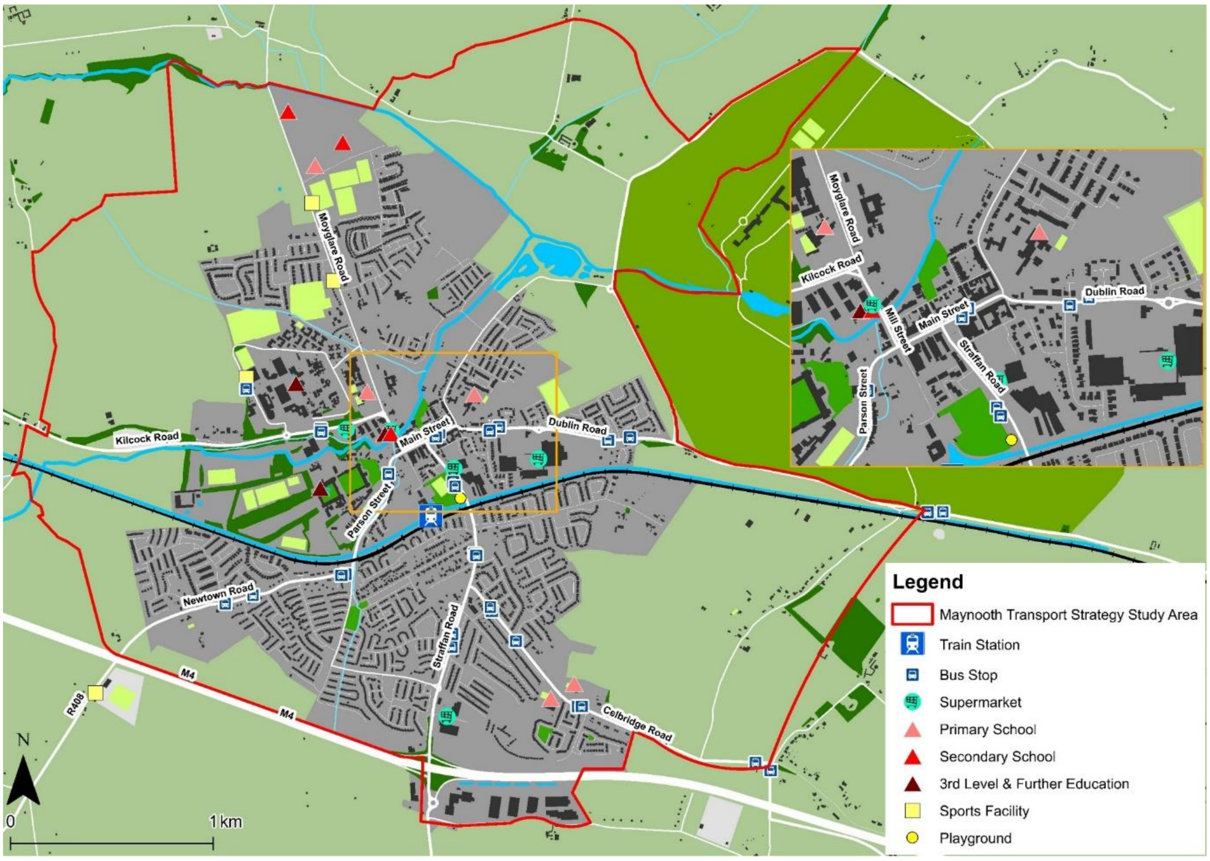

Figure 1-1 Maynooth Area Based Transport Assessment Study Area

1.5 Report Structure

The MEABTA Baseline Assessment is structured as follows:

2. Policy Context

   This section reviews the relevant national, regional and local planning policy.

3. Settlement Context

   This section reviews key demographic data regarding population change, land-use composition, job density, housing density, deprivation index, environmental constraints and education facilities to assess the implications for transport and identify issues to resolve in option development.

4. Transport Context

   This section reviews key transport information regarding public transport provision, the road network, collisions, modal split, origin-destination of trips, trip length, traffic growth, Strava walking/cycling data and permeability.

5. Public and Stakeholder Consultation

   This section provides a summary of the Phase 1 consultation results.

6. Surveys

   This section summarises the data collected during the surveys.

7. Conclusion and Next Steps

   This section concludes on the key outcomes of the Baseline Assessment in a Strengths, Weaknesses, Opportunities, Threats (SWOT) diagram and outlines the next steps in the ABTA process.

2. Policy Context

This section reviews relevant national, regional and local policy documents to highlight transport proposals or planned infrastructure which will affect the MEABTA study area.

2.1 National Policy

2.1.1 Climate Action and Low Carbon Development (Amendment) Act 2021

The Climate Action and Low Carbon Development (Amendment) Act 2021, which was passed into law in July 2021, consists of a series of significant amendments to the Climate Act of 2015. The Act commits to pursue and achieve the transition to a climate resilient, biodiversity-rich, environmentally sustainable and climate-neutral economy by 2050. It also commits to a 51 percent reduction in emissions by 2030 compared to 2018 levels, which is a key commitment of the Programme for Government. Some of the other key elements of the Act include the following:

- Government is required to adopt a series of economy-wide five-year carbon budgets, including sectoral targets for each relevant sector starting in 2021;
- Actions for each sector will be detailed in the Climate Action Plan, updated annually;
- A national, long-term Climate Action Strategy will be prepared every five years;
- Government Ministers will be responsible for achieving the legally binding targets for their own sectoral area with each Minister accounting for their performance towards sectoral targets and actions before an Oireachtas Committee each year;
- The Climate Change Advisory Council is to be expanded and will have a strengthened role, including proposing carbon budgets to the Minister;
- Each local authority will be required to prepare a Climate Action Plan, which will include both mitigation and adaptation measures and be updated every five years; and
- Public Bodies will be obliged to perform their functions in a manner consistent with national climate plans and strategies and furthering the achievement of the national climate objective.

The Climate Action Plan 2021 was published by the Department of the Environment, Climate and Communications in November 2021. It replaces the 2019 Climate Action Plan and takes account of the new greenhouse gas emissions reduction targets which have been set out in the Climate Act. It sets out measures to be taken to reach targets in each sector of the economy.

2.1.2 National Planning Framework

Project Ireland 2040 – National Planning Framework (NPF) provides a high-level strategic planning framework to guide development and investment over the coming decades. The NPF contains a set of ten National Strategic Outcomes (NSOs) to guide future development and investment.

The NPF notes that Maynooth is located in the Eastern and Midland Region which has experienced high levels of population growth in recent decades, at more than twice the national growth rate. A population of 2.58 million is forecast in the Eastern and Midland Region by 2040; 500,000 more people than live there at present.

Key future planning, development and place-making policy priorities for the Eastern and Midland Region which are relevant to Maynooth include:

- "Enabling the complementary development of large and county towns in the wider Greater Dublin Area and Midland areas on the key strategic and public transport routes in a regionally co-ordinated manner, with an enhanced emphasis on measures to promote self-sustaining economic and employment-based development opportunities to match and catch-up on rapid phases of housing delivery in recent years."
- "Building on the progress made in developing an integrated network of greenways, blueways and peatways, that will support the diversification of rural and regional economies and promote more sustainable forms of travel and activity-based recreation utilising canal and former rail and other routes."

From the ten National Strategic Outcomes: NSO 1: Compact Growth, NSO 2: Enhanced Regional Accessibility and NSO 4: Sustainable Mobility are the most relevant to the MEABTA. Applicable objectives from the NPF's National Policy Objectives are as follows:

- NPO 27 states; "Ensure the integration of safe and convenient alternatives to the car into the design of our communities, by prioritising walking and cycling accessibility to both existing and proposed developments and integrating physical activity facilities for all ages."
- NPO 31 supports the expansion of the higher education facilities, particularly if this will support wider regional development.
- NPO 35 states that residential densities in settlements should be increased which is relevant to create urban centres which can support higher frequencies

of public transport. NPO 35 describes this as follows: "Increase residential density in settlements, through a range of measures including reductions in vacancy, re-use of existing buildings, infill development schemes, area or site-based regeneration and increased building heights."

2.1.3 National Development Plan (2021-2030)

The current National Development Plan (NDP), released in September 2021, for the years 2021 to 2030 sets out the investment priorities that underpin the successful implementation of the National Planning Framework. It is designed to guide national, regional and local planning and investment decisions in Ireland over the next decade. The NDP demonstrates the Government's commitment to meeting Ireland's infrastructure and investment needs over the next ten years, through a total investment estimated at €165 billion over the lifetime of the plan.

The NDP notes that DART+ West should shortly enter the statutory planning process and that additional train services on the Maynooth Line, prior to the introduction of DART+, will be in place by 2023. The M4 between Maynooth and Leixlip is a proposed national roads project in the NDP, which is subject to further approvals. The NDP has also highlighted the Maynooth University Technology Society and Innovation Building as a location of major regional investment for the Eastern and Midland Region to support skills development.

The NDP also describes support for minor regional and local roads projects which can demonstrate "significant benefit in areas such as support for the local economy and the Town Centre First policy, improved accessibility (including areas remote from the major national road network), protection of lifeline routes, and traffic management" or which will have a "significant and quantifiable economic impact".

2.1.4 National Investment Framework for Land Transport in Ireland

The Department of Transport has developed a new high-level strategic framework for prioritising future investment in the land transport network. It replaces the Strategic Investment Framework for Investment in Land Transport (SFILT) adopted in 2015. A public consultation process on a draft framework was undertaken between April and May of 2021. The final document was published at the end of 2021.

The framework document defines ten key transport challenges across the transport network, both today and in the future. Some of the ten challenges of most relevance to the MEABTA include:

- Decarbonising the transport sector while facilitating increased travel demand;
- Increasing sustainable mode share to reduce emissions and address urban congestion;

- Balancing the protection and renewal of existing assets with significant investment in new infrastructure within available resources; and

- Incorporating innovative and emerging technologies within the future transport system.

Four investment priorities are established to address the transport challenges identified in the framework, including: Decarbonisation, Protection and Renewal, Mobility of People and Goods in Urban Areas, and Enhanced Regional and Rural Connectivity. Future transport projects will need to align with these priorities to be considered for funding.

The four investment priorities are supplemented by modal and intervention hierarchies. The modal hierarchy represents the fact that sustainable modes, starting with active travel and then public transport, will be encouraged over private vehicles. Where more sustainable modes are unsuitable, the onus will be on project sponsors to demonstrate why they do not achieve the project objectives. Active travel is described in the document as the most sustainable mode of travel and it is noted that the attractiveness of active travel is dependent on infrastructure. However, it is also acknowledged that active travel, by itself, is less feasible over longer distance.

The intervention hierarchy is intended to ensure that investment is proportionate to problems identified and that the best use is made of existing assets. It sets out four high-level categories of investment. Maintaining the existing transport network will be given first priority, followed by maximising the value of the network through optimising its use. Upgrades to existing infrastructure ('improve') will be considered before new infrastructure. Where investment priorities cannot be met by maintaining or optimising existing infrastructure, appropriate improved and new infrastructure will continue to be part of future investment plans.

Chapter five of the document sets out some proposals for how the investment framework will be implemented in the coming years. One of the relevant aspects of this section is the fact that at each Decision Gate in the future appraisal and funding process, a project's strategic fit with the framework's Investment Priorities will need to be assessed. Sponsoring agencies will be required to demonstrate that the development and appraisal of options adhere to the principles of the modal and intervention hierarchies. Specific guidance on how to meet these requirements will be set out in the Common Appraisal Framework for Transport Projects and Programmes (CAF).

2.1.5 Sustainable Mobility Policy Review

The Department of Transport's National Sustainable Mobility policy, published in April 2022, sets out a strategic framework to 2030 for active travel and public transport to support Ireland's overall requirement to achieve a 51% reduction in carbon emissions by the end of this decade. It includes a vision for sustainable mobility in Ireland in 2030 ‘to connect people and places with sustainable mobility that is safe, green, accessible and efficient’. The Policy builds on and replaces previous active travel and public transport policy as set out in the 2009 policy documents - Smarter Travel: A Sustainable Transport Future and the National Cycle Policy Framework.

Sustainable mobility is defined in the policy as: ‘Connecting people and places in a sustainable way by supporting:

- Safe, accessible, comfortable and affordable journeys to and from home, work, education, shops and leisure;
- Travel by cleaner and greener public transport; and
- A shift away from the private car to greater use of active travel and public transport.
- The policy seeks to deliver at least 500,000 additional daily active travel and public transport journeys and a 10 percent reduction in kilometres driven by fossil fuelled cars by 2030.

The policy approach set out to achieve a more sustainable transport sector is based on the ‘Avoid-Shift-Improve’ principle which encompasses measures to reduce the frequency and distance of trips, move towards more environmentally friendly modes of transport, and promote efficient fuel and vehicle technologies.

The policy is guided by three key principles which are underpinned by ten high-level goals. There are five goals under the ‘Safe and Green Mobility’ principle, including:

- Improve mobility safety;
- Decarbonise public transport;
- Expand availability of sustainable mobility in metropolitan areas;
- Expand availability of sustainable mobility in regional and rural areas; and
- Encourage people to choose sustainable mobility over the private car.

There are three goals under the ‘People Focused Mobility’ principle, including:

- Take a whole of journey approach to mobility, promoting inclusive access for all;
- Design infrastructure according to Universal Design Principles and the Hierarchy of Road Users model; and

- Promote sustainable mobility through research and citizen engagement.

There are two goals under the ‘Better Integrated Mobility’ principle, including:

- Better integrate land use and transport planning at all levels; and
- Promote smart and integrated mobility through innovative technologies and development of appropriate regulation.

Almost all of the above goals are highly relevant to the MEABTA. Goal 9, which aims to ‘support compact growth and transport-orientated development through better integrated land use and transport planning’ is of particular relevance. Under the heading of Goal 9, the benefits of a transport-orientated development approach and the importance of local transport plans prepared using the ABTA guidance are highlighted. Alongside metropolitan area transport strategies, local transport plans are stated to be key for ‘coordinating the delivery of multi-modal transport infrastructure and the integration of land use and transport planning at metropolitan and local level’. Related to this, the policy also notes that the Department of Housing, Local Government and Heritage intend to publish ‘Sustainable Compact Settlement Guidelines’ which will supersede existing 2009 Sustainable Residential Development in Urban Areas Guidelines for Planning Authorities. The new guidance will place a renewed emphasis on compact growth and on achieving a greater intensity of uses in central locations and in close proximity to high quality public transport services.

2.1.6 Programme for Government: ‘Our Shared Future’ (2020)

The Programme for Government commits to a ‘fundamental change in the nature of transport in Ireland’ and ‘unprecedented modal shift in all areas’ by a reorientation of investment to walking, cycling and public transport. It states that Government needs to make every effort to make active travel and public transport better and more accessible in order to achieve necessary improvements to climate, quality of life, air quality and physical and mental health.

The Government is committed to a 2:1 ratio of expenditure between new public transport infrastructure and new roads over the lifetime of the Government, while maintaining funding for essential road and public transport maintenance and upkeep. The Government will also prioritise plans for the delivery of Metrolink, Luas and other light rail expansion, DART expansion and interconnector and BusConnects in Dublin, Cork, Galway, and Limerick. It notes that investment in new roads infrastructure will continue, to ensure that all parts of Ireland are connected to each other.

In addition to these funding commitments, the Programme also commits to a number of other measures which are relevant to the MEABTA including:

- Enhance suburban and commuter rail across the country;

- Mandate that every local authority adopts a high-quality cycling policy, carries out an assessment of their roads network and develops cycle network plans;
- Dramatically increase the number of children walking and cycling to primary and secondary school; and
- Lead the development of an integrated national greenways strategy to develop a network of greenways to be used by commuters, leisure cyclists and tourists.

2.1.7 Road Safety Strategy 2021 – 2030

A new government Road Safety Strategy was published at the end of 2021. The development of the strategy was led by the Road Safety Authority (RSA) and involved extensive engagement with key stakeholders as well as an open public consultation. Underpinning the strategy is Ireland's long-term goal of achieving Vision Zero (i.e., zero road deaths or serious injuries) by 2050. The strategy notes that Ireland has also set a target to reduce road deaths and serious injuries by 50 percent by 2030, in line with the EU. In the 2021-2030 strategy, seven 'Safe System' priority intervention areas have been identified. Of these, four are particularly relevant to the MEABTA.

- **Safe roads and roadsides**: to improve the protective quality of our roads and infrastructure.
- **Safe speeds**: to reduce speeds to safe, appropriate levels for the roads being used, and the road users using them.
- **Safe road use**: to improve road user standards and behaviours in line with traffic legislation, supported by enforcement.
- **Safe and healthy modes of travel**: to promote and protect road users engaging in public or active transport.

The 2021-2030 strategy will feature three phases of action plans. The first action plan (2021-2024) contains 186 different actions, the first fifty of which are described as 'high impact actions'. Some of the actions which may have particular relevance for the MEABTA are listed below.

- Action no. 5: over the period 2021 to 2025, 1,000 km of segregated walking and cycling facilities will be constructed or under construction on the national, local and regional road network.
- Action no. 6: a working group will be established to examine and review the framework for the setting of speed limits and as part of this review, specific

consideration will be given to the introduction of a 30kph default speed limit in urban areas.

- Action no 8: expand speed management measures on National, Regional and Local roads (including the use of average speed cameras).
- Action no. 40: continue to implement an active travel infrastructure scheme.
- Action no. 41: encourage modal shift to support Environmental, Safety and Health objectives by promoting the use of sustainable and active modes of travel.
- Action no. 68: each local authority to publish/renew their prioritised plan on road building construction and maintenance (including footpaths and cycle lanes) on an annual basis.
- Action no. 78: extend the number of 30kmh speed limit zones in high-risk locations (urban city/town centres) for Vulnerable Road Users in line with best practice models.
- Action no. 79: examine the feasibility of 30kmh speed limit or lower in school vicinities and report on progress.
- Action no. 134: the Department of Transport will introduce necessary legislation for the safe use of e-scooters on Irish roads in Q1, 2022.
- Action no. 177: roll-out the Safe Routes to Schools Programme and provide ‘front-of-school’ treatments to a minimum of 500 schools.

2.1.8 Ministerial Guidelines - Spatial Planning and National Roads: Guidelines for Planning Authorities

These guidelines set out planning policy considerations relating to development affecting national primary and secondary roads, including motorways and associated junctions, outside the 50-60 kmh speed limit zones for cities, towns and villages.

The guidelines highlight five overarching key principles which include:

- Land-use and transportation policies are highly interdependent
- Proper planning is central to ensuring road safety
- Development should be plan-led
- Development Management is the key to Plan Implementation

- Planning Authorities and the National Roads Authority and other public transport bodies must work closely together

The guidelines provide direction on the requirements of Development Plans and Local Area Plans with regards to the objectives, polices to be considered and consultation of other stakeholders during the development of the plan. They provide detail on how to interact with the national road network in terms of future alignments or accesses from new or proposed developments. The guidelines also provide details on the management of developments in relation to the national roads.

2.2 National Guidance

2.2.1 Design Manual for Urban Roads and Streets

The Design Manual for Urban Roads and Streets (DMURS) provides guidance relating to the design of urban roads and streets, placing a strong emphasis on designs that prioritise the needs of pedestrians, cyclists and public transport users and reduce the dominance of the private car in our urban landscapes. The Manual presents an integrated design approach, which means the design must be:

a. Influenced by the type of place in which the street is located; and

b. Balance the needs of all users.

The Manual is applicable in the design of urban roads and streets with a speed limit of 60 km/h or less.

2.2.2 Traffic Management Guidelines 2019

The Traffic Management Guidelines (TMG) provide guidance on traffic planning, traffic calming and management, incorporation of speed restraint measures in new residential designs and the provision of suitably designed facilities for public transport users and for vulnerable road users. The TMG's also focus on how these issues must be examined and implemented in the context of overall transportation and land use policies. The function of the TMG's is to provide guidance on the appropriateness and scale of interventions in the public realm on a mode specific basis, helping to coordinate the design approach of these interventions.

2.2.3 TII Publications

TII Publications are the Government recommended standards and guidance for the national roads network and associated infrastructure. These standards detail the requirements that support policy, administrative and technical procedures developed by TII to govern activities with respect to the National Road network.

2.3 Regional Policy

2.3.1 Regional Spatial and Economic Strategy for the Eastern and Midland Region 2019-2031

The Regional Spatial and Economic Strategy (RSES) for the Eastern and Midland Region 2019-2031 sets out a framework to direct future growth of the Region over the medium to long term. The RSES will help implement the strategic planning framework set out in the NPF.

Four regional policy objectives are included in the RSES for Maynooth:

- RPO 4.33: Support the continued development of Maynooth, co-ordinated with the delivery of strategic infrastructure including pedestrian and cycle linkages within the town and to the Royal Canal Greenway, DART expansion and road linkages forming part of the Maynooth Outer Orbital Route in a manner which supports future development and population growth and builds on synergies with Maynooth University promoting a knowledge-based economy.

- RPO 4.34: Support Maynooth as a key town to act as an economic driver for north Kildare and provide for strategic employment at key locations to improve the economic base of the town and provide for an increased number of local jobs.

- RPO 4.35: A cross boundary Joint Local Area Plan (LAP) shall be prepared by Kildare County Council and Meath County Council to provide a co-ordinated planning framework for the Maynooth area. The Joint LAP shall identify a boundary for the plan area, strategic housing and employment development areas and infrastructure investment requirements and promote greater co-ordination and sequential delivery of serviced lands for development.

- RPO 4.36: To promote the consolidation of the town centre with a focus on the regeneration of underused buildings and strategic sites and the establishment of residential uses to encourage greater vibrancy outside of business hours and the enhancement of the public realm.

The RSES Settlement Strategy identifies Maynooth as being within the Dublin Metropolitan Area on the North-West Corridor and Maynooth is included in the Dublin Metropolitan Area Strategic Plan (MASP). The MASP sets out a strategic planning and investment framework for the Dublin Metropolitan area over the next 12 to 20 years. It provides a vision for the future growth of the metropolitan area, direction for large scale strategic residential and regeneration efforts and also indicates a sequence of infrastructure priorities. Maynooth was identified as one of three key towns within the MASP. This means it will be allocated substantial additional population growth in the period to 2031 under the provisions of NPO 68 of the National Planning Framework (NPF), which enables up to 20 percent of the phased population growth targeted in the principal city and suburban area to be transferred to the wider metropolitan area, in addition to growth identified for the Metropolitan area. This growth is in addition to the growth identified by the Kildare County Development Plan.

Within the MASP, the Railpark lands east of Maynooth town centre, along with lands to the north and west of the town were identified as areas which could cater for significant additional residential capacity. Phasing works and enabling infrastructure identified for Maynooth included the DART expansion; M4 Maynooth to Leixlip; a new bridge over the railway line; Maynooth Outer Orbital route; and local water network upgrades. A new research and technology park adjoining the University was identified as an employment generation centre. The Royal Canal Greenway was highlighted as an important amenity and has the potential to support recreational tourism. It was also noted that the greenway will connect to the Dublin-Galway EuroVelo route.

2.3.2 Draft Transport Strategy for Greater Dublin Area 2022-2042

The Transport Strategy for the Greater Dublin Area 2022-2042 (the strategy) replaces the previous regional transport strategy published in 2016. The new draft strategy was published by the NTA in November 2021 for public consultation. The overall aim of the strategy is:

> "*To provide a sustainable, accessible and effective transport system for the Greater Dublin Area which meets the region's climate change requirements, serves the needs of urban and rural communities, and supports economic growth*".

The strategy notes that a wide range of challenges facing transport in the GDA were taken into account in formulating the strategy, including:

- Climate Change;
- Recovery from the Covid-19 pandemic;
- Servicing legacy development patterns, in particular low density, car-dependent suburban areas;
- Revitalisation of Dublin City Centre and town centres across the region, informed in particular by recent Covid-19 experiences;
- Transformation of the urban environment, including a re-balancing of road space to favour sustainable transport modes and a strong focus on investment in the public realm;

- Ensuring access for all, in accordance with the principles of Universal Design;
- Serving rural needs, by acknowledging, protecting and enhancing the socio-economic and cultural fabric of rural areas;
- Improving health and equality;
- Fostering economic development; and
- Delivering transport schemes.
- Four objectives were established for the strategy as outlined below:
- To create a better environment and meet our environmental obligations by transitioning to a clean, low emission transport system, reducing car dependency, and increasing walking, cycling and public transport use.
- To enhance the health and quality of life of our society by improving connectivity between people and places, delivering safe and integrated transport options, and increasing opportunities for walking and cycling.
- To support economic activity and growth by improving the opportunity for people to travel for work or business where and when they need to and facilitating the efficient movement of goods.
- To deliver a high quality, equitable and accessible transport system, which caters for the needs of all members of society.

The strategy contains numerous measures and a large proportion of these are relevant to the MEABTA, but they are too numerous to list here. However, several measures particularly stand out as important considerations in the development of the MEABTA and the new Joint LAP, which are listed below:

- **Measure PLAN5 – Transit-Oriented Development**: The NTA will continue to support and facilitate the delivery of Transit-Oriented Development at locations identified as appropriate for such.
- **Measure PLAN7 – Filtered Permeability**: Development Plans, SDZ Planning Schemes and Local Area Plans in the GDA should ensure that the road and street networks in new development areas are designed on the basis of providing for filtered permeability and should incorporate measures which deliver filtered permeability in existing neighbourhoods.
- **Measure PLAN14 – Reallocation of Road Space**: The NTA, in conjunction with the local authorities, will seek the reallocation of road space in Dublin City

Centre, Metropolitan towns and villages, and towns and villages across the GDA to prioritise walking, cycling and public transport use and prioritise the placemaking functions of the urban street network.

- **MEASURE PLAN16 – The Road User Hierarchy**: The NTA, in the decision-making process around the design, planning and funding of transport schemes in the GDA, will be guided by the priority afforded to each mode in the Road User Hierarchy as set out in the Transport Strategy.

- **Measure INT5 – Interchange**: It is the intention of the NTA, in conjunction with local authorities and transport operators, to ensure that passengers wishing to change between services on the transport network are provided with a safe, convenient and seamless interchange experience.

- **Measure RAIL1 – DART+**: The DART+ Programme will be implemented, providing electrified services to Drogheda in the north and Maynooth plus Celbridge in the west.

- **Measure RAIL6 – New Rail Stations**: The NTA, in conjunction with Irish Rail, will develop new rail stations at Cabra, Glasnevin, Heuston West, Kylemore, Woodbrook, west of Sallins, west of Louisa Bridge and west of Maynooth. Kishoge station will also open in the short term as development of the Clonburris SDZ is realised. Other stations will be considered where development patterns support such provision.

- **Measure ROAD1** – **Principles of Road Development:** This measure includes seven principles for road development within the GDA. The first of these is that there will be no significant increase in capacity for private car trips on radial roads within the Metropolitan Area, except where re-alignments or junction changes are necessary for safety reasons.

- **Measure ROAD3 – National Roads Projects:** It is the intention of the NTA and TII to deliver the national road schemes listed in the Transport Strategy subject to their appraisal against national and regional policies and objectives. The national road schemes listed in the strategy alongside this measure include: ‘improvements to junctions 5,6 and 7 on the M4 in order to address queuing onto the mainline and associated traffic safety issues plus the provision of bus priority between Junctions 5 and 7.

2.3.3 Greater Dublin Area Cycle Network Plan

The first Greater Dublin Area Cycle Network Plan published in 2013, set out the National Transport Authority’s plan for a cycle network throughout the Greater Dublin Area, comprising of an Urban Network, Inter-Urban Network and Green Route

Network for the seven Local Authority areas in the GDA. The Maynooth cycling routes identified within this first Plan were:

- K1 Royal Canal Greenway (NCN Corridor 2);
- M1 NUIM and Moyglare Road - Leinster (Main Street) - R148 Dublin Road towards the Intel plant at Leixlip and with a link to the Royal Canal Greenway about 1.5km east of the town edge;
- M2 Straffan Road;
- M3 Celbridge Road; and
- M4 Rathcoffey Road.
- Rural Cycle Routes Connecting to Maynooth within the Plan were:
- K2 Celbridge to Maynooth along local road through Ballygoran south of the busy R405; and
- K5 Maynooth - Rathcoffey (to Clane via K6 & K3).

Figure 2-1 illustrates the proposed network for Maynooth included in the first GDA Cycle Network Plan.

Figure 2-1 2013 Greater Dublin Area Cycle Network Plan – Sheet N16: Proposed Cycle Network Maynooth, Celbridge & Leixlip

The GDA Draft Cycle Network Plan 2021 was published in November 2021 as one of the supporting documents for the new GDA Transport Strategy. This document sets out four goals for the GDA Cycle Network, including:

- Increase participation
- Improve safety and accessibility
- Improve connectivity
- Create a navigable and coherent network

The updated Cycle Network Plan includes a revised set of link classifications as shown in Figure 2-2. The document outlines that investment in the network will be targeted where it delivers on the greatest need for many users, while also taking cognisance of specific areas of need (such as schools, educational institutions, and transport hubs). Cyclists can expect the most comfortable, direct facilities on the Primary networks, followed by Secondary networks.

Figure 2-2 Draft 2021 GDA Cycle Network Plan – Link Classifications

Figure 2-3 shows the proposed network in the Maynooth, Celbridge and Leixlip area as set out in the draft 2021 Cycle Network Plan. Not all link classifications are shown in the maps that have been published and as a result, the status of proposed inter-urban and feeder links which were included in the previous Cycle Network Plan is unclear. Some of the other key differences between the previously proposed network and the 2021 proposed network include:

- A secondary route is now proposed between Celbridge and Maynooth, utilising the R405;
- The previously proposed primary/secondary route on the Kilcock Road has been removed from the proposed network; and
- A secondary route is proposed to connect Celbridge Road and Dublin Road (along the Maynooth Eastern Ring Road (MERR).

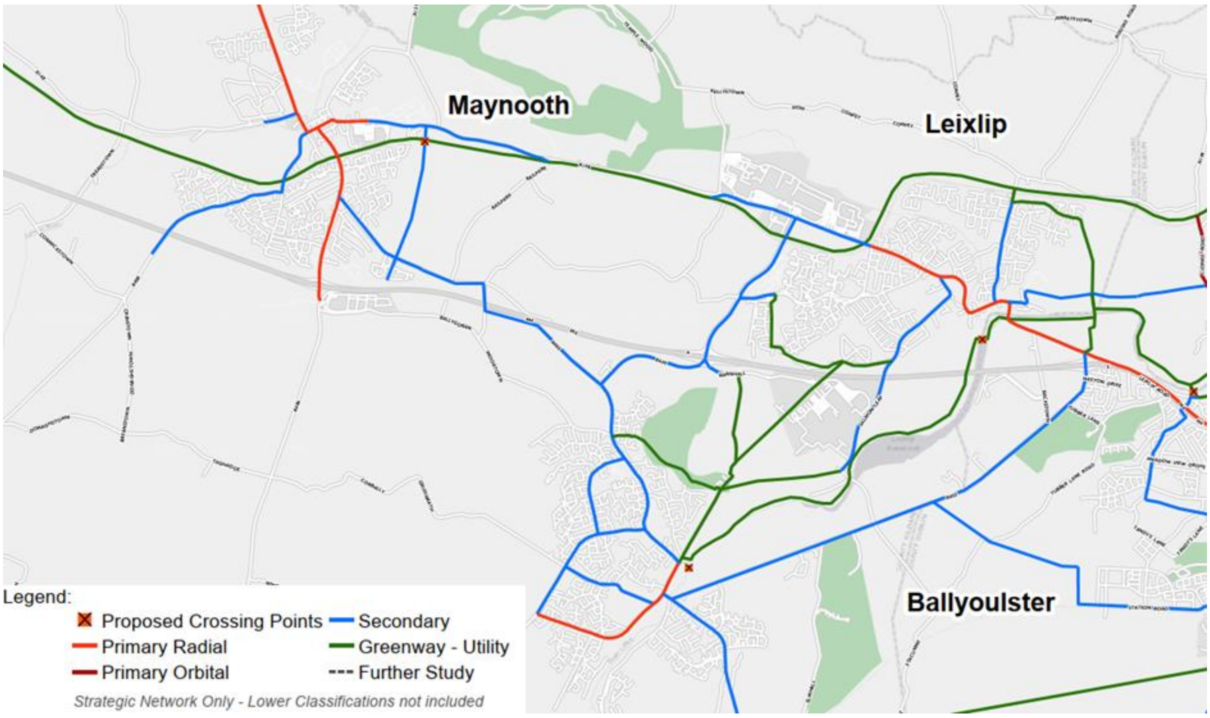

Figure 2-3 Draft 2021 GDA Cycle Network Plan – Proposed network in Maynooth, Celbridge & Leixlip area (as per Map Set 2)

2.4 Local Policy

2.4.1 Draft Kildare County Development Plan 2023 – 2029

A new Draft Kildare County Development Plan (CDP) was published by KCC in March 2022 for public consultation. Volume 1 of the Draft CDP (the Plan) is the main body of the document and contains the Vision, Core Strategy, development management standards and the overarching policies and objectives off the Plan.

The 'Strategic Vision' for the County as outlined in the Plan is:

- "To build on the strengths of the county in order to improve the quality of life of all residents, through the creation of high-quality job opportunities, by the provision of high-quality residential development supported by adequate community infrastructure, through the provision of a high-quality sustainable transport network, by healthy placemaking and transformational regeneration, by supporting the transition to a low carbon climate resilient environment, by embracing inclusiveness and by enhancing our natural and built environment for future generations."

Each chapter identifies an 'Aim' supported by policies, objectives, actions and targets (as appropriate). Ten key 'overarching guiding principles' are set out in the first chapter, the first four of which have particular relevance to the MEABTA. These four are:

- To develop a county that is resilient to climate change, plans for and adapts to climate change and flood risk, facilitates a low carbon future, supports energy efficiency and conservation and enables the decarbonisation of our lifestyles and economy;
- To ensure the compact growth and regeneration of lands within all settlements across the Settlement Hierarchy;
- To promote the sustainable development of communities by locating residential, employment, social and community facilities in close proximity to each other; and
- To support national investment in public transport services to achieve the better integration of land uses and high-quality public transport provision and to reduce car dependency throughout the county.

Chapter 2 of the draft CDP contains the Core Strategy & Settlement Strategy. The Population and Housing Unit Targets table includes a population growth target for Maynooth of 2,741 between 2023-2028. It is noted alongside this target that an additional population allocation for Maynooth of up to 10,000 persons may result from the redistribution of the NPF City and Suburbs allocation (as per the provisions of NPO 68 as mentioned earlier). However, the precise allocation that will be attributed to Maynooth will be determined at LAP stage on foot of detailed assessments and audits of the available social and physical infrastructure.

Chapter 4 of the draft CDP discusses 'Resilient Economy & Job Creation'. It mentions that the Council is focussed on developing the Key Town of Maynooth as an 'economic driver' and 'strategic employment location' within the Metropolitan Area Strategic Plan (MASP). The joint LAP with Meath County Council will ensure the town can capitalise on opportunities for regeneration, consolidation and sequential growth and that infrastructural requirements to support sustainable growth are co-ordinated and delivered.

The following Sectoral Opportunities are identified for Maynooth within the Economic Development Hierarchy:

- Knowledge based employment focusing on ICT and manufacturing through the development of a research and technology campus;
- Further development of Maynooth University as a leading third level research and educational facility – potential synergies to large new and established employers; and

- Development of St Patrick’s College Campus for a mix of uses.

Chapter 5 of the draft CDP is focused on Sustainable Mobility and Transport. The ‘Aim’ set out is:

- “To promote and facilitate ease of movement within and access to County Kildare, by integrating sustainable land use planning and a high-quality integrated transport system; and to support and prioritise investment in more sustainable modes of travel, the transition to a lower carbon transport system, and the development of a safer, efficient, inclusive, and connected transport system”

There are numerous specific objectives and actions associated within each policy in the Chapter. All policies (excluding aviation related policies) are outlined below.

- **TM P1**: Promote sustainable development through facilitating movement to, from, and within the County that is accessible to all and prioritises walking, cycling and public transport.

- **TM P2**: Prioritise and promote the development of high-quality, suitable, safe and sustainable walking and cycling pathways and facilities, both inter-county, intra-county (in consultation with all relevant stakeholders including neighbouring local authorities) and within the towns and settlements of County Kildare within a safe road/street environment that will encourage a shift to active travel that is accessible for all, regardless of age, physical mobility, or social disadvantage.

- **TM P3**: Promote the sustainable development of the county by supporting and guiding national agencies in delivering major improvements to the public transport network and to encourage a shift from car-based travel to public transport that is accessible for all, regardless of age, physical mobility, or social disadvantage.

- **TM P4**: Ensure ongoing competitiveness and the efficient movement of people and goods in the county through the improvement and expansion of the road and street network within the county to support economic development and provide access to new and existing communities, employment areas and development, all while prioritising sustainable modes of transport.

- **TM P5**: Work with Transport Infrastructure Ireland to develop and operate the motorway network through the County and to ensure that the carrying capacity, efficiency and safety of the network and associated junctions is protected, maintained and improved and to prevent development that could hinder the future upgrading of motorway routes and interchanges.

- **TM P6**: Maintain and improve the capacity, safety and function of the regional road network (as finance becomes available) and to ensure that it is planned for and managed to enable the sustainable economic development of the county and wider area while encouraging a shift towards more sustainable travel and transport in accordance with the Core Strategy, the Spatial Planning and National Roads Guidelines (2012) and the Draft Transport Strategy for the Greater Dublin Area 2022-2042.

- **TM P7**: Ensure that the safety and capacity of the local road network is maintained and improved where funding allows and to ensure that local streets and roads within the county are designed to a suitable standard to accommodate sustainable modes of transport and the future needs of the county. These roads and streets should be appropriately designed for all road users regardless of age, physical mobility, or social disadvantage.

- **TM P8**: Ensure that streets and roads within the county are designed to balance placemaking and movement, to prioritise sustainable modes of transport and to provide a safe traffic calmed street environment in accordance with the principles set out in the Design Manual for Urban Roads and Streets (2019) while meeting the needs of road users of all ages and abilities.

- **TM P9**: Effectively manage and minimise the impacts of traffic in urban areas and prioritise the movement of pedestrians, cyclists and public transport particularly at key junctions, while maximising the efficient use of existing resources.

- **TM P10**: Balance the demand for parking against the need to promote more sustainable forms of transport, to limit traffic congestion and to protect the quality of the public realm from the physical impact of parking, while meeting the needs of businesses and communities

- **TM P11**: Ensure street lighting is provided in accordance with Kildare County Councils ‘Street Lighting and Planning Guidance’ policy document in either draft or adopted form. The document outlines the general principles and requirements for street lighting in the county.

The chapter sets out modal shift targets for trips to work and to education. These are described as ‘Interim targets’ until completion of a Sustainable Energy Climate Action Plan when a review will occur.

Table 2-1 Journeys to Work Mode Share Targets for County Kildare in draft CDP

Mode of Travel	2016 Baseline	Target Mode Share (Lifetime of CDP)
Walking	6%	20%
Cycling	1%	10%
Bus	5%	13%
Train	5%	14%
Car Share	4%	8%
Car (+ motorbike, scooter, van and lorry)	74%	50%
Working from Home	4%	No specific target

Table 2-2 Journeys to Education Mode Share Targets for County Kildare in draft CDP

Mode of Travel	2016 Baseline	Target Mode Share
Walking	28%	50%
Cycling	2%	15%
Public transport	20%	25%
Car (+ motorbike, scooter, van and lorry)	50%	40%

There are a number of objectives and actions throughout the Chapter which specifically mention Maynooth, as outlined below.

- **TM O11:** Investigate the feasibility of developing high-quality, suitable, safe and sustainable cycling pathways from Leixlip, Maynooth and Naas into Dublin (other connections also listed).

- **TM O12**: Promote and facilitate the implementation of public transport projects (bus and rail) and encourage transport providers and other agencies (e.g. NTA, developers etc.) to improve public transport (bus and rail) and to have regard to and support recently implemented and/or planned routes under NTA's Bus Connects and proposed / planned routes under NTA's Connecting Ireland Rural Mobility Plan; including:
    - 1. Kilcock, Maynooth and Leixlip into Dublin;
    - 2. Celbridge into Dublin;
    - 3. Maynooth to Naas;
    - 4. Celbridge to Naas;
    - 5. Naas to Caragh.
- **TM O25**: Ensure the provision of improved cycle and walking infrastructure linking Maynooth Town Centre, the Royal Canal Greenway, the train station, the proposed Maynooth Orbital Route and to Kilcock and Leixlip.
- **TM A7:** Investigate the feasibility of providing a footpath connection from Maynooth to Celbridge.
- **TM O46:** Support and facilitate, in co-operation with Irish Rail and the National Transport Authority the delivery of the following proposed new facilities to connect to the existing and proposed rail network including DART+:
    - New Sallins & Naas railway station, including park and ride facility (1 000 spaces).
    - Collinstown or Maynooth Station/Depot including park and ride facility (1 000 spaces – 500 initially).
    - Kill park and ride facility - bus based (500 spaces).
- **TM O59**: Support and facilitate in conjunction with Meath County Council, private developers and landowners, the construction of the Maynooth Relief Road.
- **TM O72**: Improve the safety and capacity at the M4 Maynooth Interchange (Junction 7) and investigate the provision of a future improved connection to the M4, either at the current location or elsewhere.
- **TM O108**: Minimise the impact of out-of-town parking on urban regeneration by ensuring adequate active transport infrastructure and/or public transport services

between parking facilities and urban centres such as Naas, Newbridge, Maynooth etc.

A table (5.4) within the 'Road and Street Network' part of the chapter identifies twenty-four 'Priority Road and Bridge Projects'. Three of these are located in Maynooth, including:

- **Outer Relief Road, Maynooth:** L1012 Moyglare Road and Dunboyne Road (Co. Meath) to be delivered by Meath County Council under Section 85 agreement;
- **Inner Relief Road, Maynooth**: R148 to L1012 c. 3km – Kilcock Road to Moyglare Road; and
- **Examine options for a Western Inner Relief Road in Maynooth:** From Kilcock Road to Rathcoffey/ Straffan road

Another table (5.5) within the same part of the chapter identifies forty-four regional roads for improvement. Five of these connect to Maynooth, including:

- R405 Maynooth to county boundary at Hazelhatch via Celbridge;
- R406 Maynooth to Barberstown;
- R408 Prosperous to Maynooth;
- R157 Junction with R148 at Maynooth to county boundary; and
- R148 County boundary at Leixlip to county boundary at Cloncurry via Maynooth and Kilcock.

2.4.2 Kildare County Development Plan 2017 – 2023

The Variation (No. 1) of the Kildare County Development Plan (CDP) 2017-2023 established a Municipal District system for local administration and Maynooth is designated within the Maynooth Municipal District area. Within the Settlement Hierarchy of the Development Plan, Maynooth is designated as a Key Town as shown in Figure 2-4. The RSES defines Key Towns as:

> *"Large economically active service and/or county towns that provide employment for their surrounding areas and with high-quality transport links and the capacity to act as growth drivers to complement the Regional Growth Centres."*

The development strategy for County Kildare *'is based on building strong urban centres while protecting the rural hinterlands'* and this strategy is informed by the RSES. The strategy will focus on achieving critical mass in the Metropolitan Area

Strategic Plan (MASP) area (Maynooth, Leixlip, Celbridge, Kilcock) and in the Key Towns of Naas and Maynooth. Chapter 2 of the CDP notes that the development of the part of Kildare in the MASP area will support the future growth of the Metropolitan Area through the strategic development of the North-West corridor which has been identified through MASP along the Maynooth/Dunboyne commuter line/DART. Economic clusters are promoted as part of the overall economic strategy. Maynooth is clustered with Leixlip, Celbridge and Kilcock. Clusters are to develop in a mutually dependent way, so that the amenities and economies of the whole cluster are greater than the sum of the individual parts.

Economic development policy CS 5 of the KCC core strategy seeks to support the development of the identified Key Towns of Naas and Maynooth and the Self-sustaining Growth Towns of Leixlip and Newbridge as focal points for regional critical massing and employment growth. Chapter 5 of the CDP notes a number of Sectoral Opportunities in Maynooth including: knowledge-based employment focusing on ICT and manufacturing through the development of a research and technology campus; further development of Maynooth University as a leading third level research and educational facility; and development of St Patrick’s College Campus for a mix of uses.

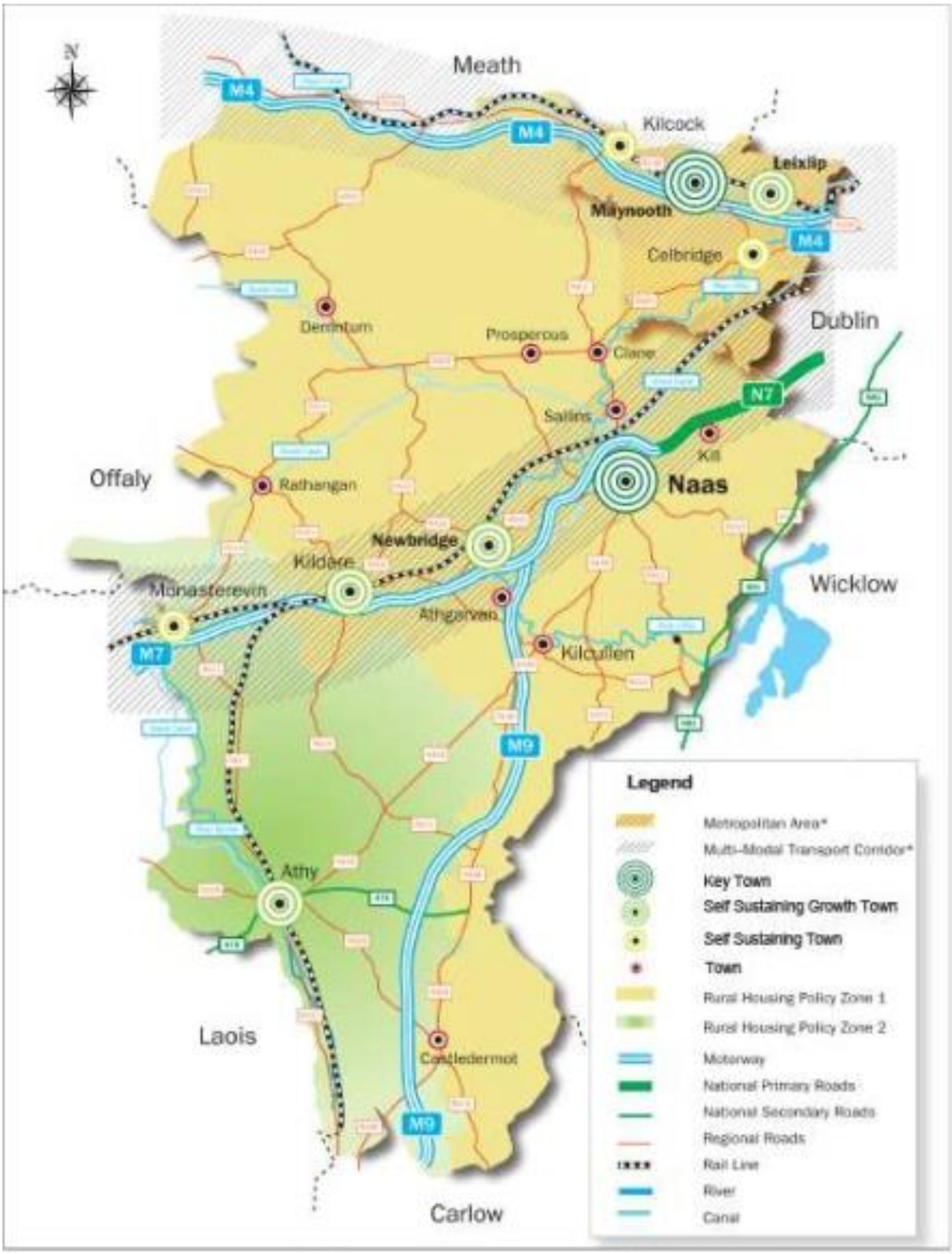

Figure 2-4 Core Strategy Map of the Kildare County Development Plan 2017 – 2023

The Development Plan contains a number of transport policies that are relevant to the development of the MEABTA. Some of the most relevant policies include the following:

- MT1: Promote the sustainable development of the county through the creation of an appropriately phased integrated transport network that services the needs of communities and businesses;
- MT2: Support sustainable modes of transport by spatially arranging activities around existing and planned high quality public transport systems;
- MT3: Influence people's travel behaviour and choices towards more sustainable options by working closely with relevant organisations in improving and accessing public transport facilities;
- MT4: Develop sustainable transport solutions within and around the major towns in the county that encourage a transition towards more sustainable modes of transport, whilst also ensuring sufficient road capacity for trips which continue to be taken by private vehicles;
- MT7: Focus on improvements to the national, regional and local network that provide additional capacity in order to reduce congestion and provide for current and future demand;
- MT8: Seek to address urban congestion with particular emphasis on facilitating improved bus transport movement and reliability and improved links to bus and railway stations; and
- MT11: Focus on improvements to the local road and street network that better utilise existing road space and encourage a transition toward more sustainable modes of transport, while ensuring sufficient road capacity exists for trips which will continue to be taken by private vehicle.

The following Development Plan Movement and Transportation Objectives are also relevant to the development of the MEABTA:

- MTO3: Review and implement Integrated Transport Studies for Maynooth, Leixlip, Celbridge, Naas, Newbridge, Kildare and Athy in conjunction with the DTTAS, TII and the NTA and to prepare new Integrated Transport Studies for other towns, villages and settlements as required, to provide a framework to cater for the movement of pedestrians, cyclists, public transport and private vehicles.
- The following Public Transport Policies are relevant to the MEABTA:

- PT7: Improve access to public transport as part of road improvement projects where possible; and

- PT8: Increase the catchment of public transport services by reducing walking and cycling distances through the implementation of Local Permeability Improvements.

- The following Public Transport Policies are relevant to the MEABTA:

- WC5: Identify new walking and cycling routes and linkages on all sites where new development is proposed and to ensure that all streets and street networks are designed to prioritise the movement of pedestrians and cyclists; and

- WC7: Provide for safer routes to schools within the county and promote walking and cycling as suitable modes of transport as part of the Green Schools Programme and other local traffic management improvements.

- Walking and Cycling Objectives include:

- WCO1: Prepare a Cycle Network Study for each of the major towns in Kildare consisting of primary links identified in the Greater Dublin Area Cycle Network and local links, all in accordance with the National Cycle Manual. The report shall also identify pinch points on the links and propose draft widths and level of service facilities;

- WCO2: Seek funding to develop Local Permeability Schemes in established areas in order to promote active modes of travel in conjunction with the NTA; and

- WCO3: Carry out local traffic management improvements to provide safer routes to schools in order to encourage students, where possible, to walk and cycle as a sustainable alternative to the car. These improvements may be carried out in conjunction with the NTA, through the Sustainable Transport Management Grants Scheme.

- The Motorways Objectives include:

- MO6: Improve safety and capacity at the M4 Maynooth Interchange (Junction 7) and to investigate the provision of a future improved connection to the M4, at this location or elsewhere near Maynooth.

There is also a Traffic and Transportation Management objective in the Development Plan to:

- TMO 2: Carry out a review of Traffic Management Plans including the following towns in conjunction with the NTA: Maynooth, Naas, Newbridge, Kildare, Celbridge, Athy.

There are several policies relating to compliance with national guidance including: Design Manual for Urban Roads and Streets 2013 and the National Cycle Manual. There are also policies and objectives which are in support of existing strategies, for example: Smarter Travel – A Sustainable Transport Future, A New Transport Policy for Ireland 2009 – 2020 and the Greater Dublin Area Cycle Network Plan.

2.4.3 Maynooth Local Area Plan 2013-2019

Local Area Plans (LAPs) are required to be prepared for towns with a population of over 5,000. These plans must be consistent with the County Development Plan and set out in greater detail the Council's requirements for new development, including factors such as density, layout and design requirements, community facilities, transportation, open space and recreational facilities. The existing LAP for Maynooth (Maynooth Local Area Plan 2013-2019 Incorporating Amendment No. 1) was adopted in June 2018 and amended the LAP 2013-2019 which had originally been adopted in 2013. A new Joint LAP (encompassing part of County Meath) will be prepared to replace the existing LAP and the new Joint LAP will be informed by the MEABTA.

The existing LAP planned for the delivery of 3,542 new residential units between the years 2016 and 2023. Half of these units were to be accommodated in the following developments: the quadrant between Moyglare road and the Dunboyne Road at Mariavilla; lands to the south of the Dunboyne Road and on the Celbridge Road (1,022) and a development on the land southeast of the town at Railpark and Blacklion (750). A detailed breakdown of development areas is available in Table 2-3.

Table 2-3 Local Area Plan (2013 – 2019) New Residential Zoned Sites

Location	Zoning Reference	Site Area (ha)	Approximate Unit Numbers (35 units/ha)
Mariavilla	C	11.5	402
Dunboyne Road	C	2.1	73
Dunboyne Road Roundabout	C	5.2	182
Dublin Road	C	0.9	32
Greenfield Drive	C	0.4	14
Celbridge Road	C	9.1	319
Railpark Southeast Quadrant & Blacklion	C	32.5	720
Total	C	61.7	1,742

The development at Railpark and Blacklion was to capitalise on the proposed Maynooth Eastern Relief Road, Figure 2-5 shows a map of this development area. The existing LAP stipulates that there shall be no vehicular routes into the estates of Parklands or Rockfield to the West of the Key Development Area at Railpark and no pedestrian or cycle connectivity at either Rockfield Park, Parklands Lodge or Parklands Lawns. Connectivity would be provided to the canal greenway, along with pedestrian and cycle access across the railway and canal onto the towpath.

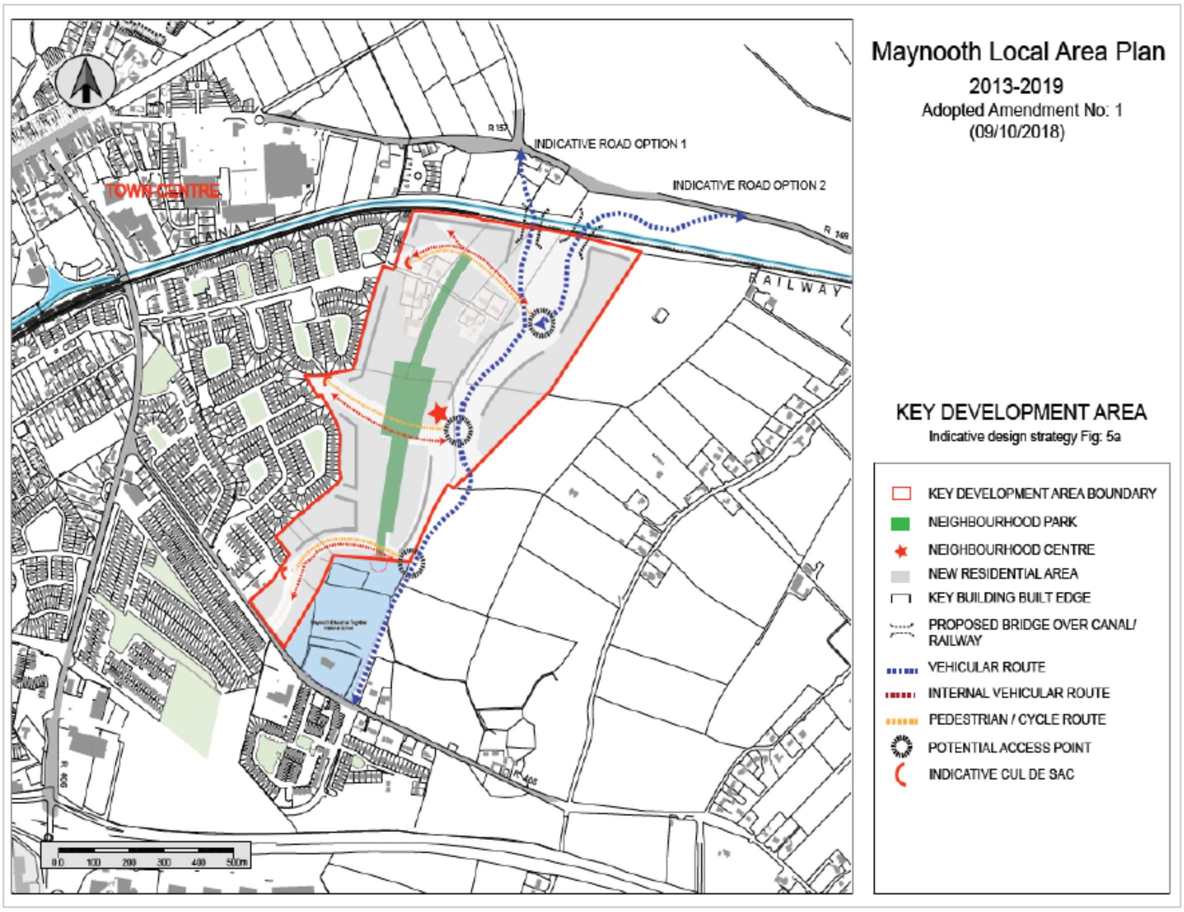

Figure 2-5 Indicative Design Strategy for Railpark and Blacklion Development

Proposals for commercial development in the existing LAP focused on 72.3ha of land zoned for the development of a research and technology-based employment generating area with associated related educational uses along the Kilcock road, combined with 3.2ha of H2 Light Industry / Office and Warehousing zoned land located on the Leixlip road which could accommodate further employment generating enterprises. There was also less than 1 hectare remaining to be developed in the Maynooth Business Campus. The existing LAP also states that a certain quantum of residential development can be facilitated as an ancillary use in the area identified for research and technology development on the Kilcock Road.

In 2013 Maynooth University had 8,400 students and it was anticipated that halfway through the academic year 50% of those students would be living in Maynooth. Nine hundred students lived in on-campus accommodation and 100 lived in off-campus university accommodation. Maynooth university had plans to provide on-campus accommodation for 300 more students.

In the town centre, maintaining or increasing permeability was a priority to retain Main Street as the retail heart of the town. The map in Figure 2-6 shows the urban design framework plan for the town centre. Policies USD 6, EA 2, 4, 5 and 6 provide for this by creating new links.

Figure 2-6 Urban Design Framework Plan - Permeability

Figure 2-7 shows the transportation and infrastructure objectives of the existing Maynooth LAP. Some of the most relevant include the following:

- PT 2: To support the enhancement of facilities at the Maynooth train station including additional car parking.
- PT 3: To investigate the feasibility of the provision of a new vehicular access to the railway station from the Rathcoffey road.
- TRO 1: To carry out a study investigating the safety and capacity of the existing Straffan Road M4 Interchange to establish whether an upgrade or new interchange working in tandem with the existing one is required. In the event that a new interchange is required the location shall be identified together with connections to the existing and proposed non-national road network.

- TRO 2 lists eight future road construction projects.
- TRO 3 lists 10 road realignment projects.
- TRO 5 lists four car parking projects.
- PC 2: To ensure the development of ‘shared surface’ and similarly passively calmed environments throughout the town. Surfaces should be different colours to distinguish the intended uses.
- PCO 3 lists 11 areas in which footpaths and lighting are to be provided.
- PCO 4 lists 16 areas in which cycle paths are to be provided.

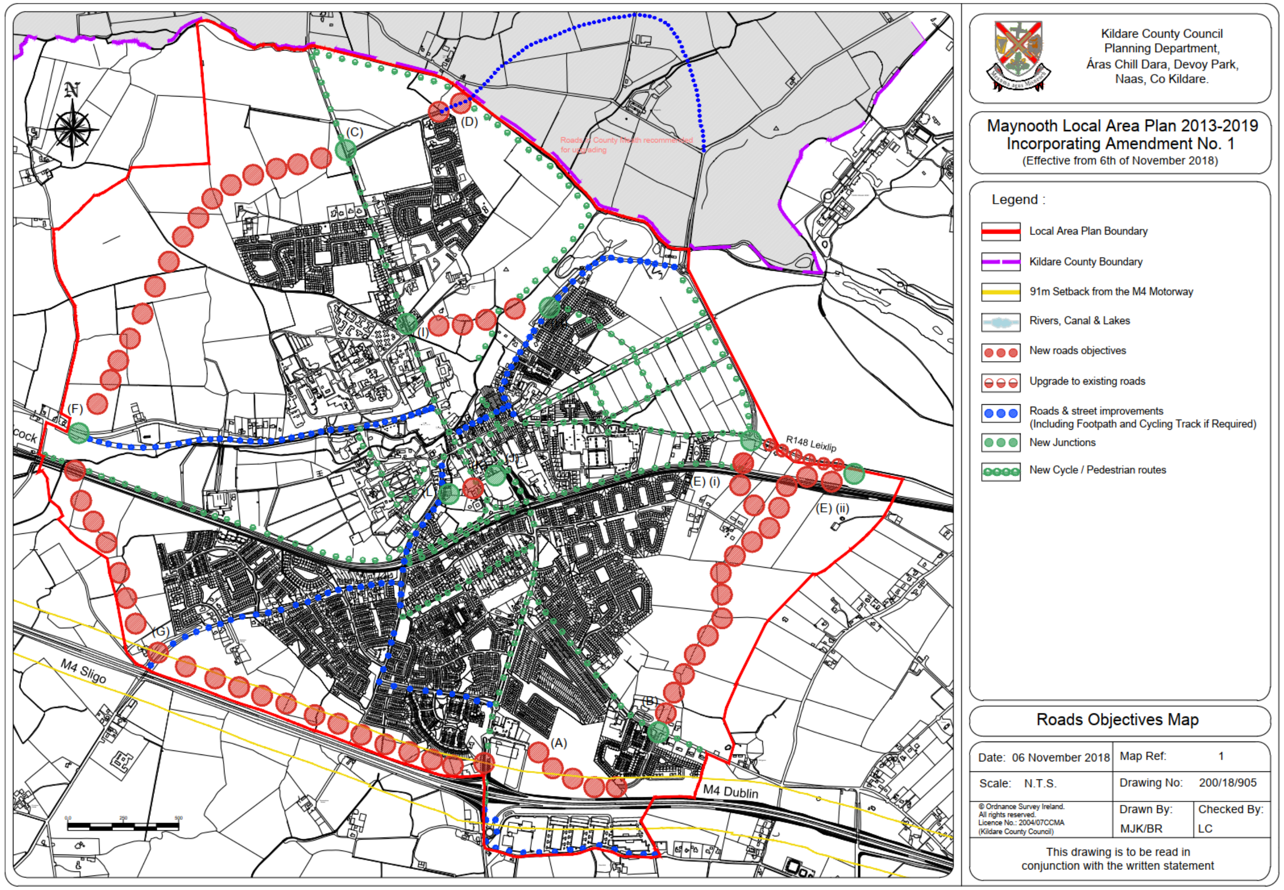

Figure 2-7 Local Area Plan Movement and Transportation Objectives

2.4.4 Maynooth Traffic Management Plan 2017

In 2017, a traffic management plan (TMP) was developed for Maynooth by AECOM for Kildare County Council. The TMP sought to identify transport improvements which would improve travel within the town, as well as improving journeys to and from future development areas. The TMP was focused on road network, walking and cycling measures within Maynooth and the wider study area, but it did not consider public transport or parking improvements. The Maynooth TMP conducted a detailed study of the receiving environment in respect to the settlement and transport characteristics, which informed the development of measures, along with strategic traffic modelling. The study area for the Maynooth TMP is shown in Figure 2-8 and the following sections will outline the measures proposed for the road, walking and cycling networks.

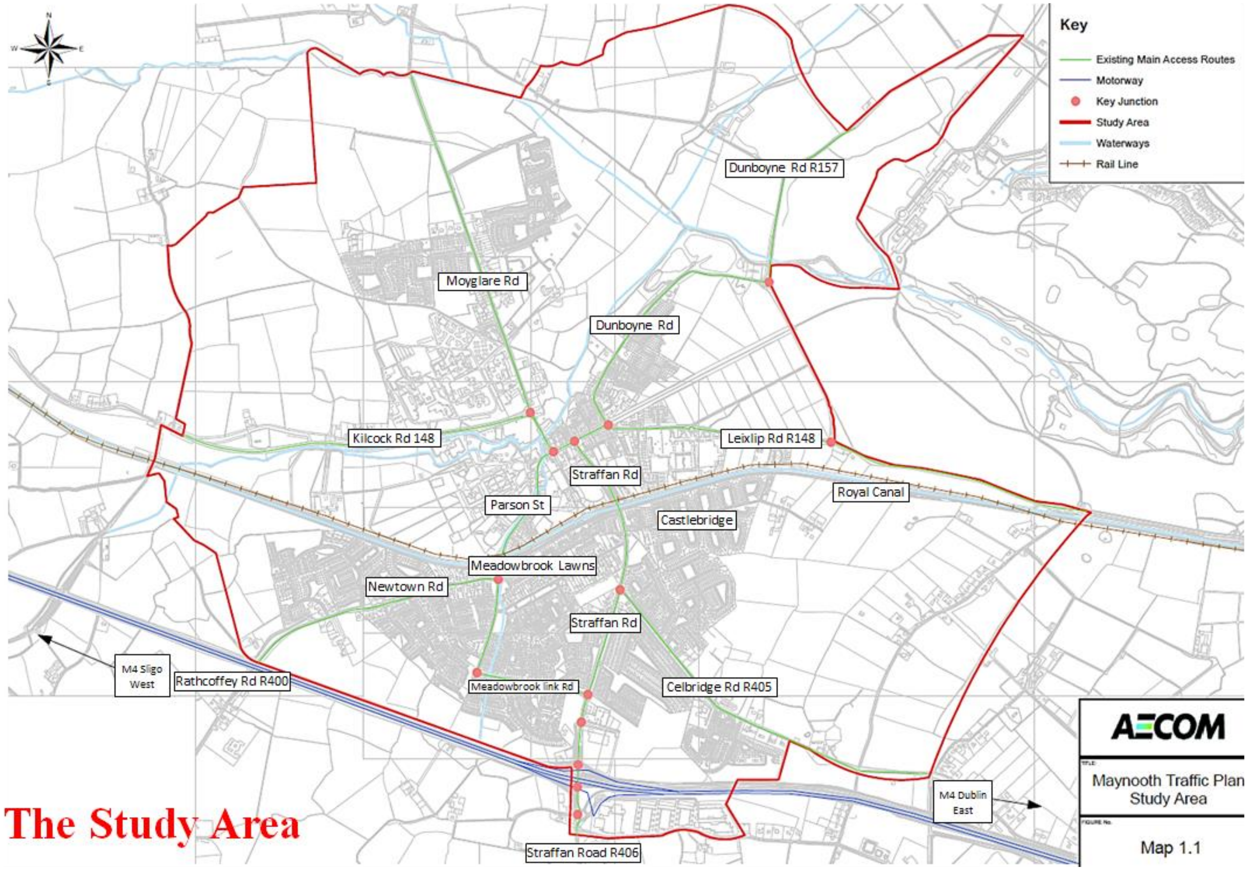

Figure 2-8 Maynooth TMP Study Area

2.4.4.1 Proposed Road Network

The road network proposed in the Maynooth TMP is shown in Figure 2-9. The TMP proposes the upgrade of several junctions to signal controlled junctions or modifying their signal timings. A number of new roundabouts, primarily on new roads, are also proposed. In respect to new road projects in the TMP, these consist of:

- Lyreen Avenue: Connecting Dunboyne Road to the Moyglare road to the north of the town centre.
- North-eastern section of the Maynooth Outer Orbital Route (MOOR) connecting Leixlip Road with the Moyglare Road
- Maynooth Eastern Ring Road (MERR), which connects Celbridge Road to Leixlip Road, with a connection to the Straffan Link Road in the south
- Straffan Link Road, which connects the Straffan Road to Celbridge Road
- South-western section of the MOOR connecting Straffan Road to the Kilcock Road
- North-western section of the MOOR connecting Kilcock Road with Moyglare Road

Other than Lyreen Avenue, the new road proposals are all orbital roads in suburban or rural areas, which would allow for traffic to bypass the town centre.

Figure 2-9 Maynooth TMP – Proposed Road Network

2.4.4.2 Proposed Cycle and Pedestrian Network

The proposed cycle network from the Maynooth TMP is shown in Figure 2-10 and the proposed pedestrian network is shown in Figure 2-11. In the short term, described as during 2017-2018 in the TMP, the following measures were planned as cycling and pedestrian proposals:

- Upgrade of cycle facilities on the Straffan Road
- Improvements to the Town Centre Laneways for pedestrian and cycle safety
- Upgrade of the Royal Canal Towpath (West of Town)
- Improved shared pedestrian and cycle facilities on the Straffan Road north of the M4 interchange
- Pedestrian and Cycle provision on the Straffan Road to Celbridge Road Link

- Celbridge Road Pedestrian and Cycle Scheme
- Pedestrian and Cycle Link Straffan Road to Leinster Street
- Pedestrian and Cycle Bridge over the Lyreen River
- Pedestrian ‘Super’ Crossing on the Kilcock Road
- Kilcock Road Pedestrian and Cycle Scheme
- Moyglare Road Shared Pedestrian and Cycle Path
- Dunboyne Road Pedestrian and Cycle Scheme
- Pedestrian and Cycle provision on the Dunboyne Road to Moyglare Road Link
- Pedestrian and Cycle provision on the Leixlip Road to Moyglare Road Link
- Pedestrian and Cycle Improvements at Carton Avenue

In the medium term, described as during 2019 in the TMP, the following cycling and pedestrian measures were planned:

- Mill Street Pedestrian Bridge
- Moyglare Hall Permeability Routes
- River Lyreen Linear Park Walking and Cycling Routes
- New Pedestrian and Cycle Access on Parson Street
- Dublin Road Pedestrian and Cycle Scheme
- Pedestrian and Cycle provision on the Kilcock Road to Moyglare Road Link
- Pedestrian and Cycle provision on the Celbridge Road to Leixlip Road Link
- New Pedestrian and Cycle Bridge crossing of the M4 Motorway
- Upgrade of the Royal Canal Towpath (East of Town)
- Proposed Permeability Routes

In the longer term, described in the TMP as beyond 2020, the following cycling and pedestrian measures were planned:

- Final upgrades to the town centre laneways
- Pedestrian and Cycle Upgrades to Parson Street
- Pedestrian and Cycle Upgrades to Meadowbrook Link Road
- Pedestrian and Cycle Scheme Rathcoffey Road
- Pedestrian and Cycle provision on the Kilcock Road to Straffan Road
- New Pedestrian Bridge at the Train Station

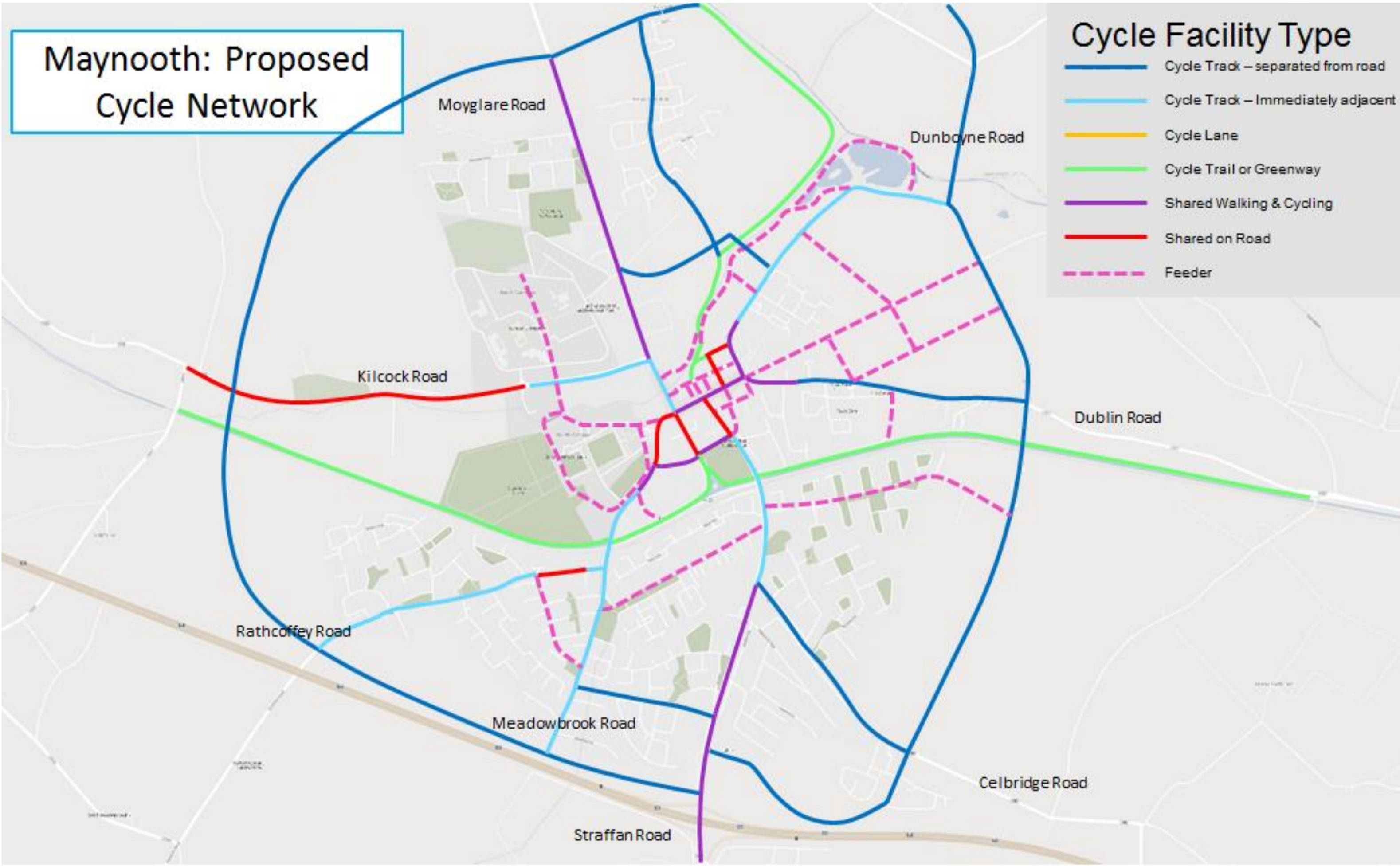

Figure 2-10 Maynooth TMP – Proposed Cycle Network

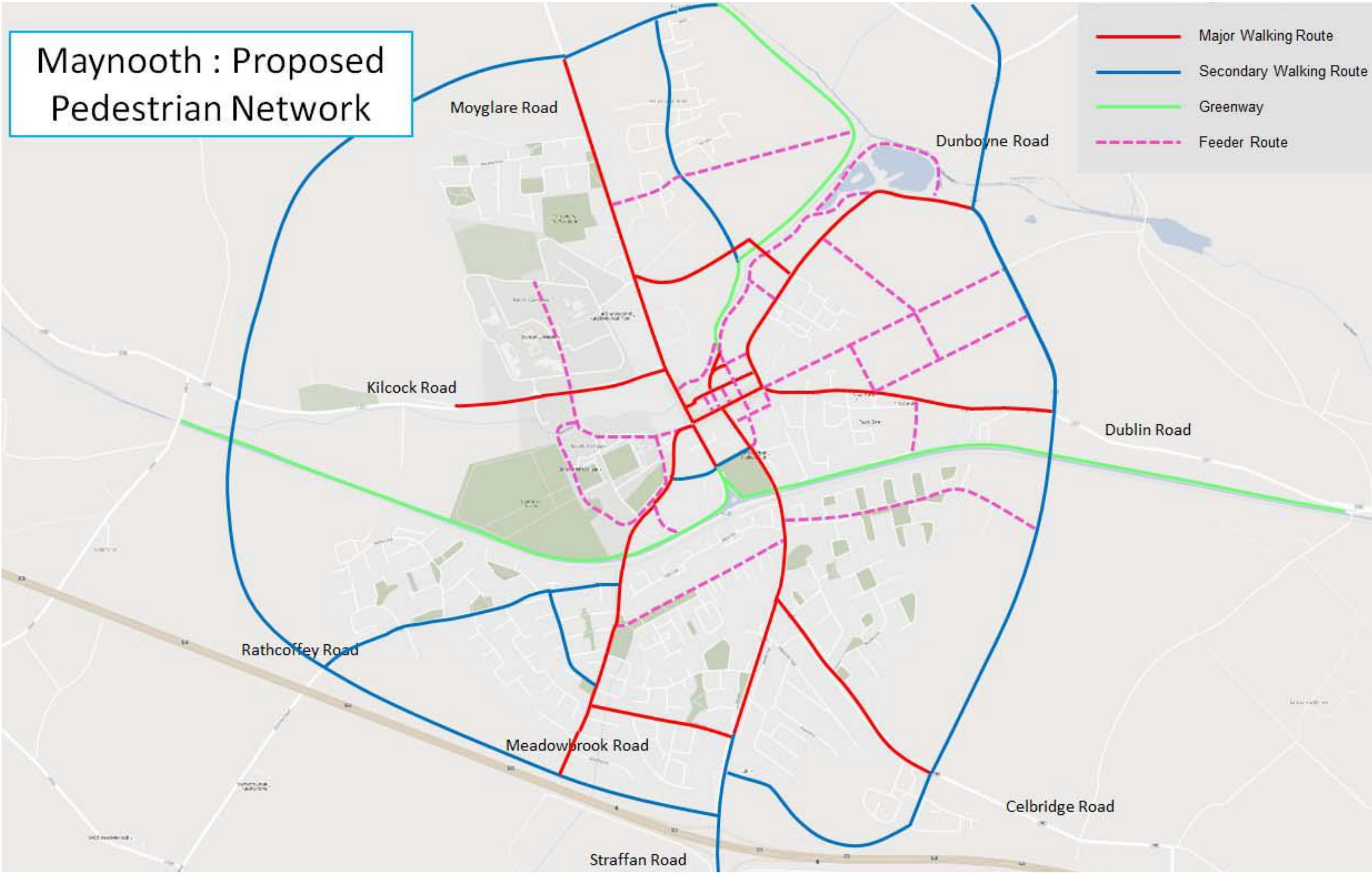

Figure 2-11 Maynooth TMP – Proposed Pedestrian Network

2.4.5 Maynooth University Commuting Framework Strategy 2016

The Maynooth University Commuting Framework Strategy 2016 proposes a strategy to promote sustainable commuting to the University campus and reduce reliance on cars. The framework includes an assessment of the commuting requirements of the University in 2016, along with the existing transport provisions. The framework encompasses all transport modes but emphasises the promotion and use of sustainable modes.

Key findings of travel surveys carried out by Maynooth University and the National Transport Authority in both 2014 and 2016 are presented in the Commuting Framework the results are compared to previous studies carried out in 2009 and 2011. Table 2-4 shows the combined modal split for staff and students across each survey, while Table 2-5 shows the results for staff and students separately for 2016.

Table 2-4 Mode Share for Travel to Maynooth University (2009-2016 Travel Survey Results, Staff and Students Combined)

Transport Modes	2009 %*	2011 %*	Target 2013 %*	2014 %*	2016 %*
Car – Single Occupancy	44	38	34	35	31
Walking	19	15	22	17	16
Car Sharing[2]	16	6	18	7	6
Train	10	17	12	14	16
Bus	8	19	9	23	27
Cycle	3	3	5	3	2
Other	-	2	-	1	2

*Extrapolated to population

[1] Passenger in a car with driver going to same destination and passenger in a car with driver going to a different destination

Table 2-5 Mode Share for Travel to Maynooth University (2016 Travel Survey)

Transport Modes	Students %	Staff %
Car – Single Occupancy	28.5	55.0
Walking	16.8	9.6
Car Sharing[1]	6.3	4.0
Train	16.7	14.0
Bus	28.1	13.5
Cycle	2.4	3.1
Other	1.2	0.8

The travel surveys demonstrated an increased number of respondents travelling further to reach the university between 2009 and 2016, as shown in Table 2-6.

Table 2-6 Distance Travelled (Staff and Students Combined)

Distance	2009 %	2011 %	2013 %	2014 %	2016 %
Less than 1km	17	11	9	9	9
1 to 3km	15	11	13	13	12
3 to 5km	6	3	4	4	4
5 to 10km	12	10	11	11	10
Over 10km	42	65	63	63	65

The Commuting Framework outlines that the 2014 travel survey found that staff and students would be willing to use alternative modes of transport if they were available and that for those who had already changed mode, the cost savings was the largest influencing factor. The majority of staff and half of students reported that nothing would encourage them to walk to campus and just under half of staff and students reported that nothing would encourage them to cycle to campus. For others, factors highlighted as important to encourage walking or cycling were improved lighting / security on route, improved showers and changing facilities, more lockers and storage facilities on site, better / safer cycle routes.

An assessment of the existing infrastructure within the Commuting Framework noted that while upgrades had taken place since the last assessment (2009), there were still a range of issues about the transport infrastructure on and around the campus. Some of the main issues identified were:

- A lack of footpath continuity and safe crossing points to parking areas, long waiting times to cross between the North Campus and the South Campus;
- Obstructed cycleways on campus and a requirement for cyclists to dismount at the North Campus pedestrian access and to cross between campuses;
- A lack of a quality well connected cycle network within Maynooth more generally, with upgrades required to meet the National Cycle Manual standards;
- The need for upgrades to bus stops on campus and issues with rail accessibility for wheelchair users;
- The demand for car parking exceeding the space available (driven in part by the lack of accommodation near to the university, therefore requiring longer commutes).
- According to the document, in 2016 demand for car parking exceeded provision by 2:1. Table 2-7 provides the breakdown of spaces available on the campus in 2016.

Table 2-7 Maynooth University On-Campus Parking Allocations

Campus Parking Allocation	North	South	Total
Staff	212	156	368
Students	198	90	228
Pay and Display	17	34	51
Multi	557	249	806
Car Share	14	0	14
Disabled	32	10	42
Visitor	0	6	6
Service	20	3	23
Other	59	0	59
Total	1,109	548	1,657

Table 2-8 shows the package of measures for each mode of travel proposed in the Maynooth University Commuting Framework Strategy.

Table 2-8 Package of Proposed Measures in the Commuting Framework Strategy

Package of Measures	
Walking	Improve signal timings at the pedestrian-crossing to minimise delays – discuss with Local Authority
	Provide a super-crossing to maximise the connectivity between the two campuses (Mobility Objective 4)
	Pedestrianisation and public realm first phase (Mobility Objective 7)
	Consider the recommendations of DMURS as part of the North Campus redevelopment to provide increased pedestrian priority.
	Pathway re-alignments rationalisation – north/ south and improve and meet the existing pedestrian desire lines on both campuses (Mobility Objective 12)
	Wide campus connectivity (Mobility Objective 13)
	Discuss with St. Patrick's College regarding the construction of a new pedestrian entrance to Parson Street (Mobility Objective 12)
	Provide adequate lighting along pedestrian routes as part of the North Campus redevelopment in accordance with DMURS
	Provide adequate lockers and changing facilities as part of the North Campus redevelopment
	Provide an improved pedestrian link to the Railway Station
Cycling	Construct cycle lanes as part of the North Campus redevelopment to the National Cycle Manual Standard (Mobility Objective 10)
	Upgrade the existing cycle facilities on the North Campus to integrate with existing and proposed cycle routes in Maynooth Town to National Cycle Manual standards – discuss with Local Authority (Mobility Objective 10 & 11)
	Remove the no cycling restriction on the South Campus - discuss with St. Patrick's College
	Improve cycle connectivity at the Super-crossing between both campuses (Mobility Objective 10)
	Improve cycle network within Maynooth Town to National Cycle Manual standards - discuss with Local Authority
	Replace existing unsecure cycle parking racks with secure stands (e.g., Sheffield stands) similar to the covered stands at the Iontas Building (Mobility Objective 11)

Package of Measures

Cycling	Provide adequate lockers and changing facilities as part of the North Campus redevelopment
	Provide more shower and changing facilities for cyclists.
	Cycle nodes and integrated parking nodes (Mobility Objective 11)
	Cycle path re-alignment (SPCM) (Mobility Objective 10)
	Make information available to Staff and Students regarding cycle maps and public transport integration
Public Transport	Provide improved information on public transport availability including real time bus and rail information, fares and route planning.
	Improve layover facilities on North Campus with the provision of a bus terminus
	Extend Dublin Bus services closer to the University Campus on Kilcock Road - discuss with Dublin Bus
	Bus drop expansion (Mobility Objective 1)
	Provide a shuttle bus on the North Campus as part of the campus redevelopment
Traffic and Parking	Provide a car free zone on the North Campus with parking moved to the fringes
	Provide a minimum of 2,034 parking spaces to satisfy Development Plan Parking standards
	Continue to implement the Permit Parking and Clamping policy as part of traffic management
	Provide a new vehicular access on Parson Street - discuss with St. Patrick's College
	Creation of a University Avenue (Mobility Objective 14)
	Wider campus connectivity (Mobility Objective 13)
	Consolidation of Lyreen spaces car park (SPCM) (Mobility Objective 9)
	Logic car park Integration (SPCM) (Mobility Objective 8)

Package of Measures

Traffic and Parking	Closing of loop on North Campus (Mobility Objective 2)
	Moyglare Road entrance (Mobility Objective 5)
	Westlands car park (Mobility Objective 6)
	Provide a new vehicular access on Kilcock Road to prevent vehicles having to traverse the super-crossing twice - discuss with Local Authority (Mobility Objective 4)
Sustainable Travel Information and Promotion	Continue to promote Tax Saver schemes for public transport within the University
	Provide a direct link to the Sustainable Travel website from the main Maynooth University website
	Update Sustainable Travel information and broken links on the website
	Provide easier access to documents relating to Sustainable Travel, Tax Saver schemes etc
	Continue to carry out travel questionnaire surveys and on-site data collection.
	Monitor and assess the progress of the plan to identify those measures that are performing most effectively and allow the strategy to be tailored tor changed to suit specific travel patterns.

2.4.6 Kildare 2016 Census Profiles (AIRO)

The All-Island Research Observatory (AIRO) prepared a census profile for Kildare County Council (KCC) and Kildare Local Community Development Committee, the findings were presented under six key headings which are summarised below:

Demographics

- County Kildare contains a significant population base within the State. Census 2016 outlines that the total population within Kildare was 222,504. This represents 4.7% of the State total.
- Kildare has a rapidly growing population over a 20-year period (1996 to 2016), Kildare experienced a 64.8% (+87,512) increase in its population base. This is

explained by high levels of natural increase (birth rate) and a strong performance in estimated net migration.

- Between 2011 and 2016, Maynooth ED had one of the highest population increases in Kildare, with an increase of 16.8%.

- Kildare has the highest rate of young people aged 0 to 24 years in the State. Maynooth MD has the highest rate of young people aged 0 to 24 years at 39.1%, and Maynooth settlement has a rate of 42%. This is connected to the presence of the University.

- Kildare has high levels of child and youth dependency over 28% of Kildare's population is aged '0-18' years,

- Demand for child and youth services is building and set to grow, the county's population has not yet peaked, and that there is likely to be an increased demand for children's and young people's services over the next decade. Maynooth MD had the highest rate of children aged 0 – 4 years old, 8.2%

- Kildare has a geographically varied population density approximately 72% of the county's population live on 5% of the county's total land area, with the northeast of the county having by far the highest population densities

- The '65 and over' age cohort has rapidly increased in Kildare representing 9.9% of the total population living in the county - the 2nd lowest rate in the State. Since 2011 this cohort has increased by 32%. However, Maynooth MD has the lowest rate of people over the age of 65 in Kildare at 9.4% (compared to a state average of 13.4%).

- Polish nationals are by far the largest non-Irish community living in Kildare 10.6% or 23,279 of the population residing in county Kildare are non-Irish nationals. Polish nationals make up the largest proportion of non-nationals in Kildare, representing 30% of all non-nationals or 3.3% of the total population. Maynooth settlement has a high rate of those identifying as non-Irish nationals (15.9%).

- Kildare has lower than national and regional rates of Travellers. There are 739 Travellers living in Kildare, with an observable spatial pattern. Most Travellers live in urban areas, with the highest rates in the towns of Newbridge and Athy

- Kildare has the 5th highest number of Lone Parent families (with children under 15) in the State. There are 4,795 lone parent families residing in Kildare.

- Deprivation levels have remained stable in Kildare between 2011-2016. The county experienced the third highest rate of increases in affluence levels nationally (+2.74) between 2011-2016. Most deprivation is clustered in the east and south of the county with the most disadvantaged areas within Athy.

Education

- Kildare has a very well-educated population. 36.3% of the population have a third level degree or higher - the 5th highest rate in the country
- There are clear spatial variations in education attainment across Kildare. High levels of educational attainment (third level plus) mirror the main urban centres of Naas, Newbridge and in particular the north of the county in Celbridge and Maynooth (Maynooth University employment catchment)
- Maynooth MD has one of the counties lowest rates of those who finished their education at lower and higher secondary education or Apprenticeship, Technical or Vocational Education. It also has one of the highest rates in the country of those finished education with a lower and/or higher third level education.
- Most Kildare students study in Dublin. According to Department of Education and Skills data, a total of 7,279 Kildare resident students were attending third level education institutions in 2017. The majority of these students were attending third level institutes in Dublin (52.5%), followed by Kildare/Maynooth (23%) and Carlow (10%).
- In 2017, Kildare (7,879) had the 7th lowest number of childcare spaces available (vacant and filled). This figure equates to a rate of 455.1 spaces available per 1,000 population aged 0 to 4, the 7th lowest in the State.
- Kildare has a low rate of schools per student population. In 2017/18 there were 100 mainstream primary schools in Kildare. This figure equates to a rate of 3.4 schools per 1,000 population aged 5 to 12 years, the 4th lowest of all local authorities and considerably lower than the State (5.73) average. Maynooth has one of the higher rates in the county at 3.81.

Housing

- Kildare is a significant residential base within the State with the eighth largest housing stock nationally
- Home ownership rates in Kildare remain high with the county having the 3rd highest rate of households with a mortgage in the State. According to the 2016 Census, 72% of households in Kildare are Owner Occupied, considerably higher than the State average (67.6%).

- The rate of private rented properties in Kildare (17.2%) is marginally lower than the State (18.2%) average. However, the rate of growth in Kildare (3.7%) is more than twice the State (1.4%) average.

- Maynooth MD and settlement have higher rates of private rented accommodation at 19.8% and 30.8% respectively, as compared to County Kildare as a whole.

- The private rental housing market is heavily subsidised by state funding in the form of Housing Assistance Payments (HAP), the Rental Accommodation Scheme (RAS) and Rent Supplement. In total, there are now 1,193 HAP tenancies in Kildare, 717 households linked to RAS (approximately €6.4m in Kildare in 2016) and 2,308 recipients of Rent Supplement (15.7% short term and 84.3% long-term).

- Rental accommodation prices in Kildare are relatively high in comparison to other eastern counties in Ireland. The average monthly rental in the county is now €1,023 (approx. 25% higher than 2014) with higher rates in the north-east of the county including in Leixlip (€1,235) and Maynooth (€1223).

- According to Census 2016 there were 4,650 vacant properties (excluding holiday homes) recorded in Kildare. This figure marks a reduction of 25.5% since Census 2011. Maynooth MD has a very low rate of vacant houses (excl. holiday homes) at 5.4% as compared to the state average of 9.1%.

- In the period since the 2011 Census, 1,739 or 2.4% of all housing in Kildare was constructed. This was marginally higher than the State (2%) average and represents the 7th highest rate of all local authorities. Of all new housing constructed between 2011 and 2016, 36.5% was built in the Maynooth MD, 22.8% in the Naas MD, 18.2% in the Kildare/Newbridge MD, 11.4% in the Celbridge/Leixlip MD and 11.4% in the Athy MD.

Health

- Census 2016 outlines that 63.1% of Kildare's population report their health status as 'Very Good'. This is higher than both the State and regional figures and is the third highest rate in the State. Within the Maynooth Municipal District area, 65.1% of the population report their health status as 'Very Good', while a further 25.8% report it as 'Good'.

- There are 27,768 people in Kildare with a disability, being the sixth highest number in the State and the fourth lowest relative to population size. Maynooth MD reports a low rate of people living with a disability at 11.7% (11.3% male population, 12% female population)

- There are low levels of GP practices in Kildare. In total, there are 81 GP practices in Kildare, this number equates to a rate of 0.36 practices per 1,000 population, considerably lower than the State (0.41) and EMRA (0.42) averages and higher than the Eastern Strategic Planning Area (SPA) (0.32) average. The rate of GP provision in Maynooth MD is 0.32 per 1,000.

- There are low levels of HSE listed Health Centres in Kildare. In total, there are 17 HSE listed Health Centres in Kildare, this number equates to a rate of 0.08 centres per 1,000 population, lower than the State (0.16) and Eastern SPA (0.09) averages and in line with the EMRA (0.08) average. The rate of HSE listed health centres in Maynooth MD is 0.08 per 1,000.

- Maynooth MD has a higher rate of nursing home provision of 1.55 per 1,000 population as compared to the Kildare county average of 1.05 per 1,000 population and a state average of 0.91 per 1,000 population.

Employment, Industry and Occupations

- The labour force participation rate in Kildare is 64.1%, the fourth highest rate in the country. However, there is significant spread around this figure throughout the county – the highest labour force participation rate in the county is Sallins (74.5%) and the lowest is Suncroft (52.3%). Maynooth MD has a labour force participation of 62.8%.

- 88.6% of the labour force are 'At Work' in Kildare. This is the fifth highest rate in the country and is mirrored by low unemployment rates. There is, however, an uneven distribution of the labour force 'At Work' throughout Kildare with a significant variance between the highest and lowest rates in the county. The highest rate recorded is found in Straffan (95.8%) and the lowest in Athy (73.4%). In Maynooth MD, 90.6% of the labour force are at work.

- In 2015 there were 10,314 active enterprises in Kildare. Of these, only 15 enterprises (0.1%) employed more than 250 persons. A total of 9,598 (93.1%) enterprises employed less than 10 people. This figure is marginally higher than the State average of 92.2%.

- Kildare recorded the highest rate of employment supported by foreign owned (FDI) companies. In 2016, 18.6% or 10,377 of total employment in the Kildare enterprise sector was in foreign owned companies. This is the highest rate in the country followed by Cork (18%) and Galway (17.6%).

- Kildare has the 2nd highest rate of managers, directors and senior officials (9%) and the 3rd highest rate of associate professional and technical occupations (13.1%) as shown in Table 2-9. Both rates exceed the national average for each occupational group by a considerable margin and are reflective of a well-educated and highly skilled workforce.

Table 2-9 Kildare Population by Occupation

Occupational Group	Maynooth MD %	Kildare %	State %
Managers, Directors and Senior Officials	9.3	9	7.4
Professionals	21.4	17.7	17.3
Associate Professional and Technical	13.9	13.1	10.9
Administrative and secretarial	11	10.9	10
Skilled Trades	12.8	12.6	13.9
Caring, Leisure and Other Services Occupations	6.5	6.9	7.3
Sales and Customer Services Occupations	5.8	6.7	6.8
Process and Machine Operatives	5.7	6.8	7.2
Elementary	7.7	8.6	8.8

Commuting

- Kildare has the 6th highest rate of outbound commuters in the State. Of the 95,345 workers residing in Kildare, 39.1% or 37,340 commute to areas outside of the county. The top employment destinations for Kildare workers are; Dublin City (15,481), South Dublin (10,593), Fingal (3,324), Dún Laoghaire Rathdown (2,810) and Meath (969).
- 33% of Kildare's resident workers are employed in the Dublin Metropolitan Area. In total, 31,710 workers commute from Kildare into the Dublin Metropolitan Area.

Highest rates are primarily located in the north-east of the county proximate to settlements; Naas, Celbridge, Leixlip and Maynooth, where many parts have in excess of 50% of workers commuting into the Dublin Metropolitan Area.

- In excess of 33% of all jobs in Kildare are filled by persons living outside the county. Of the 62,985 jobs located in Kildare, 21,195 are filled by persons commuting into the county. The top worker origins are; Laois (3,189), South Dublin (3,141), Meath (2,480), Dublin City (2,462) and Offaly (1,607).
- Of the key settlements in Kildare, Naas (10,999) has the largest concentration of jobs. Naas accounts for 17.5% of all jobs in Kildare. Of this number, 8,115 persons commute into Naas making it a key commuting destination in the county. Newbridge (6,526) has the second highest number of jobs followed by Leixlip (5,825).
- In Maynooth the largest industry of employment is Manufacturing[3] (36.8%), followed by ICT, Financial and Professional Services (29%) and Wholesale and retail, transportation (17.1%).
- Commuting/Jobs Profile Maynooth: There are 6,295 people in employment living in Maynooth, 19% work in Maynooth, 16% work elsewhere in Kildare and 51% commute out of Kildare - the remaining number of workers are either mobile workers or did not provide a codable destination in the Census. There are 5,201 jobs with a fixed location in Maynooth, this accounts for 8.3% of all jobs in Kildare.

[3] Manufacturing, Mining and Quarrying, Electricity, Gas, Water, Waste

3. Settlement Context

This section provides a review of key demographic, employment, building-use and school location datasets within Maynooth.

3.1 AIRO Estimate of 2021 Maynooth Population

As a result of the Covid-19 pandemic, the Census which had originally been due to take place in April 2021 was postponed for one year. The next Census will now take place in April 2022 and preliminary results will be made available in mid-2022, with definitive results not available until April 2023. As there has been significant population growth in Maynooth since the 2016 Census, Kildare County Council commissioned AIRO to undertake a research project to provide a current population estimate for Maynooth in order to support a number of initiatives within Kildare County Council such as the development of the Joint LAP.

Using the GeoDirectory address database combined with site visits, planning documentation and real estate marketing material, the AIRO project team created an evidence-informed listing of all new residential dwellings which were 'habitable' in Q2 2021 by bedroom size ranging from one bedroom to five bedrooms. The team then applied an individual occupancy rate to each category of dwelling as follows:

- 1 bed (* 2 persons);
- 2 bed (*2.5 persons);
- 3 bed (*3 persons);
- 4 bed (*4 persons); and
- 5 bed (*5 persons).

The total new 'habitable' dwellings since Census 2016 was calculated to be 866, plus 292 bed spaces which were delivered as part of a student accommodation development on the North Campus of Maynooth University which opened between October 2016 and January 2017. The additional population was estimated to be 3,124 people. This results in a current population estimate for Maynooth for Quarter 2, 2021, of 17,709 people. This represents an increase of 21.4% compared to Census 2016.

3.2 Population Change 2011 - 2016

The Central Statistics Office (CSO) Settlement boundary for Maynooth contained 14,585 people in the 2016 Census. Figure 3-1 shows the change in population between the period between the 2011 census and 2016 census on a square kilometre grid for the areas surrounding Maynooth. This analysis shows that Maynooth, and its environs, are growing at a faster rate than other nearby towns such as Kilcock or Leixlip. The rural areas surrounding Maynooth are experiencing small levels of population growth or a slight decline in population. This is in line with the NPF which favours growth within existing urban settlements and shifts development away from one-off housing in rural areas. However, the growth in population will put the existing transport system under pressure and the MEABTA will have to anticipate and mitigate these issues. It should be noted that the population of Maynooth will have grown significantly since Census 2016 as explained in the AIRO analysis.

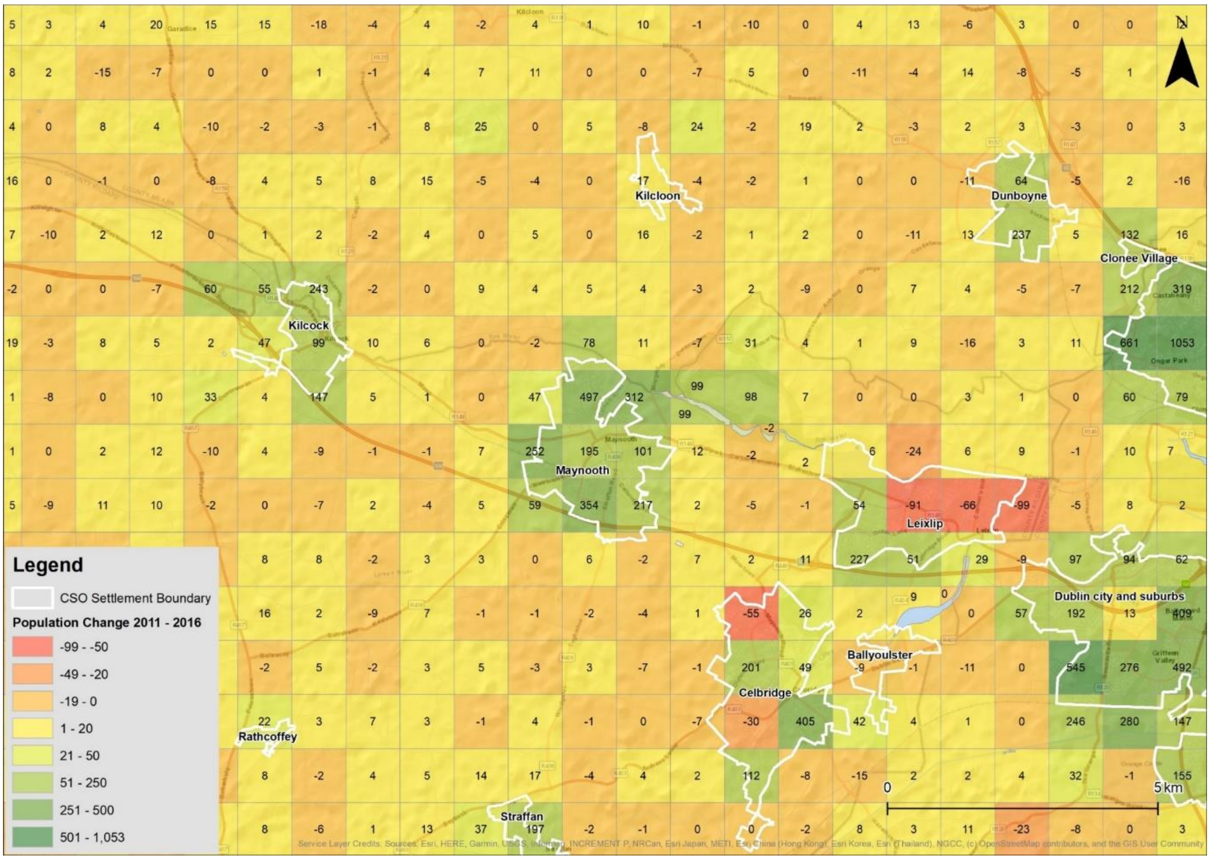

Figure 3-1 Regional Population Change on Square KM Grid (Census, 2011-2016)

Figure 3-2 shows the main areas of residential construction in Maynooth during 2001-2016. This demonstrates that most of the residential construction has been on the outskirts of Maynooth, with the exception of one central development (The Mills

Shopping Centre development) of more than 101 housing units. There has been a small amount of infill development throughout the established parts of Maynooth during this period, but this has been very modest and there is the potential for further densification. The growth of the outer suburbs, where walking and cycling distances to key locations are longer, will increase the likelihood of car use rather than sustainable modes. Intensification of existing built-up areas near public transport corridors and central areas, as well as mixed-use development would be preferable to reduce car dependency.

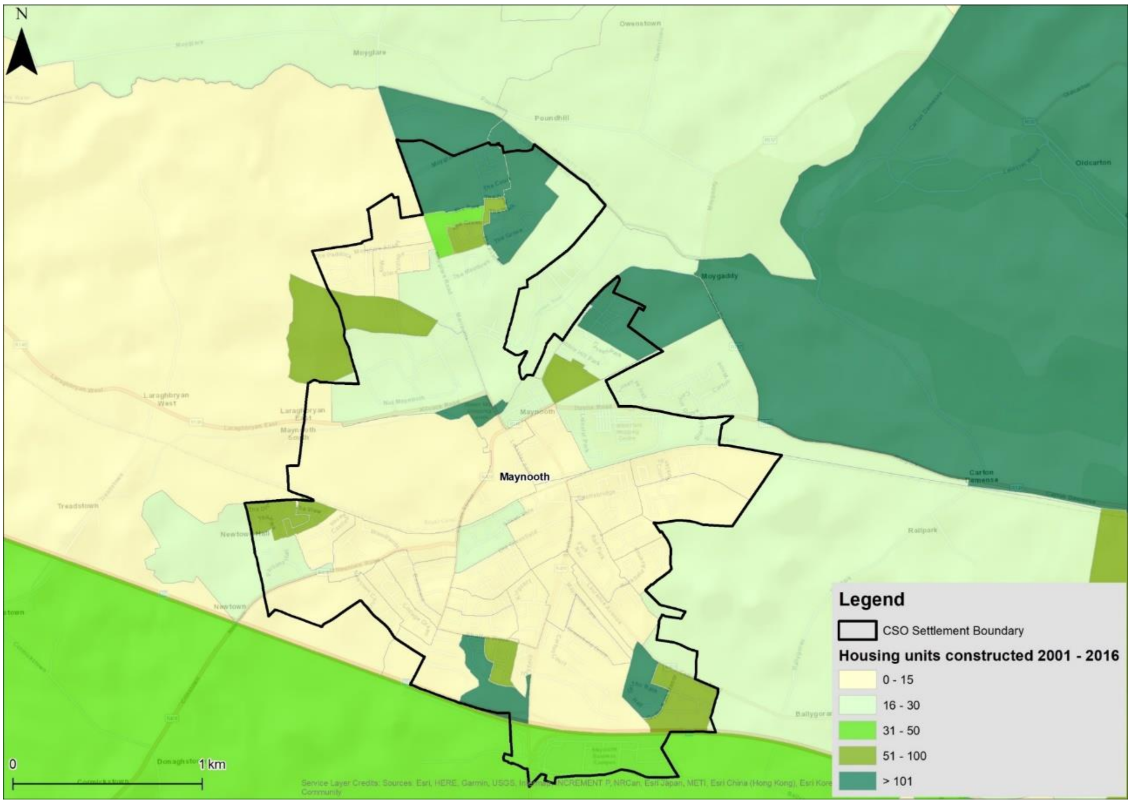

Figure 3-2 Number of Houses Constructed During 2001-2016 (Census, 2016)

3.3 Land Use Composition

Figure 3-3 provides an overview of the split between commercial and residential buildings in Maynooth using the GeoDirectory[4] dataset. This indicates that commercial activities are concentrated in the town centre, Carton Retail Park, the university campus and Maynooth Business Campus to the south of the M4. There is a clear spatial separation of land-use activities in suburban areas with little evidence of mixed-use development, or jobs in these areas, which would promote shorter trips and active modes. Even in Maynooth town centre, mixed-use developments are limited and there is scope for improving this through schemes to encourage living above ground floor retail and the construction of greater amounts of mixed-use buildings. Despite the lack of mixed-use development, there are a large volume of residential homes within walking and cycling distance of commercial premises and this has the potential to increase active travel to work if the infrastructure is improved.

[4] County Kildare building information is taken from a 2021 GeoDirectory database. This information was not available for Meath, with the buildings in this county represented with an older 2017 GeoDirectory database.

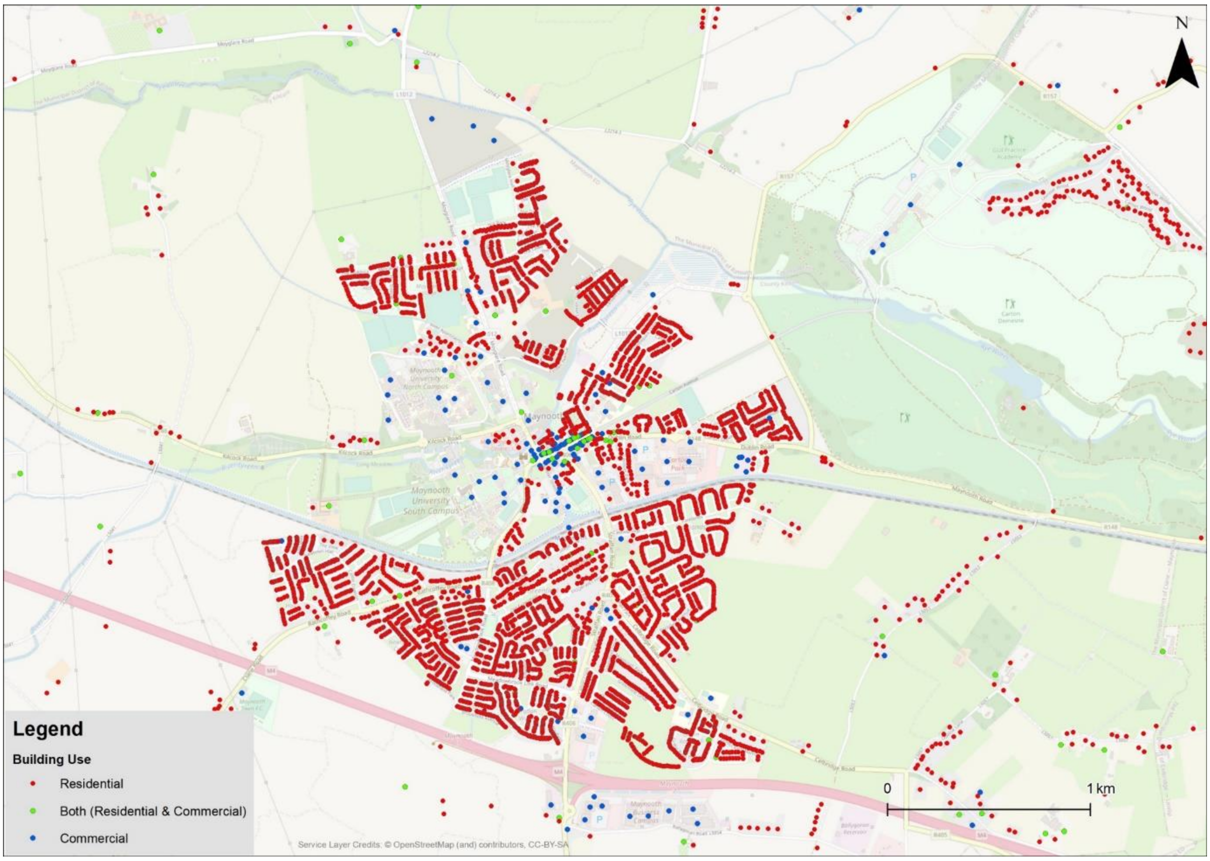

Figure 3-3 Residential and Commercial Buildings in Maynooth (GeoDirectory 2017 and 2021)

3.4 Job Density

Figure 3-4 shows the density of jobs throughout Maynooth based on CSO Workplace Zones in 2016. Maynooth contains some major trip attractors, such as the two university campuses, which are clearly highlighted as areas with dense job concentrations. Furthermore, the town centre, Carton Retail Park and Maynooth Business Campus are clearly highlighted as strong employment locations. In the south of the town, there is an area with slightly higher job densities due to the presence of a Lidl and Barton's Transport. Similar to the GeoDirectory building use, it can be observed that there are very few local jobs within the suburban areas of Maynooth and this separation of land-uses will mean that people will have to walk/cycle/drive further to reach local jobs.

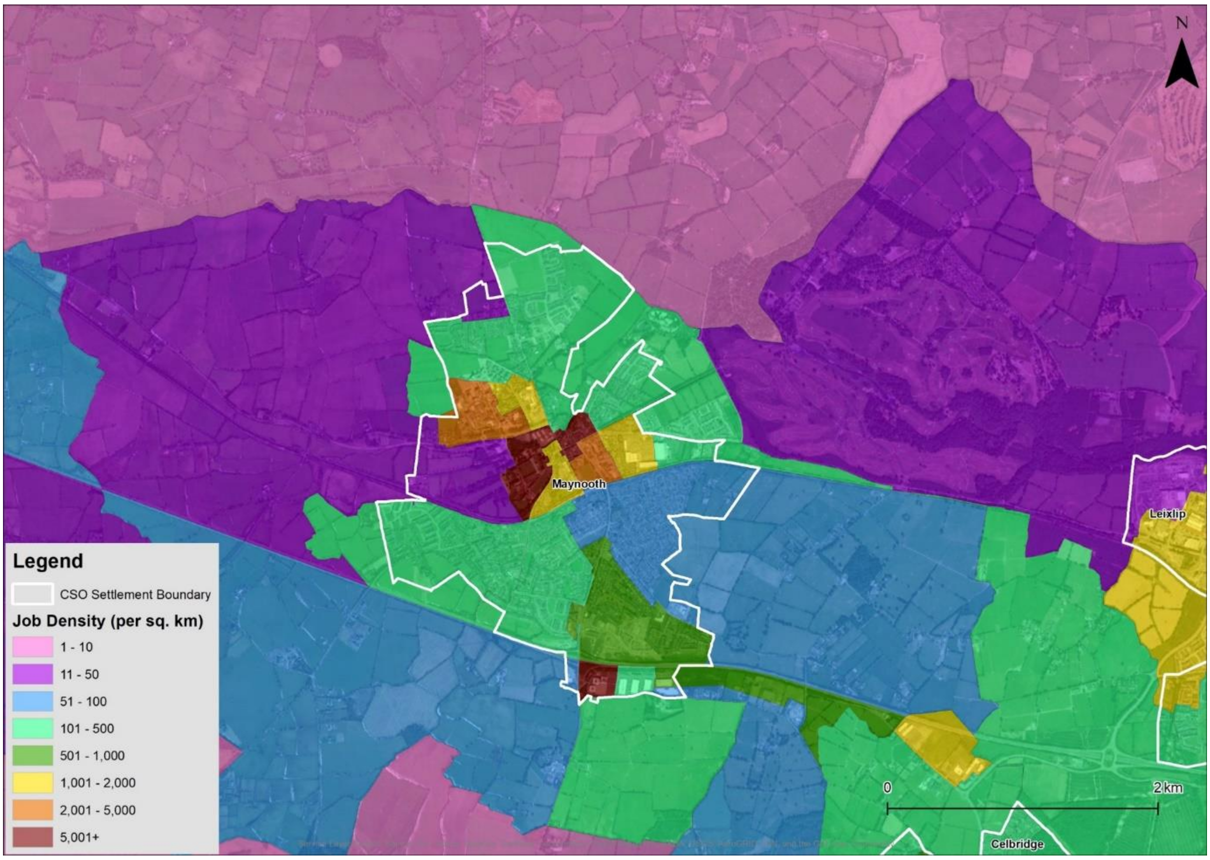

Figure 3-4 Census Workplace Zones (2016) – Number of Jobs Per Sq. KM

Figure 3-5 shows the job destinations in Maynooth, from any national origin, based on POWSCAR (2016). This is a more accurate way of identifying key trip attractors in Maynooth and it highlights similar areas to the job density map, with the university campuses, town centre and Maynooth Business Campus emerging as the most popular work destinations within the town. The values from this map show that over a thousand people work in Maynooth Business Campus to the south, meaning that improving access to this peripheral site by sustainable travel models will be an important part of the MEABTA.

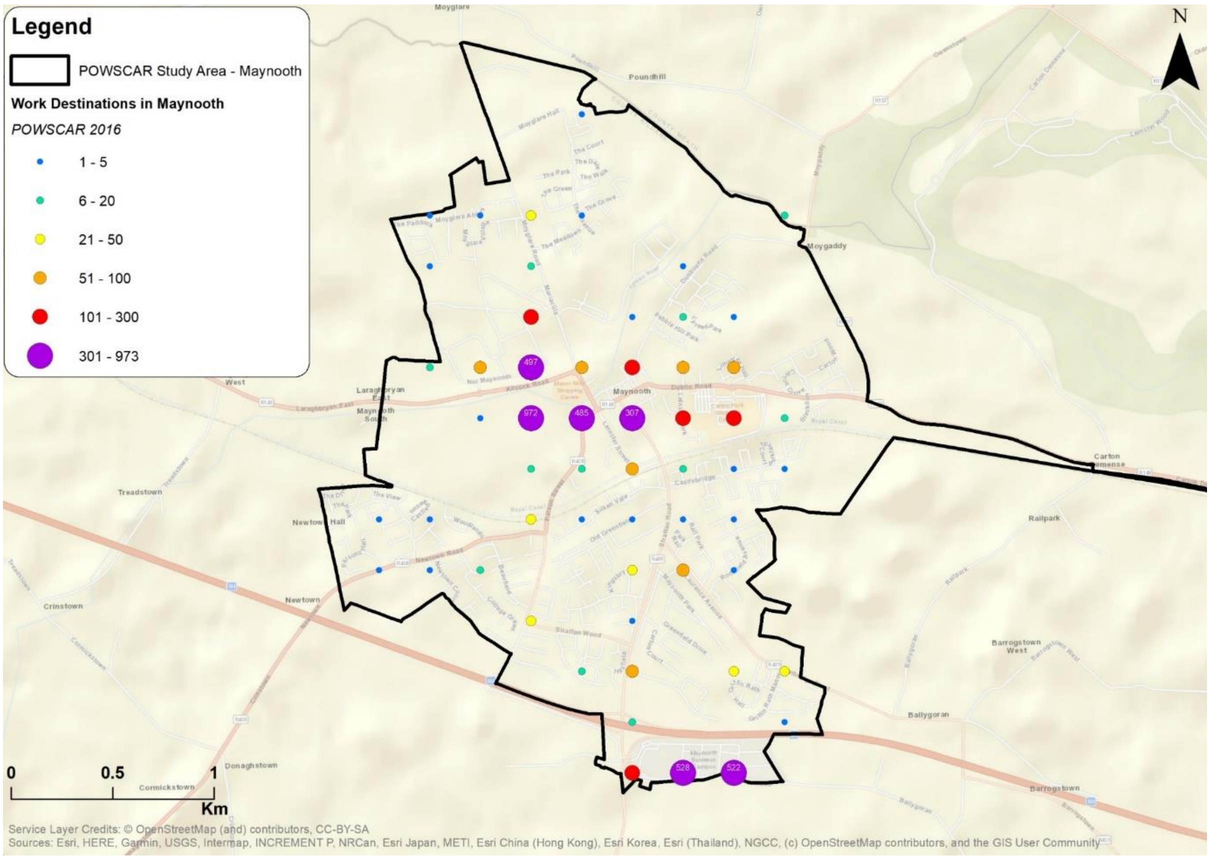

Figure 3-5 POWSCAR 2016 - Work Destinations in Maynooth

3.5 Housing Density

Figure 3-6 shows the housing density in the study area according to the number of residential units per hectare (UPH). This highlights very low residential densities throughout Maynooth, with the majority of areas containing between 11 and 20 UPH or less than 10 UPH. Low residential density has implications for the provision of local public transport, reducing the potential patronage a local bus route can attract. As a result, new bus routes intended to serve these areas would have to link with major trip producers/attracters, like the University or Maynooth Business Campus, to be viable operations. The highest housing density location is the Mill Shopping Centre development in the centre with 51 to 60 UPH. There are pockets of slightly higher housing density (21-30) in the town centre, south of the town and a small area in the north of the town. Unfortunately, the housing densities in the areas surrounding the train station are very low and further densification of this area would help to support patronage on rail, particularly when the DART+ upgrade is complete, and frequencies improve.

It should be noted that there has been significant infill development to the east of the university in the Lyreen Avenue/Mariavilla development. The planning permission for this development shows that the housing density will range from 57 UPH near the Moyglare Road, due to the presence of student accommodation, to 32 UPH to the rear of the development. It is positive that this newer development is meeting the goals of the Sustainable Residential Developments in Urban Areas (2009) which discourages urban development on greenfield sites under 30 UPH and recommends 35-50 UPH as the preferred density. However, overall housing densities across Maynooth are low and further densification will be necessary to support higher frequency public transport and encourage greater walking/cycling across the town.

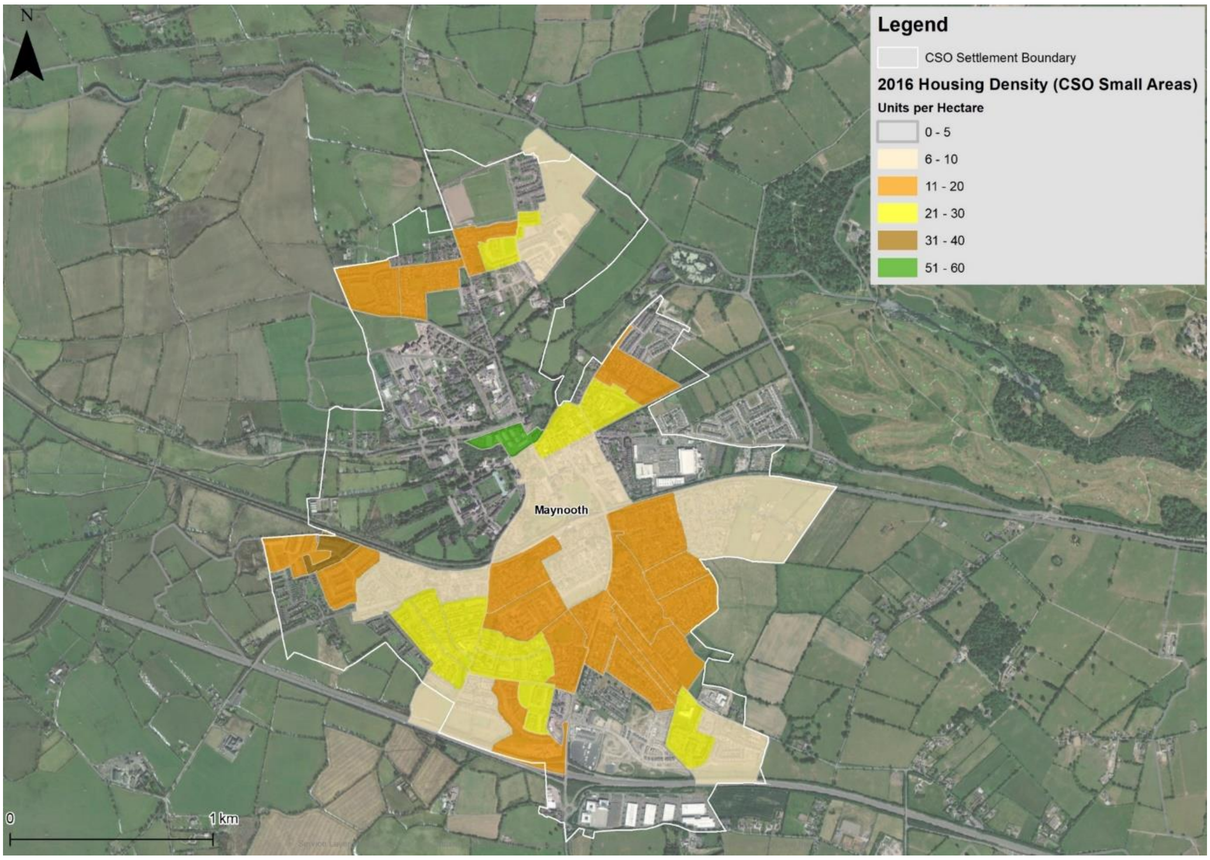

Figure 3-6 Census Small Areas (2016) – Housing Density (Units Per Hectare)

3.6 Deprivation Index

The Pobal Deprivation Index (2016) is used to determine the relative affluence or disadvantage of geographical areas in the study area. A map of the 2016 Pobal HP Deprivation Index at CSO Small Area level is shown in Figure 3-7. This shows that the majority of Maynooth is marginally above average or affluent and there are not widespread issues with deprivation in the town. There is one disadvantaged area in the south of Maynooth town and it will be important to improve transport accessibility to this area for non-car modes. There are pockets of very affluent areas in the town centre (e.g., The Mills Shopping Centre development) as well as the northeast and in the southwest of the town in the newer housing estates. However, the overall study area is not characterised by extreme disadvantage or affluence.

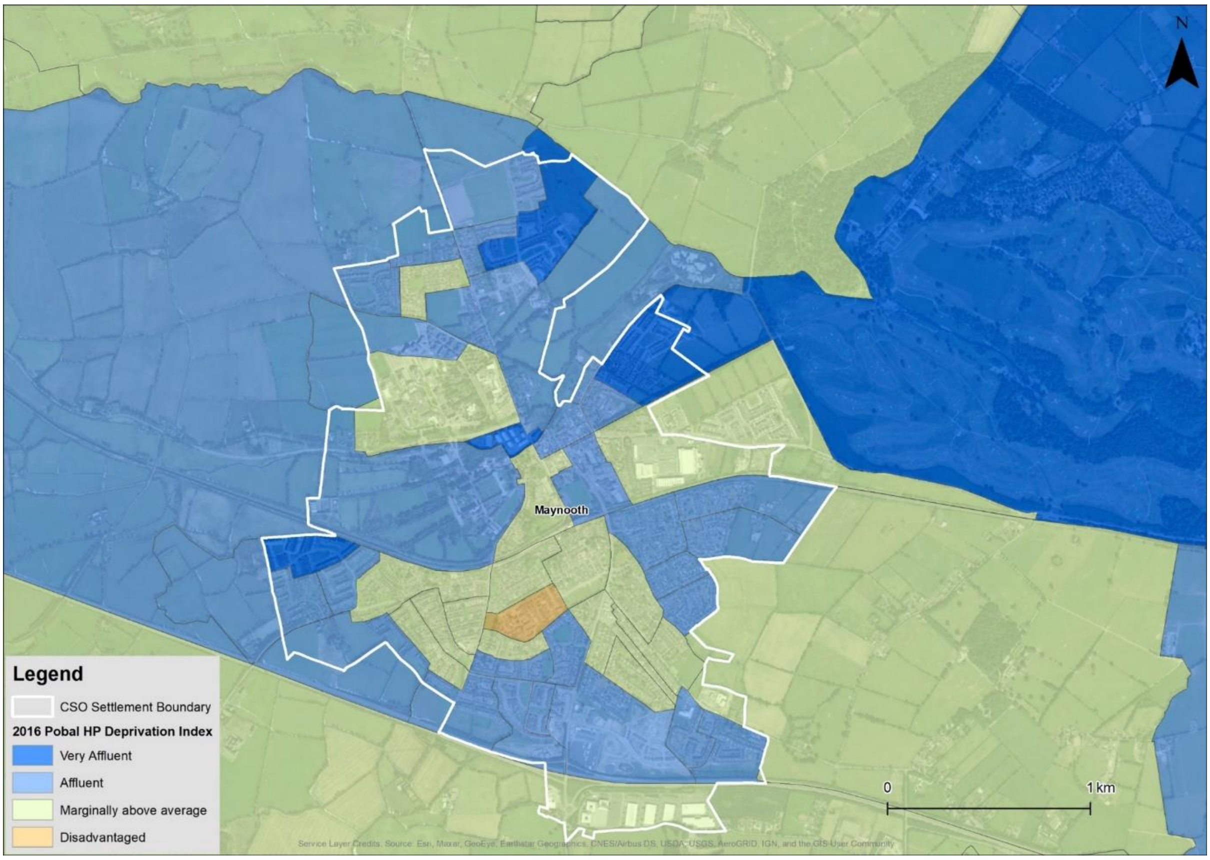

Figure 3-7 Pobal Deprivation Index 2016 – Maynooth (CSO Small Areas)

3.7 Schools and Education Facilities

There are five primary schools and three secondary schools in Maynooth, which provide education for 3,713 pupils in total. Table 3-1 provides a list of the schools in Maynooth and the number of pupils who attend each school. Figure 3-8 shows the location of each school spatially, the three schools in the northern campus (Maynooth Post Primary, Maynooth Community College, Gaelscoil Ruairí) are recent additions which have been constructed since Census 2016. As a result, the Census modal split and POWSCAR results will not reflect the presence of these new schools to the north. The peripheral location of the new schools, which contain 1,675 pupils in total, may result in a greater number of trips by bus, car and bike due to the distances involved which may be too far for walking.

Table 3-1 Overview of Schools and Pupils in Maynooth (2021)

School Level	Official Name	Female Pupils	Male Pupils	Total Pupils
Primary	Presentation Girls Primary School	648	5	653
Primary	Maynooth Boys National School	0	592	592
Primary	Maynooth Educate Together National School	135	169	304
Primary	Scoil Ui Fhiaich	233	232	465
Primary	Gaelscoil Ruairí	13	18	31
Secondary	Maynooth Post Primary School	463	529	992
Secondary	Maynooth Community College	311	341	652
Secondary	Gaelcholáiste Mhaigh Nuad	17	7	24

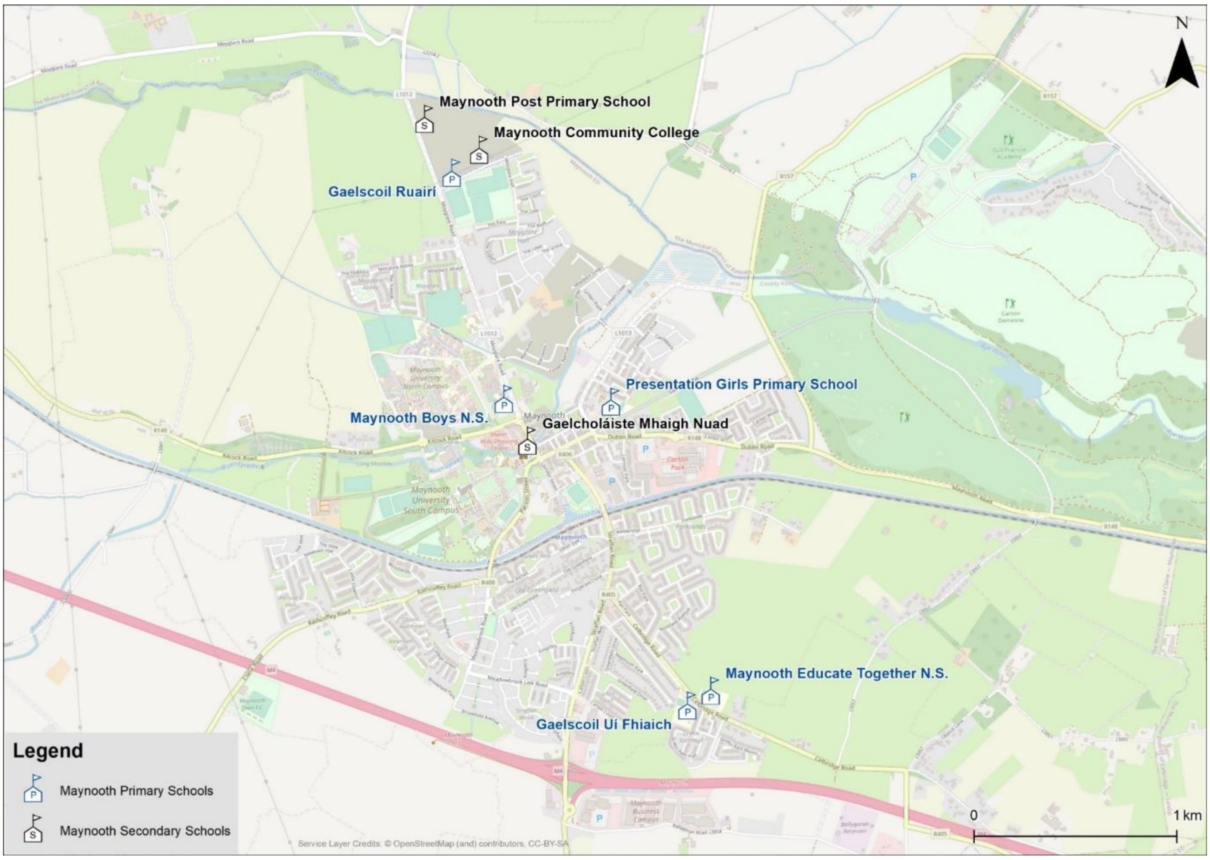

Figure 3-8 Primary and Secondary Schools in Maynooth

In addition to the schools, the town also contains Maynooth University, which is a major third level education centre which contains 13,700 undergraduates, 1,750 masters' students, 450 doctoral students and 2,297 international students in the 2019-2020 academic year. The university is divided into a northern and southern campus, with the southern campus containing St Patricks College. Due to the volume of students and staff who travel to the university each day, it is one of the largest trip attractors in the town and is accessed by all modes of transport. The MEABTA will develop options to improve access to the university, with a particular focus on improving walking, cycling and public transport access from residences in the town. In addition to the two university campuses, there is also a further education and training centre located in the town centre. The location of these third level education facilities and the schools are shown in Figure 3-9.

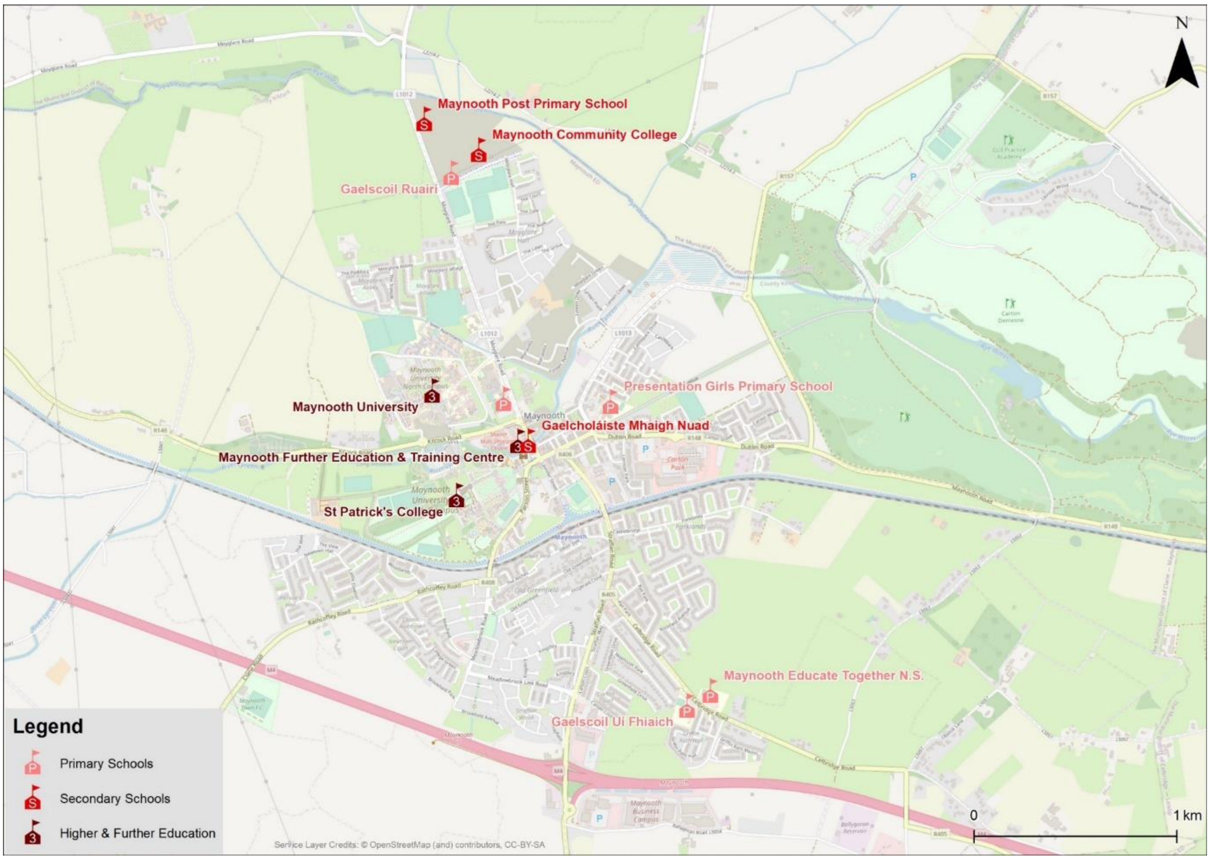

Figure 3-9 Location of Schools and Third Level Education Facilities

3.8 Physical Characteristics

The physical characteristics of the study area impact existing connectivity and future transport infrastructure proposals. The two main types of physical characteristics which require consideration as part of the MEABTA are the waterbodies within the study area and the topography of the area.

Figure 3-10 shows the rivers and streams within the study area which are contained within the 'River Network Routes' dataset published by the Environmental Protection Authority[5], as well as the Royal Canal which is another significant water body within the study area. The rivers and streams are classified according to their 'Strahler Stream Order', a standard classification based on stream/tributary relationships. The uppermost channels in a drainage network are designated as first-order streams, while a second-order stream is formed below the confluence of two first-order channels, third-order streams are created when two second order channels join, and so on.

Rivers and canals can sometimes present opportunities for linear movement along their alignments subject to space and environmental constraints, but they can also present barriers to movement, particularly when there is an absence of sufficient well distributed bridges to facilitate direct trips by active modes of travel. The two significant rivers within the study area are the Lyreen River and the River Rye or 'Rye Water'. The Lyreen River flows from the east of the study area south of the Kilcock Road through the town centre and continues northeast to join with the Rye Water. The Rye Water rises north of Kilcock and flows through the northern part of the study area from east to west before continuing through the grounds of Carton House and onwards to join the River Liffey in Leixlip.

Figure 3-11 illustrates the topography of the study area, based on LiDAR[6] (Light Detection and Ranging) data. The main roads within the study area have been overlayed on the map in the form of partially transparent white lines to aid orientation. The data used in

Figure 3-11 was collected by the OPW in 2011 and is now available through the GSI Open Topographic Data Viewer portal. This Digital Terrain model (DTM) removes buildings, trees, and other temporary structures, to display the underlying topography

[5] http://gis.epa.ie/geonetwork/srv/eng/catalog.search#/metadata/c4043e19-38ec-4120-a588-8cd01ac94a9c

[6] LiDAR is a remote sensing technology. An airborne LiDAR system sends a light pulse to the ground which hits the ground and returns back to a sensor on the system. The time is recorded to measures how long it takes for this light to return. Knowing this time measurement scientists are able to create topography maps.

of the terrain (although some artefacts remain). The resolution of the data is 2m which means that every pixel on the image represents the average elevation of a 2m x 2m square.

The lowest elevations, sinking to 47m, occur in and around the Rye Water, shown in pale blue and green. Orange and red colours show rising elevations to the east and southeast of Maynooth and the highest areas are shown in white, reaching 84m to the southeast.

In general, the study area has a relatively even topography, which is a significant strength with regard to the promotion of active modes of travel. The highest naturally occurring slope angles occur on the banks of the Rye Water to the east of the town. The only significant slopes along existing main roads within the study area are connected with anthropogenic structures, such as the road bridges over the Royal Canal and the railway line on Straffan Road and Parson Street/the R408. The main roads also connect to the Royal Canal Greenway/ towpath at these bridges, with ramps sloping down from the road bridge to the path adjacent to the canal. Another location where relatively steep gradients will be encountered by people walking in the area is in the new Lyreen neighbourhood, where a walkway which currently has a mainly recreational function has been developed adjacent to the banks of the Lyreen River within the river valley, at a ground level significantly lower than the residential streets it connects to.

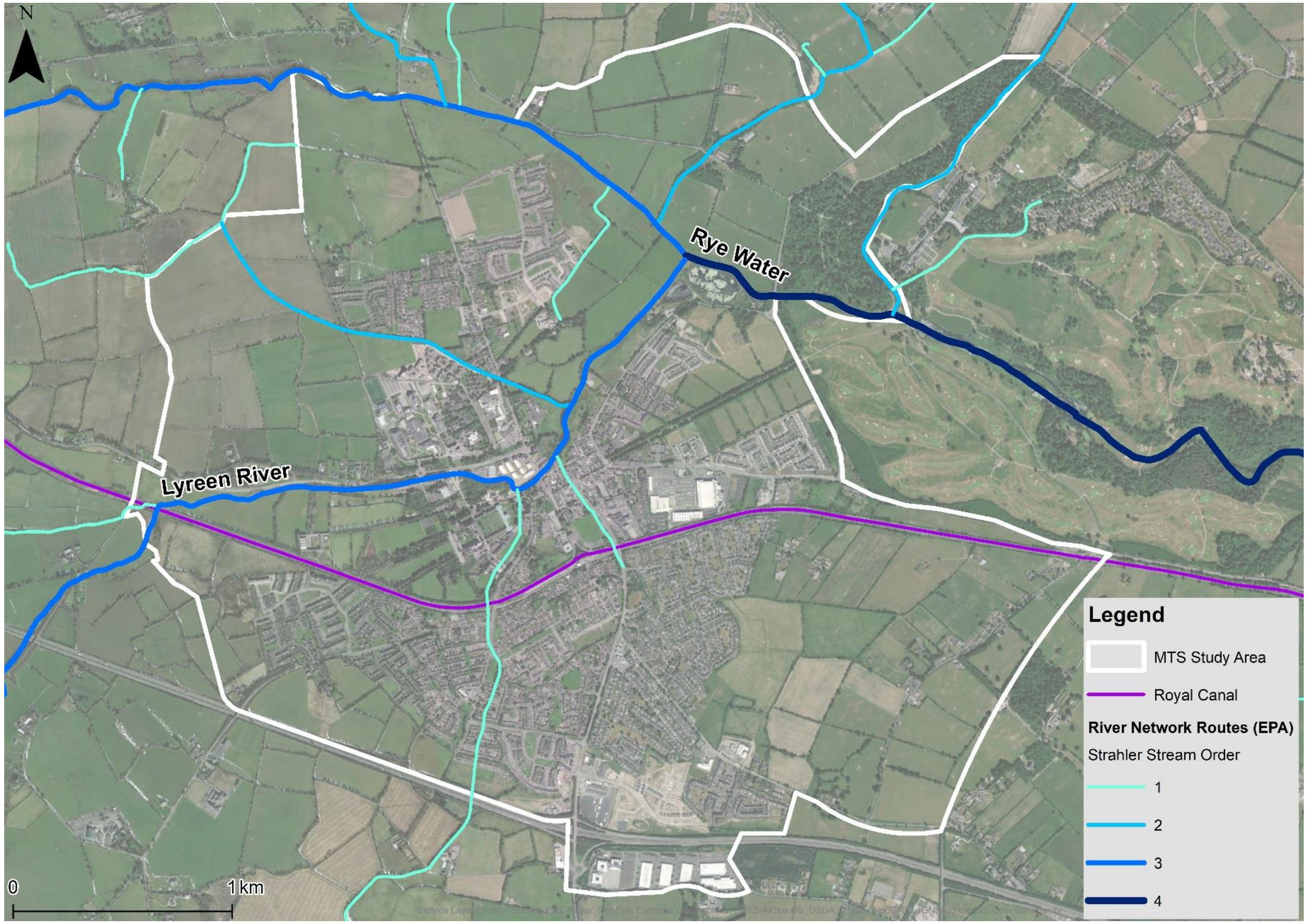

Figure 3-10 River and Canal Network

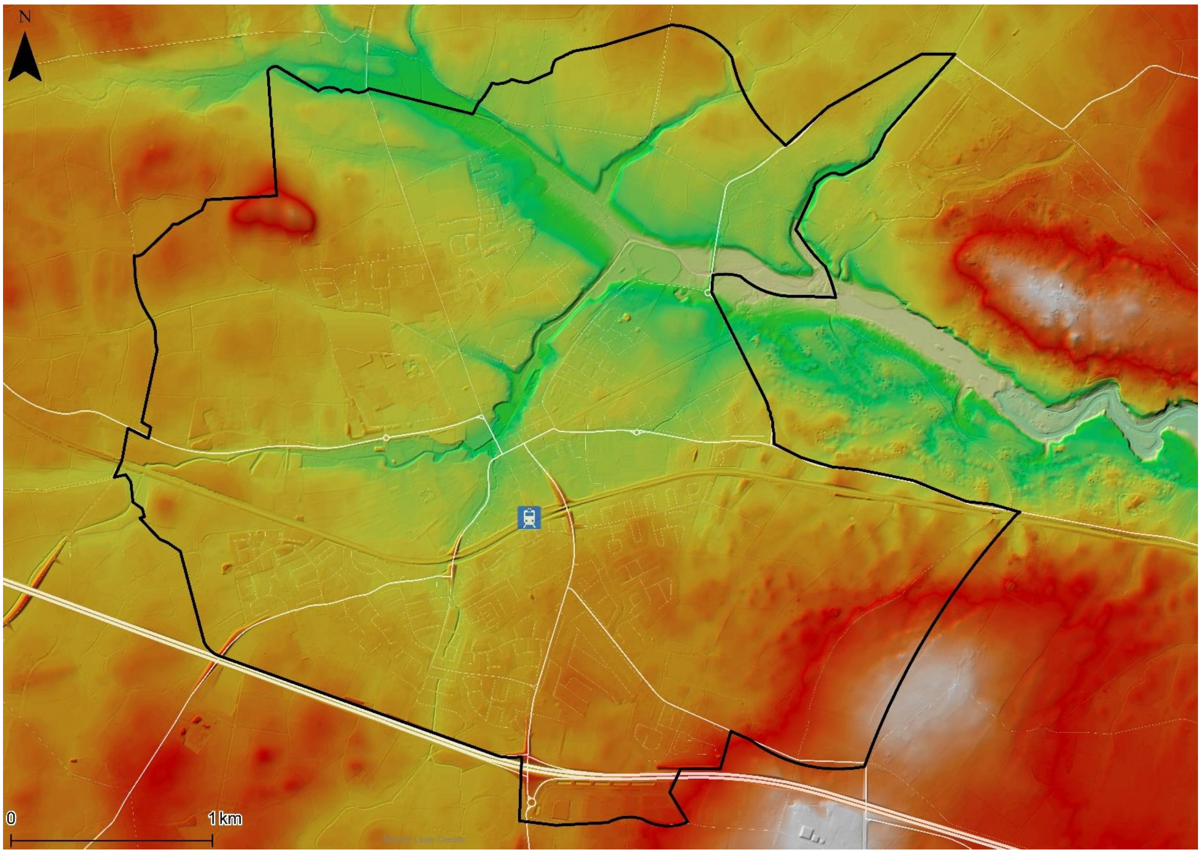

Figure 3-11 Topography of the Study Area (LiDAR Digital Terrain Model)[7]

[7] Contains Irish Public Sector Data (Geological Survey Ireland & the Office of Public Works) licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence.

3.9 Environmental and Heritage Sites

The location of environmental and heritage sites within the study area may impact upon the feasibility of some potential transport and land use options. The study area contains a Special Area of Conservation (SAC) and two proposed Natural Heritage Areas (pNHAs) in addition to numerous National Monument Service Records and National Inventory of Architectural Heritage Structures. Further detail on each type of site is provided in this section. There are no Natural Heritage Area sites (NHAs) or Special Protection Area sites (SPAs) within, or in close proximity to, the study area.

Special Areas of Conservation (SACs) are prime wildlife conservation areas, considered to be important on a European as well as Irish level. Figure 3-12 shows the part of the Rye Water Valley/Carton SAC which is in, or close to, the study area. However, this SAC also extends further east to Leixlip, where the Rye Water joins the River Liffey. The conservation importance of the site lies in the presence of several rare and threatened plant and animal species, and the presence of petrifying springs, a habitat type listed on Annex I of the E.U. Habitats Directive. The woods found on the Carton Estate and their birdlife are of additional interest.

Three conservation objectives have been defined for the SAC including:

- To restore the favourable conservation condition of Petrifying springs with tufa formation;
- To restore the favourable conservation condition of Narrow-mouthed Whorl Snail; and
- To maintain the favourable conservation condition of Desmoulin's Whorl Snail.

Further information about the attributes and targets associated with each of the Conservation Objectives is available in the Conservation Objectives document published by the National Parks and Wildlife Service[8].

A Natural Heritage Area (NHA) is an area considered important for the habitats present or which holds species of plants and animals whose habitat needs protection. There are no sites with an NHA designation within the study area. However, nationwide, there are 630 proposed NHAs (pNHAs) which were published on a non-statutory basis in 1995 and have not since been statutorily proposed or designated. Prior to statutory designation, pNHAs are subject to limited protection,

[8] https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO001398.pdf

including recognition of their ecological value by Planning and Licencing Authorities. Two pNHAs overlap the study area, as shown in Figure 3-13. The Rye Water Valley/Carton pNHA is almost identical in extent to the Rye Water Valley/Carton SAC already discussed above. In addition, the entire Royal Canal corridor between Dublin and Longford is also a pNHA (site code 002103). The canal pNHA comprises the central channel and the banks either side of it. According to the site synopsis published in 1995, the ecological value of the canal lies more in the diversity of species it supports along its linear habitats than in the presence of rare species. It crosses through agricultural land and therefore provides a refuge for species threatened by modern farming methods.

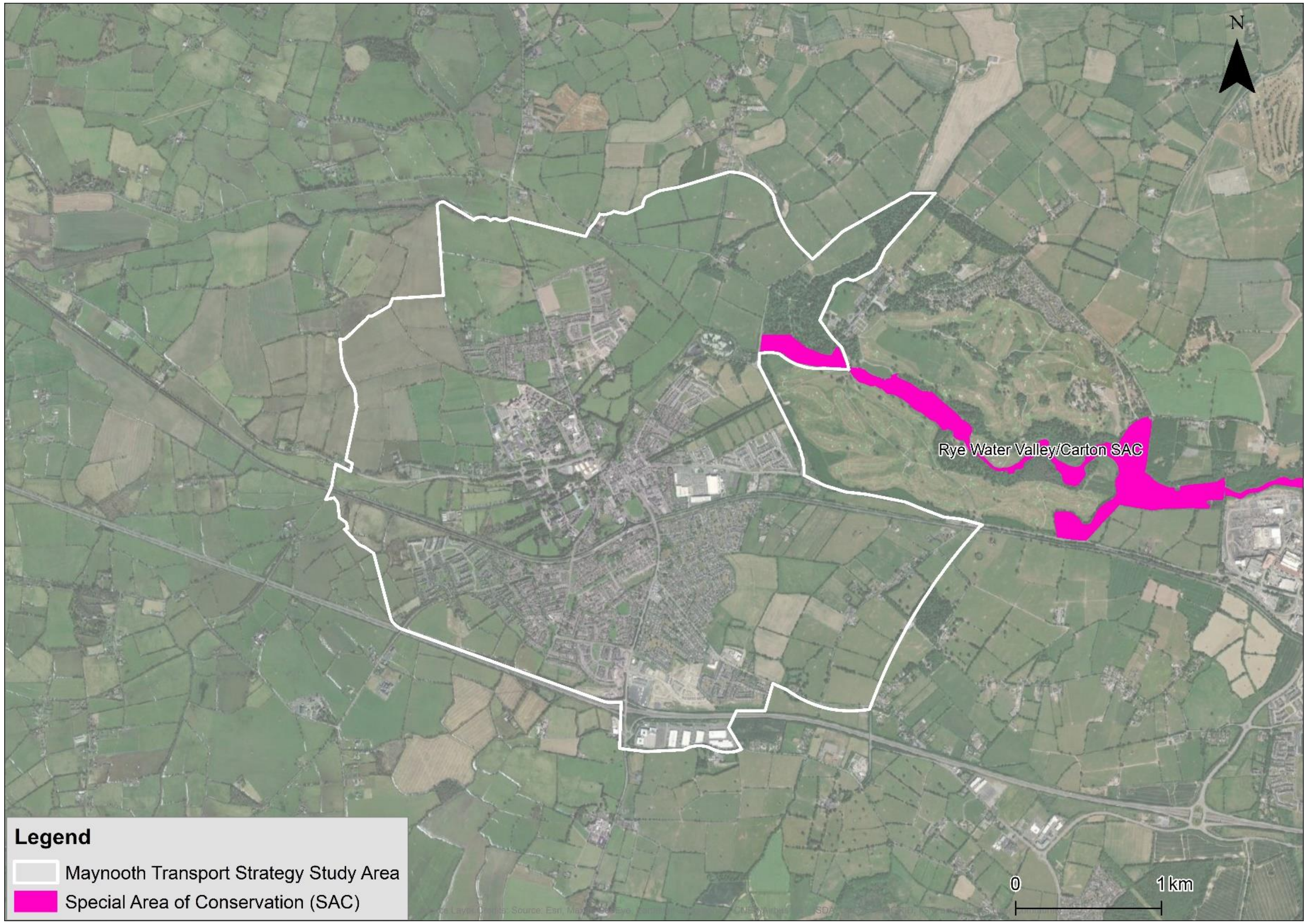

Figure 3-12 Special Area of Conservation (SAC) Sites

Figure 3-13 Proposed Natural Heritage Area (pNHA) Sites

The Sites and Monuments Record (SMR) is a database maintained by the Archaeological Survey of Ireland (ASI) which is a unit of the National Monuments Service. The SMR contains details of all monuments and places (sites) where it is believed there is a monument known to the ASI pre-dating 1700AD and also includes a selection of monuments from the post-AD 1700 period. There are 27 National Monuments Service sites within the study area which are listed in Table 3-2. As shown in the second column of the table, these sites consist of a wide variety of different types of features. The locations of all sites within and surrounding the study area are shown in Figure 3-14.

Table 3-2 National Monuments Service Sites and Monuments Records in Study Area

SMRS	CLASSDESC	TOWNLAND_NAME
KD005-014----	Architectural feature	MAYNOOTH
KD005-037----	Barrow - ring-barrow	LARAGHBRYAN EAST
KD005-013----	Building	COLLEGELAND
KD005-015004-	Building	MAYNOOTH
KD010-040----	Burial ground	MONEYCOOLY
KD005-015----	Castle - Anglo-Norman masonry castle	MAYNOOTH
ME053-001----	Castle - tower house	MOYGADDY
KD005-008----	Castle - unclassified	LARAGHBRYAN EAST
KD005-016----	Church	MAYNOOTH
KD005-009002-	Church	LARAGHBRYAN EAST
KD005-021----	Ecclesiastical enclosure	LARAGHBRYAN EAST
KD005-009001-	Ecclesiastical site	LARAGHBRYAN EAST
KD005-011001-	Enclosure	MAYNOOTH
KD005-036----	Enclosure	LARAGHBRYAN EAST
KD005-041----	Enclosure	LARAGHBRYAN EAST
KD005-023----	Field boundary	MAYNOOTH
KD010-008----	Field system	MONEYCOOLY
KD005-012----	Field system	MAYNOOTH
KD011-061----	Furnace	MONEYCOOLY
KD005-009003-	Graveyard	LARAGHBRYAN EAST
KD005-015002-	House - early medieval	MAYNOOTH

SMRS	CLASSDESC	TOWNLAND_NAME
KD005-015003-	House - early medieval	MAYNOOTH
KD005-015001-	House - prehistoric	MAYNOOTH
KD005-010----	Ring-ditch	MAYNOOTH
KD005-011002-	Road - road/trackway	MAYNOOTH
KD005-015005-	Well	MAYNOOTH
KD005-015006-	Well	MAYNOOTH

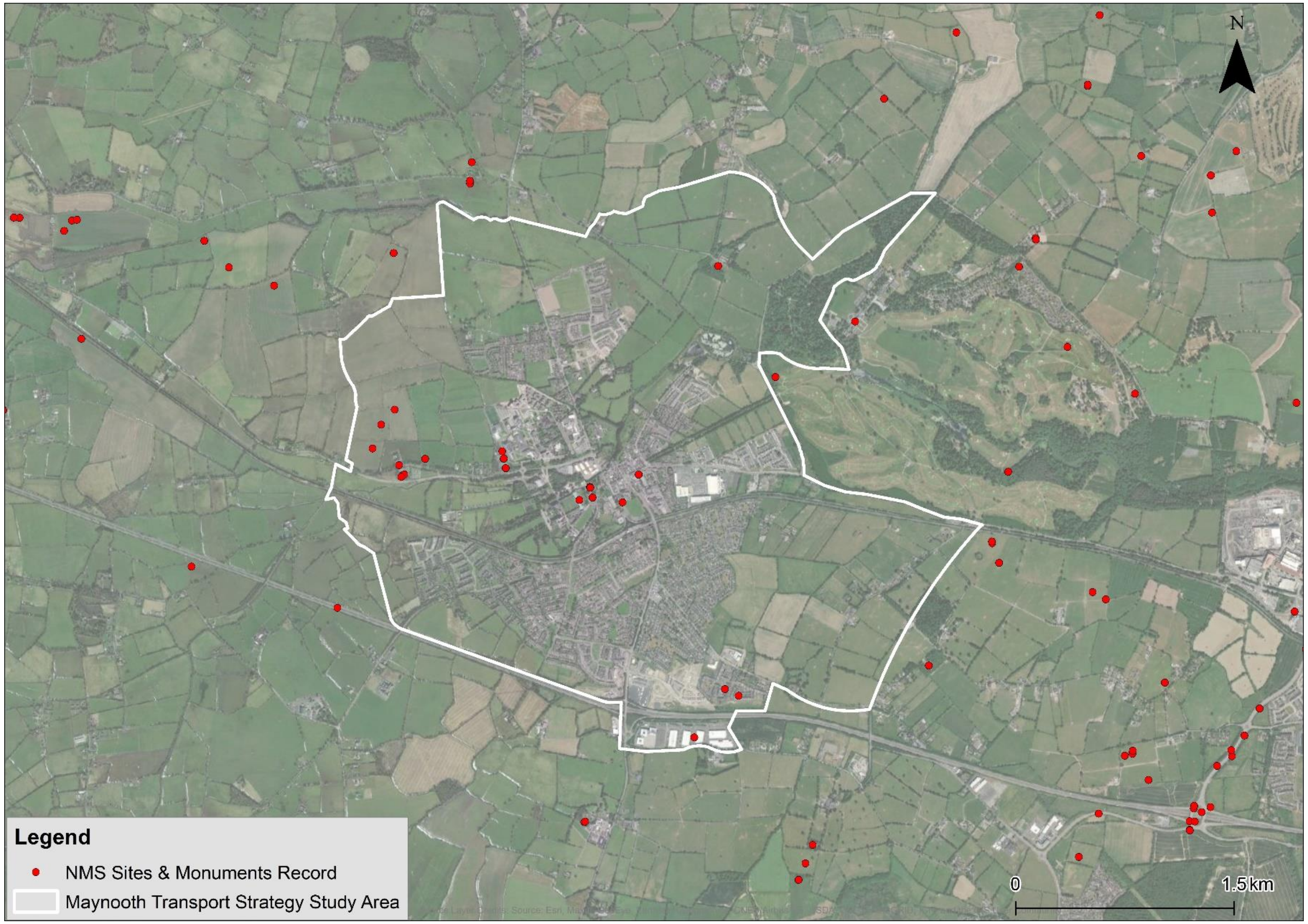

Figure 3-14 National Monuments Services Sites & Monuments

The National Inventory of Architectural Heritage (NIAH) is a state initiative under the administration of the Department of Housing, Local Government and Heritage and is established on a statutory basis. The purpose of the NIAH is to identify, record and evaluate the post-1700 architectural heritage of Ireland, uniformly and consistently as an aid in the protection and conservation of built heritage. A Record of Protected Structures (RPS) forms part of each local authority's development plan and the Minister for Housing, Local Government and Heritage may recommend structures to the local authorities for inclusion on the RPS. Sites, structures, or groups of structures which are given a Regional, National or International Rating by the NIAH are included in the Minister's recommendations.

There are 97 structures included in the NIAH within the study area, 93 of which have a 'Regional' rating and four of which have a 'National' rating. Three of the four sites with a 'National' rating in the NIAH are part of Saint Patrick's College campus (a university building, a church/chapel and a miscellaneous building), while St. Mary's Church on Parson Street also has a 'National' rating. All NIAH structures within the study area are summarised in Table 3-3 according to their original type (which may not be the same as the current use of the structure) and location, while Figure 3-15 shows the location of all NIAH structures within and surrounding the study area. A significant number of the structures are located within the grounds of St. Patrick's College.

Further information on individual features contained within the SMR and the NIAH can be accessed using the Historic Environment Viewer provided by the Department of Housing, Local Government and Heritage[9] and both datasets are also available in a range of other formats[10].

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[9] https://www.archaeology.ie/archaeological-survey-ireland/historic-environment-viewer-application

[10] https://data.gov.ie/dataset/national-inventory-of-architectural-heritage-niah-national-dataset?package_type=dataset;

https://data.gov.ie/dataset/national-monuments-service-archaeological-survey-of-ireland?package_type=dataset

Table 3-3 National Inventory of Architectural Heritage Structures

Original Type	Count of Original Type	Street/Location	Count by Type and Street
House	54	Main Street	31
		Court House Square	4
		Leinster Street	4
		Dublin Road	3
		Mill Street	3
		Old Greenfield	2
		Maria Villa	1
		Convent Lane	1
		Dunboyne Road	1
		Leinster Cottages	1
		Old Railpark	1
		Parson Street	1
		Straffan Road	1
Building Misc.	10	Main Street (Saint Patrick's College)	9
		Pound Lane	1
Bridge	5	Mill Street (William Bridge)	1
		Bond Bridge	1
		Mullen Bridge	1
		Pike Bridge	1
		<NULL>	1
Church/Chapel	4	Main Street	1
		Mill Street	1
		Parson Street	1
		Pound Lane	1

Original Type	Count of Original Type	Street/Location	Count by Type and Street
Foot Bridge	2	Parson Street (Castle View House)	2
Handball Alley	2	Main Street (Saint Patrick's College)	2
Outbuilding	2	Doctor's Lane	1
		Main Street (Saint Patrick's College)	1
Presbytery/Parochial/ Curate's House	2	Leinster Street (The Presbytery)	1
		Mill Street (Saint Mary's Parochial House)	1
School	2	Leinster Street (Geraldine Hall)	1
		Pound Lane	1
Canal (Section Of)	1	<NULL>	1
Engine House	1	Main Street (Saint Patrick's College)	1
Exam Hall	1	Main Street (Saint Patrick's College)	1
Gate Lodge	1	Main Street (Carton)	1
Graveyard/Cemetery	1	Main Street (Saint Patrick's College)	1
Hall Of Residence	1	Main Street (Saint Patrick's College)	1
Hotel	1	Main Street	1
Library/Archive	1	Main Street (Saint Patrick's College)	1
Monument	1	Court House Square	1
Museum/Gallery	1	Main Street	1

Original Type	Count of Original Type	Street/Location	Count by Type and Street
Rectory/Glebe/Vicarage/ Curate's House	1	Parson Street (The Rectory)	1
Signal Box	1	Maynooth Railway Station	1
Station Master's House	1	Maynooth Railway Station	1
University	1	Main Street (St. Patrick's College)	1

Figure 3-15 National Inventory of Architectural Heritage Structures

4. Transport Context

This section provides an overview of the modal split for travel, the origin-destination of trips, public transport services, the road network and collisions in the study area.

4.1 Modal Split Analysis

4.1.1 Work Trips

Figure 4-1 shows the modal split for work trips by Maynooth Town residents. This highlights that Maynooth residents are quite car dependent with 66% of work commuters travelling by private motor vehicle. Public transport use is reasonably high with a combined figure of 21% of trips made this way which breaks down as 15% and 6% using rail and bus respectively. The relatively high public transport use will reflect the fact that Maynooth is part of the Dublin Bus network and has regular train services on the Maynooth line to Dublin City centre. The percentage of people walking to work is quite low at 9%, perhaps reflecting a lack of local employment beyond the town centre and the university. Similarly, cycling to work is low at 2% considering that the town is relatively compact, with a large student population, and this may reflect the lack of dedicated cycle infrastructure.

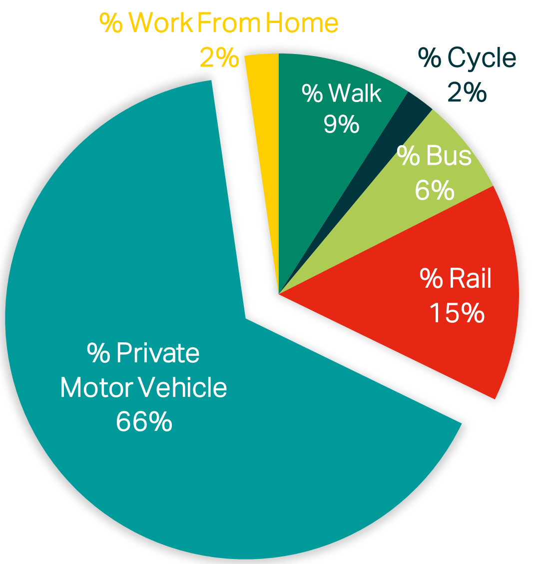
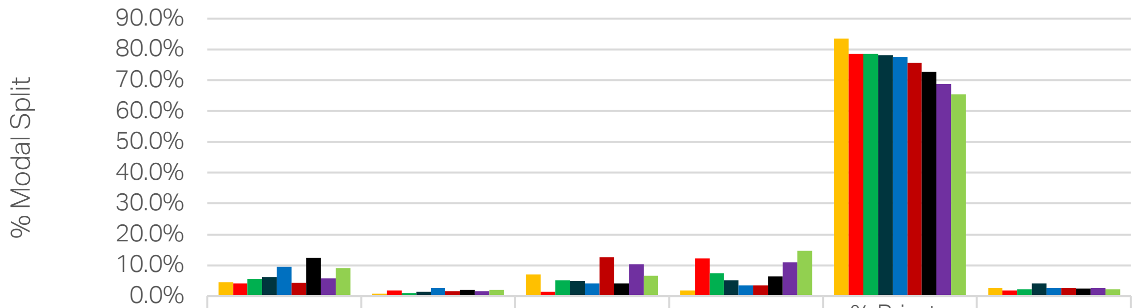


Figure 4-1 Census 2016 – Work Trip Modal Split for Maynooth Settlement

Figure 4-2 compares the modal split for work trips in Maynooth with the county average and other similar settlements across county Kildare. The levels of car use in Maynooth are lower than the county average by a substantial margin and the other towns in Kildare. The lower levels of car use in Maynooth are due to a higher percentage of people walking and using rail or bus to get to work, when the results are compared to most comparable towns in Kildare. Yet, while car use is lower than the other towns, the majority of people in the town are still car dependent (66%) and this is a major issue in respect to local emissions, transport system efficiency and safety. The MEABTA will seek to shift modal choices to sustainable modes such as walking, cycling, bus and rail for work trips.



	% Walk	% Cycle	% Bus	% Rail	% Private Motor Vehicle	% Work From Home
Clane	4.4%	0.7%	6.9%	1.8%	83.6%	2.6%
Sallins	4.1%	1.8%	1.5%	12.3%	78.6%	1.8%
Kilcock	5.5%	1.1%	5.2%	7.5%	78.5%	2.3%
County Kildare	6.2%	1.4%	5.0%	5.2%	78.2%	4.1%
Naas	9.6%	2.6%	4.2%	3.5%	77.5%	2.7%
Celbridge	4.3%	1.5%	12.5%	3.4%	75.6%	2.6%
Newbridge	12.3%	1.9%	4.2%	6.4%	72.8%	2.3%
Leixlip	5.7%	1.5%	10.4%	11.0%	68.8%	2.6%
Maynooth	9.1%	2.0%	6.5%	14.6%	65.5%	2.3%

Figure 4-2 Census 2016 – Work Trip Modal Split for Settlements in Kildare

4.1.2 Education Trips

Figure 4-3 shows the modal split for education (school and college) trips by Maynooth residents. This shows that the primary mode of travel for education trips is walking at 60%, which is positive in respect to sustainable travel. However, three large schools have been added to the northern periphery of the town since the Census was conducted in 2016 and this will mean it is likely that a lower proportion of students now walk to school due to the greater distances involved. A key objective of the MEABTA will be to improve access to schools and the university via walking and cycling, as well as public transport, to minimise car use where possible and promote modal shift to sustainable travel modes.

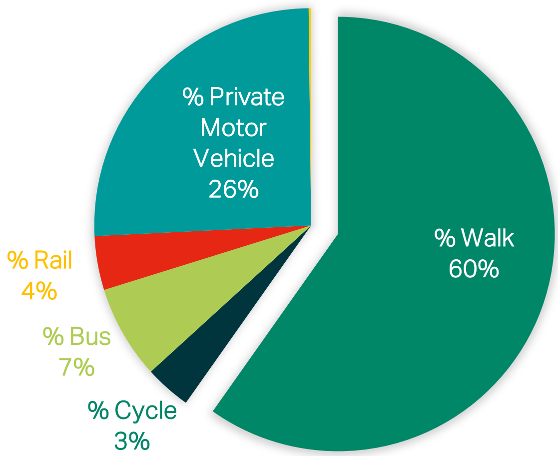
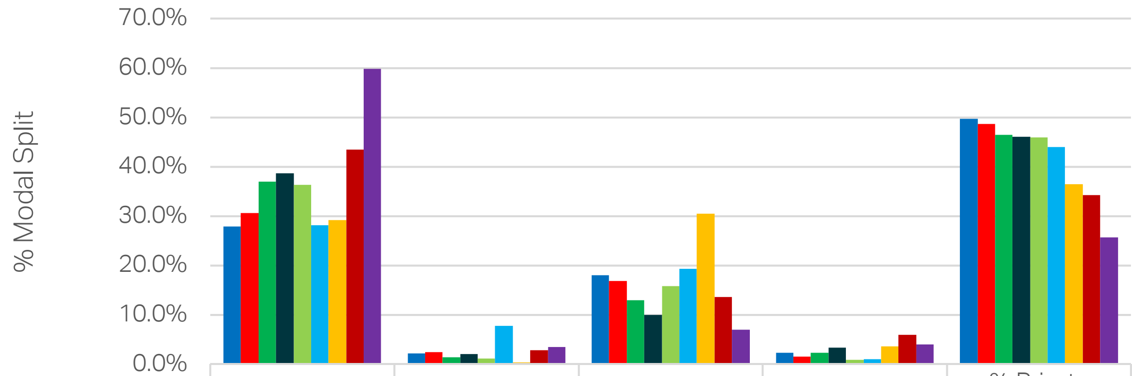


Figure 4-3 Census 2016 – Education Trip Modal Split for Maynooth Settlement

Figure 4-4 compares the modal split for education trips in Maynooth with other similar urban centres in County Kildare. Car use is lower in Maynooth than the county average for education trips and this is due to the very high levels of walking to education which occur in Maynooth. The high levels of walking in Maynooth are due to the central location of schools in 2016 and the presence of a walking distance university from most residences. School and college buses play a lesser role in Maynooth than other comparison towns, primarily due to the high percentage of walking trips to education. While car use is relatively low for Maynooth in the 2016 Census, this situation may have increased since the opening of the new northern school complex and the MEABTA will seek to minimise the shift to car use for longer distance education trips where possible.



	% Walk	% Cycle	% Bus	% Rail	% Private Motor Vehicle
County Kildare	27.8%	2.1%	18.0%	2.3%	49.7%
Naas	30.6%	2.4%	16.9%	1.5%	48.6%
Kilcock	37.0%	1.3%	13.0%	2.2%	46.5%
Newbridge	38.6%	2.0%	10.0%	3.3%	46.0%
Clane	36.4%	1.1%	15.8%	0.9%	45.9%
Celbridge	28.1%	7.7%	19.2%	0.9%	44.0%
Sallins	29.2%	0.3%	30.5%	3.6%	36.4%
Leixlip	43.5%	2.7%	13.6%	5.9%	34.2%
Maynooth	59.8%	3.4%	7.0%	4.0%	25.6%

Figure 4-4 Census 2016 – Education Trip Modal Split for Settlements in Kildare

4.2 Trip Length Distribution

The National Transport Authority provided trip length distribution information which summarises the length of trips made by residents of Maynooth using each mode of transport for internal and external trips. In this section, the trip length distribution for internal and external work and education trips will be examined. The purpose of this analysis is to understand the potential for modal shift to active modes for internal trips within Maynooth and to public transport for external trips. In the following graphs, modes were excluded from the analysis if the maximum trips recorded using that mode was less than 10 trips.

Figure 4.5 shows the trip length distribution for internal work trips within Maynooth by mode. The chart highlights the popularity of walking to work in Maynooth as the majority of internal work trips are less than 3km in length. However, the prevalence of car usage for the remainder of these trips, suggests that there remains scope to encourage modal shift away from private cars to walking and cycling for these short trips. The small number of trips currently undertaken by cycling, particularly for trips of over 3km or longer, further highlights the opportunity to increase this proportion and promote cycling as a preferred mode choice for short internal work trips.

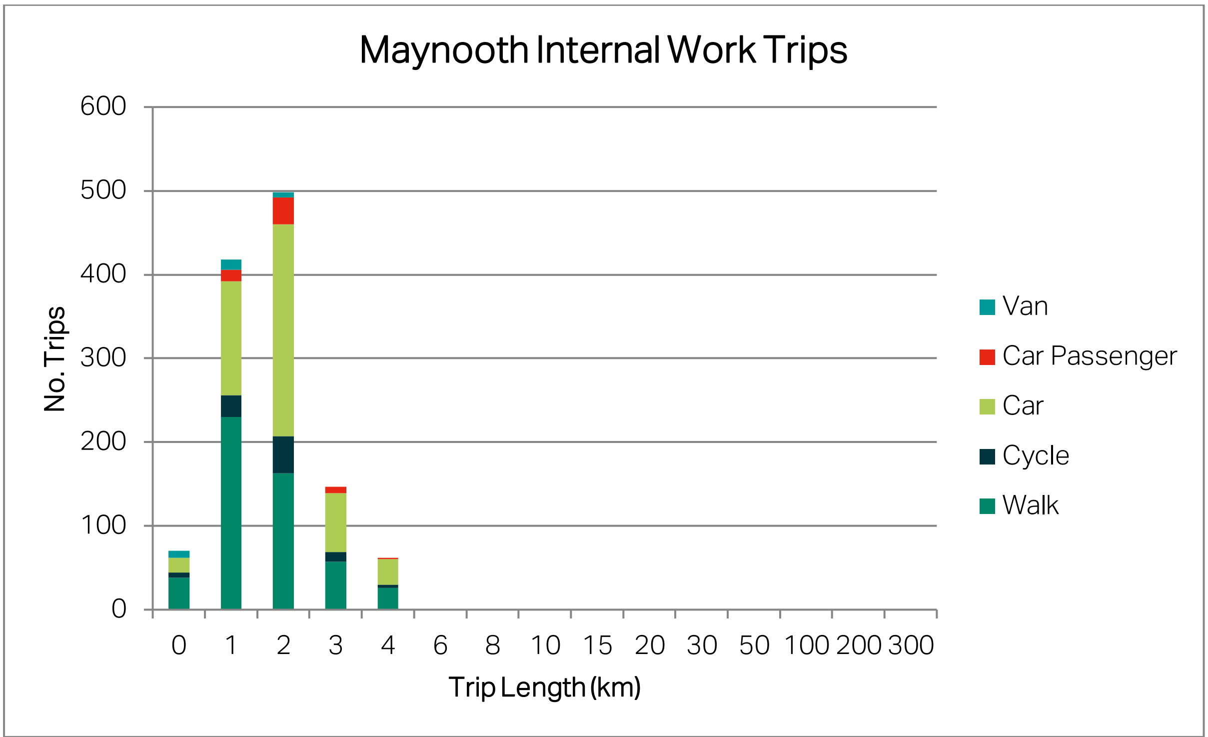


Figure 4.5 Trip Length Distribution of Internal Work Trips within Maynooth

Figure 4.6 shows the trip length distribution and mode choice for external work trips from Maynooth. The majority of external work trips are between 20km and 30km in length, likely as this is the distance to Dublin from Maynooth. In this bracket, the importance of the train and bus is evident. These two modes cover just over half of all trips of this length, with the private car covering the majority of the remaining trips. The strong use of public transport for this length of trip is starkly contrasted by the dominance of the private car in all other trip length brackets. The graph suggests that improvements to connections with other, non-Dublin, nearby employment destinations along with improvements to public transport frequencies in the AM and PM peaks may help to encourage more commuters out of cars and onto public transport for external work trips.

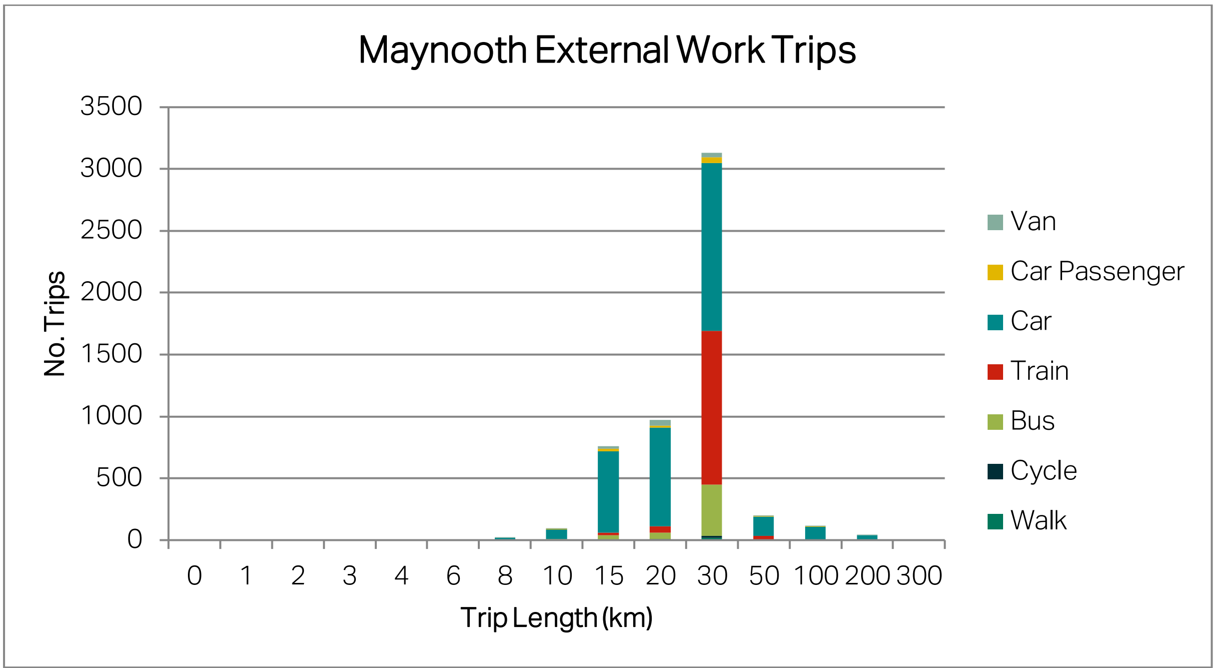


Figure 4.6 Trip Length Distribution of External Work Trips within Maynooth

Figure 4.8 shows the trip length distribution of internal trips for education in Maynooth by mode. These figures are from 2016, before the new Maynooth Education Campus to the north of the town was completed. The 2022 census results are likely to show a different picture as three schools are now located on the northern outskirts of the town, accommodating almost 2,000 students in total. Figure 4.7 shows the previous and new location of the two secondary schools in Maynooth (Gaelscoil Ruairi is a new primary school and has always been located on the Maynooth Education Campus).

Due to the peripheral location of the Maynooth Education Campus, the relocation of schools that were originally centrally located will result in a greater number of trips to education being made by bus, car and cycling than was previously the case, as more students now need to travel distances which are too far for walking. It is therefore essential that both cycling and bus connectivity to the Maynooth Education Campus is improved to avoid a mass transition to the private car for internal education trips.

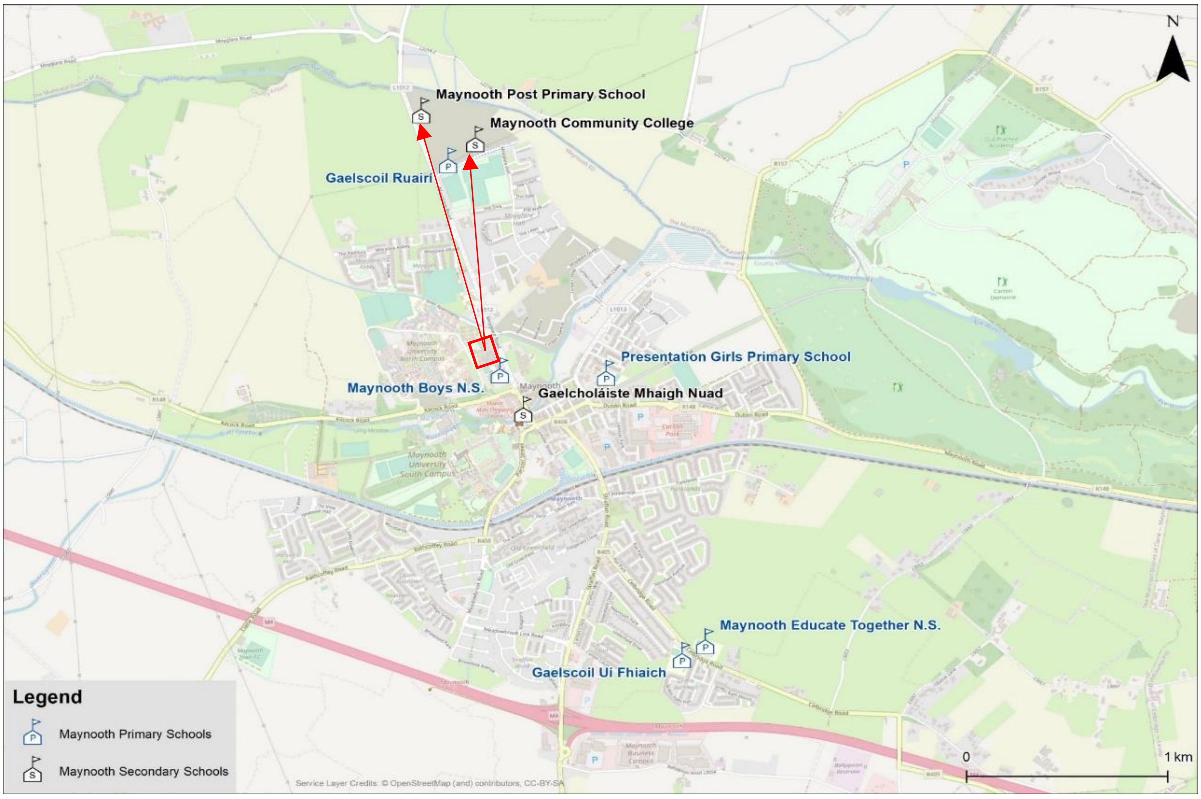


Figure 4.7 Map displaying the old and new location of the two secondary schools in Maynooth

Recognising that the 2022 results are likely to show a different picture, the 2016 figures highlight the strong prevalence of walking to education in Maynooth, with this mode accounting for 64% of all internal education trips. Within this positive trend there is still space for further growth of public transport and active modes usage to cover the 27% of trips made by private car as a driver or passenger. There is scope to encourage these people to change modes to active modes or bus. Similar to internal work trips, cycling accounts for a very small proportion of trips and this points to an opportunity to expand the use of this mode for these short internal education trips in the town.

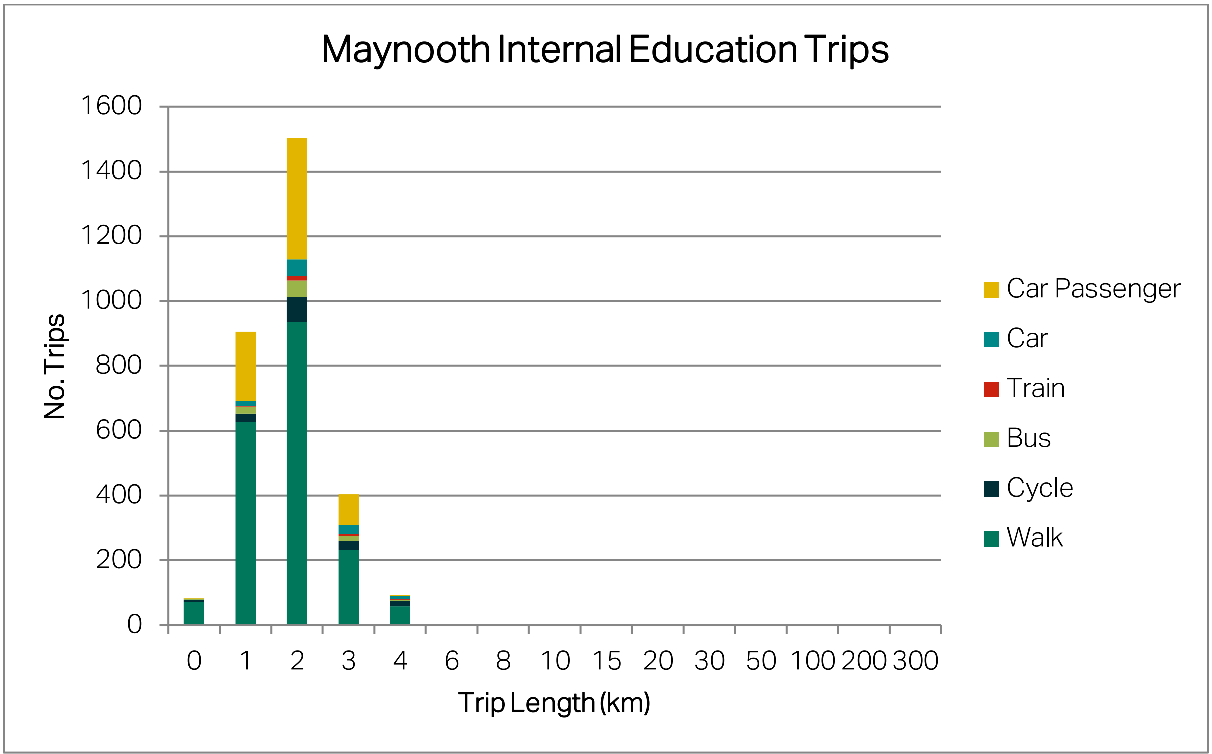


Figure 4.8 Trip Length Distribution of Internal Education Trips within Maynooth

Figure 4.9 shows the trip length distribution of external Maynooth education trips made by mode. This graph demonstrates that the majority of these trips are between 20 and 30km in length, and therefore likely terminate in Dublin. 78% of these trips are completed by train or bus and 69% of all external education trips form Maynooth are completed on public transport. These figures demonstrate strong usage of non-private car modes to access external education opportunities from Maynooth. Within the 20-30km length trips there is not much room to improve as current usage of public transport is already very high. However, the proportion of car use for trips of other lengths is higher and as such, with improvements to frequencies at the AM and PM peak and improved connections to education facilities outside of Dublin, usage of private cars for these shorted external trips could be decreased further.

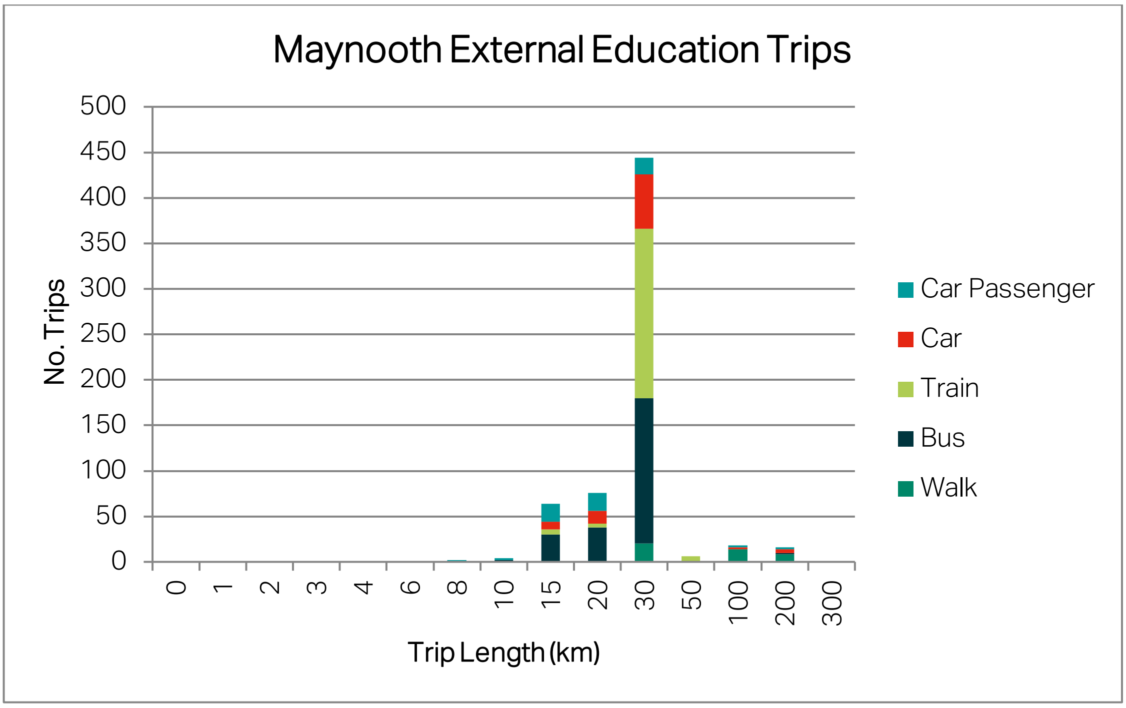


Figure 4.9 Trip Length Distribution of External Education Trips from Maynooth

4.3 Origin-Destination Analysis

The Place of Work, School or College - Census of Anonymised Records (POWSCAR, 2016) dataset was used to assess the origin and destinations of trips to and from the Maynooth study area.

4.3.1 Trips from Maynooth

This section provides information on the destination of trips made by residents of Maynooth.

4.3.1.1 Work and Third Level Education Trip Destinations

Table 4-1 shows the destination of work and 3rd level education trips[11] by residents of Maynooth based on the POWSCAR (2016) dataset. This table shows that around a fifth of work/college trips are internal to Maynooth (22.1%) and this shows the potential for a substantial number of local trips to be catered for by walking and cycling modes. Just over 30% of trips are long distance to County Dublin, with the

[11] Work and 3rd level trips have been combined because they involve similar independent, often long distance, travel by adults. In contrast with this, school travel is often shorter distance and escorted by a parent or involves the use of dedicated school buses rather than general public transport.

majority of these to the Dublin City Council area, which explains the strong modal split result for rail and the potential to encourage modal shift when the rail line is improved in the DART+ programme. There are relatively low volume trips to nearby towns in Kildare, but a substantial number of people work/study in Leixlip with over 350 people making this trip, which shows the importance of bus links with this town.

Table 4-1 POWSCAR Destination of Work and 3rd Level College Trips by Maynooth Residents

Destination of Work and Third Level Trips (POWSCAR Town)		**Number of Trips**	**Percent of all Work and Third Level Trips from Maynooth**
Dublin City and Suburbs		2,958	30.9%
Administrative Area within Dublin City and Suburbs	*Dublin City*	*1,924*	20.1%
	Dun Laoghaire Rathdown	*289*	3.0%
	Fingal	*245*	2.6%
	South Dublin	*500*	5.2%
Maynooth		2,114	22.1%
Leixlip		356	3.7%
Kildare Rural		346	3.6%
Dublin Rural		208	2.2%
Celbridge		113	1.2%

Destination of Work and Third Level Trips (POWSCAR Town)	Number of Trips	Percent of all Work and Third Level Trips from Maynooth
Naas	72	0.8%
Meath Rural	60	0.6%
Swords	44	0.5%
Kilcock	35	0.4%
Other Destinations	313	3.3%
Total (excluding Dublin administrative area breakdown)	6,619	

Figure 4-10 shows the destination of work and college trips by Maynooth residents spatially. This shows the themes explained in the table in geographic form, while also highlighting the high number of dispersed trip destinations to the Dublin suburbs which will be more challenging to reach by public transport and likely contribute to car dependency. It may be the case in the future that the introduction of public transport improvements in Dublin such as BusConnects, MetroLink, Luas expansion and DART+ will make interchange with orbital and radial public transport easier and make these locations more accessible to residents from Maynooth.

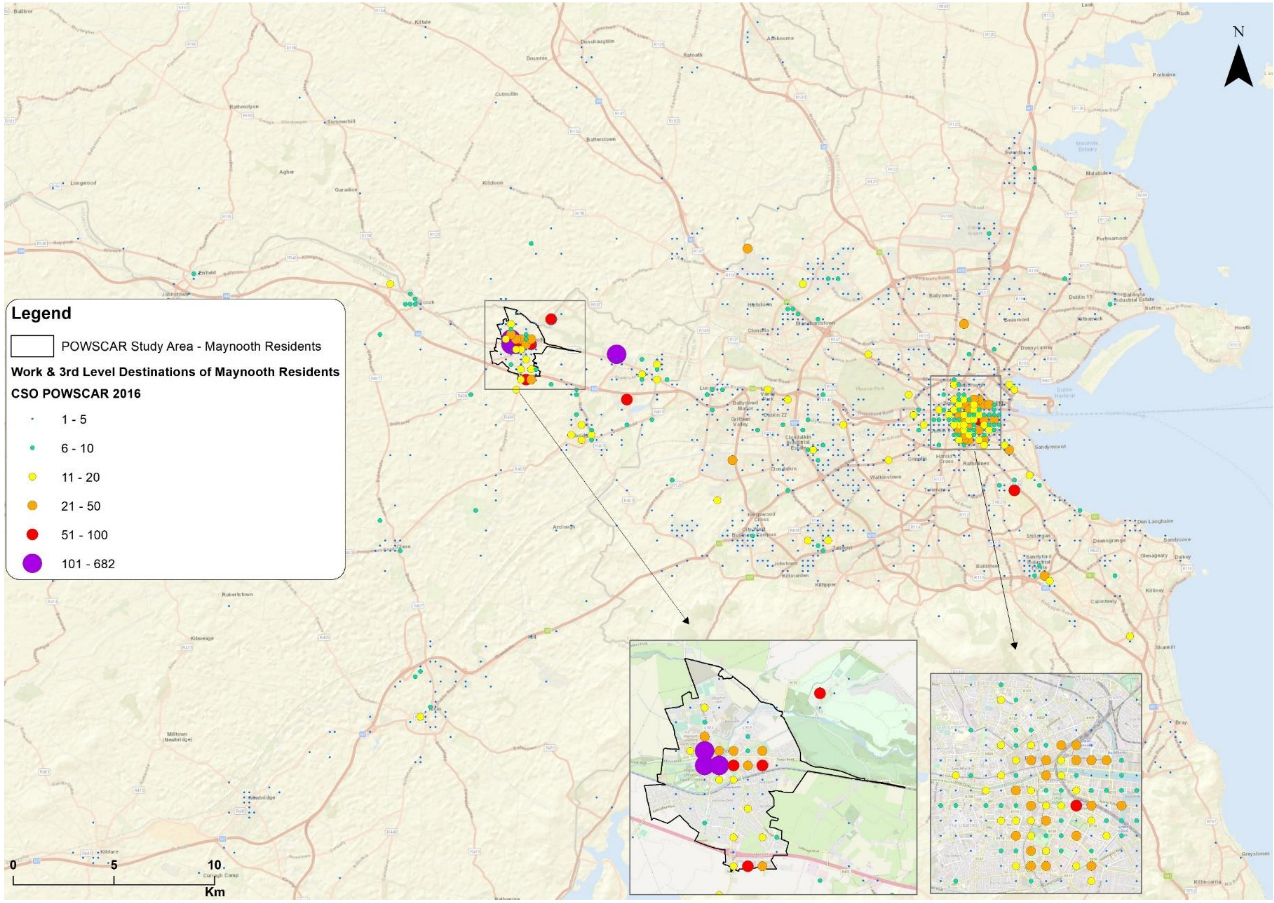


Figure 4-10 POWSCAR Destination of Work and 3rd Level College Trips by Maynooth Residents

4.3.1.2 Primary and Secondary Level Education Trip Destinations

The vast majority of primary and secondary school pupils who live in Maynooth also attend school in Maynooth. The POWSCAR dataset shows that when ‘Blank or Uncodeable’ responses are excluded, 93% of pupils with a known primary school location attended school in Maynooth, while 86% of pupils with a known secondary school location attended school in Maynooth. Just under 2% of primary school pupils travelled to Celbridge and to Meath Rural, while 1% of primary school pupils travelled to Leixlip and to Kilcock. At secondary school level, the most significant destination outside of Maynooth was Dublin City and Suburbs, with 9% of secondary school pupils living in Maynooth attending school somewhere in that area. Other areas to which pupils travelled to secondary school in 2016 included ‘Kildare Rural’ (1%), Celbridge (0.9%) and Leixlip (0.9%).

The recent opening of the new northern school campus has significantly increased the number of school places available within Maynooth at secondary school level and therefore it is possible that an even lower proportion of resident pupils are travelling outside of the study area for school now than was previously the case. The POWSCAR maps showing school destinations have been excluded from this section due to the relocation of schools within Maynooth since the 2016 Census, which will have changed the school destinations significantly.

4.3.2 Trips to Maynooth

This section provides a summary of the origin of trips to Maynooth by people who work or study in the town based on the POWSCAR (2016) dataset.

4.3.2.1 Origin of Work Trips

Table 4-2 shows the origin of work trips to Maynooth CSO Settlement to access jobs. This shows that around 20% of work trips originate within Maynooth and these internal trips will have the greatest potential for modal shift to shorter distance modes such as walking or cycling. Notably, 21.5% of trips originate in Dublin City and Suburbs so the town is attracting longer distance work commutes along a radial corridor and there is the potential for these trips to be catered for via train or bus. The table also highlights the important role of Maynooth in providing employment for people from Celbridge, Leixlip, Clane and Kilcock; showing the potential for improved public transport links with these areas to reduce car dependency.

Table 4-2 POWSCAR (2016) – Origin of Work Trips to Maynooth CSO Settlement

<table>
<tr><th colspan="2">CSO Settlement / County –Workers' Residence</th><th>Number of Trips</th><th>Percent of all Work Trips to Maynooth</th></tr>
<tr><td colspan="2">Maynooth</td><td>1046</td><td>20.7%</td></tr>
<tr><td colspan="2">Dublin City and Suburbs</td><td>1083</td><td>21.5%</td></tr>
<tr><td rowspan="4">Administrative Area within Dublin City and Suburbs</td><td>Dublin City</td><td>418</td><td>8.3%</td></tr>
<tr><td>South Dublin</td><td>376</td><td>7.4%</td></tr>
<tr><td>Fingal</td><td>168</td><td>3.3%</td></tr>
<tr><td>Dún Laoghaire Rathdown</td><td>121</td><td>2.4%</td></tr>
<tr><td colspan="2">Kildare Rural</td><td>436</td><td>8.6%</td></tr>
<tr><td colspan="2">Celbridge</td><td>335</td><td>6.6%</td></tr>
<tr><td colspan="2">Meath Rural</td><td>260</td><td>5.2%</td></tr>
</table>

CSO Settlement / County –Workers' Residence	Number of Trips	Percent of all Work Trips to Maynooth
Leixlip	231	4.6%
Kilcock	227	4.5%
Clane	110	2.2%
Enfield	65	1.3%
Naas	64	1.3%
Other Kildare Settlements	238	4.7%
Other Meath Settlements	233	4.6%
Westmeath	181	3.6%
Offaly	75	1.5%
Wicklow	72	1.4%
Other Fingal (excl. Dublin City and Suburbs)	56	1.1%
All Other	335	6.6%
Total (excluding Dublin administrative area breakdown)	5,047	

Figure 4-11 shows the Electoral Divisions where people start their journey when travelling to Maynooth for work, based on data from POWSCAR (2016). This shows a similar theme to the table, with relatively high trip numbers from local towns and longer distance trips from dispersed locations across County Dublin.

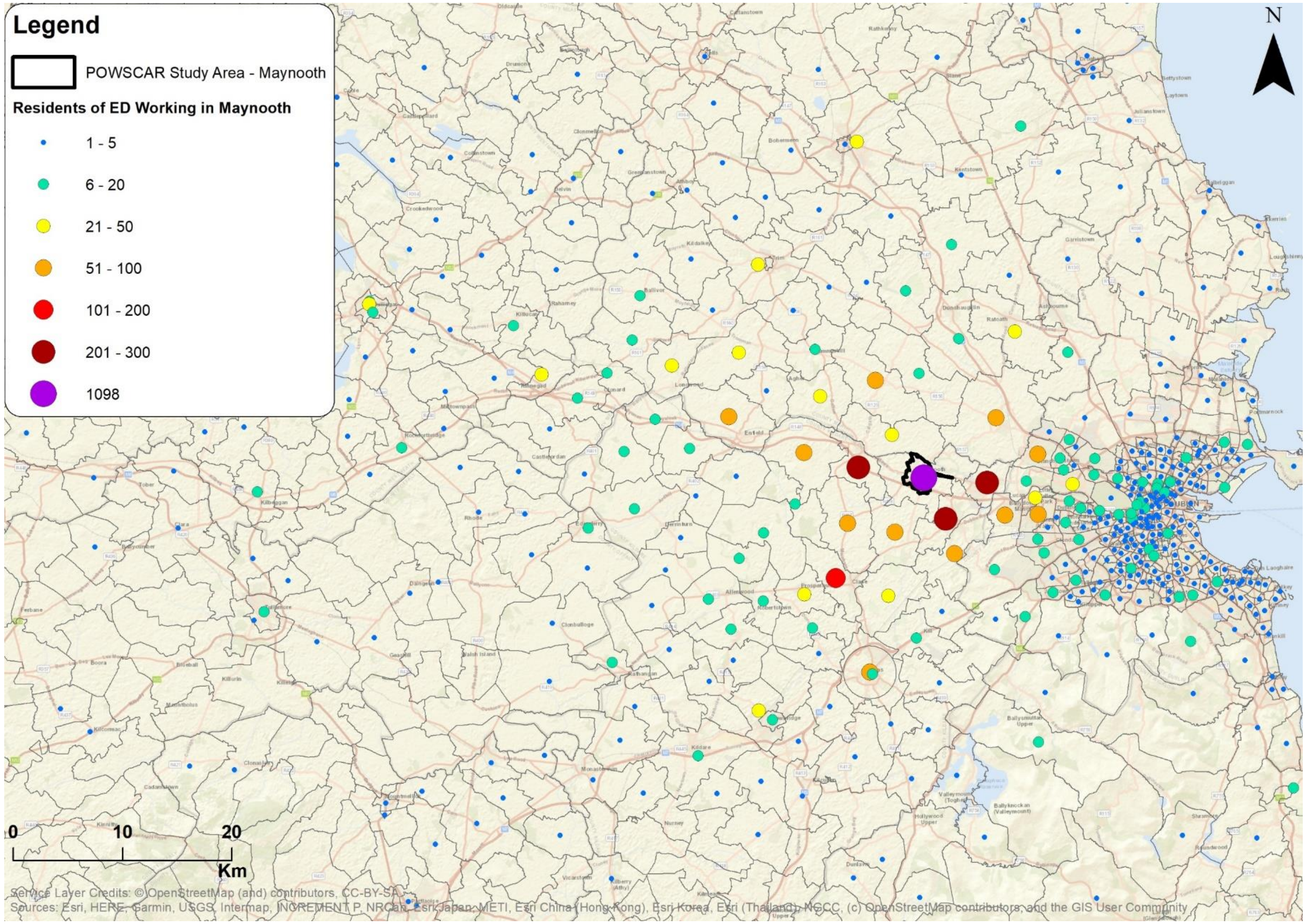


Figure 4-11 POWSCAR 2016 – Origin of Work Trips to Maynooth CSO Settlement

4.3.2.2 Origin of School Trips

Figure 4-12 shows the origin (by ED) of trips to primary schools in Maynooth in 2016. Almost three quarters of pupils attending primary school in Maynooth also lived in Maynooth (73.6%). A significant number of pupils travelled from Celbridge to primary school in Maynooth (8%), while a much smaller number travelled from Kilcock (2%) and Leixlip (1.4%). Eleven percent of pupils travelled from elsewhere in Kildare, the majority of which came from rural areas within the county rather than towns and villages.

POWSCAR 2016 data on the origin of trips to secondary schools located in Maynooth has also been examined but is not presented here in detail as there appears to be coding errors within this data. The data suggests that only 66% of pupils attending secondary school in Maynooth live in County Kildare and that significant numbers of pupils are traveling from distant counties (e.g., Donegal) to attend secondary school in Maynooth. This is considered unlikely to be plausible and suggests that some trips related to the university have been accidentally coded as second level trips within the dataset.

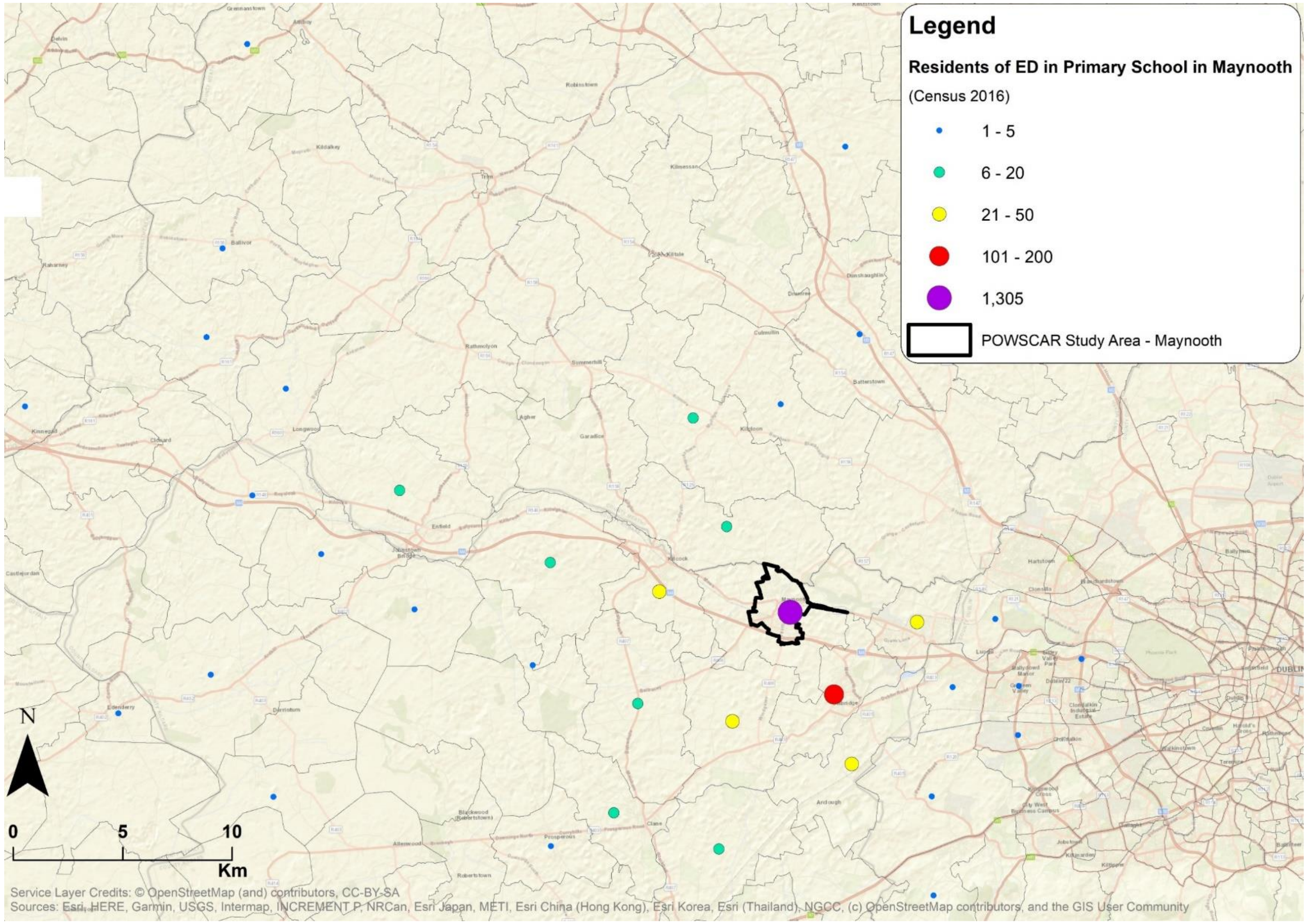


Figure 4-12 POWSCAR 2016 – Origin of Primary School Trips to Maynooth CSO Settlement

4.3.2.3 Origin of College Trips

Table 4-3 shows the origin of trips to the Maynooth CSO settlement to access third level education. This shows that around 15% of third level education trips to Maynooth are internal trips originating in Maynooth settlement, while 16% originate elsewhere in Kildare (outside Maynooth). Almost one quarter of third level trips to Maynooth originate within Dublin City and Suburbs. It should be noted that there are often coding issues with POWSCAR college trips in the Census, generally due to parents recording their student children as living at home, when in fact they may be living in Maynooth during term time. This means that there may be a greater volume of internal trips originating in Maynooth than recorded in POWSCAR, and the volume of long-distance student trips to Maynooth University may be over-emphasised.

Figure 4-13 and Figure 4-14 show the origin of trips to Maynooth CSO Settlement to access third level education visually, with the former showing a more detailed view and the latter showing a wider extent. As shown in the figures, the university attracts education trips from a wide catchment across the counties of Kildare, Dublin, Westmeath, Meath and Louth.

It should be noted that there is likely to be a significant proportion of all students attending third level in Maynooth who are not captured by the Census and therefore not included in the POWSCAR dataset. While student numbers for Maynooth University are not available for 2016, data published by the Higher Education Authority (HEA) for the academic year 2017/2018 shows that there were 10,484 students attending Maynooth University in that year which is significantly higher than the number included within the POWSCAR dataset for 2016 (7,072).

Table 4-3 POWSCAR (2016) – Origin of Third Level Education Trips to Maynooth CSO Settlement

CSO Settlement / County – Students' Residence		Number of Trips	Percent of all Third Level Education Trips to Maynooth
Maynooth		1,069	15.1%
Dublin City and Suburbs		1,716	24.3%
Administrative Area within Dublin City and Suburbs	*South Dublin*	*697*	*9.9%*
	Dublin City	*498*	*7.0%*

CSO Settlement / County – Students' Residence		Number of Trips	Percent of all Third Level Education Trips to Maynooth
	Fingal	*420*	*5.9%*
	Dún Laoghaire Rathdown	*101*	*1.4%*
Other Kildare (excl. Maynooth)		1,169	16.5%
Meath		817	11.6%
Westmeath		240	3.4%
Louth		220	3.1%
Wexford		154	2.2%
Offaly		153	2.2%
Wicklow		148	2.1%
Other Fingal (excl. Dublin City and Suburbs)		140	2.0%
Laois		135	1.9%
Cavan		130	1.8%
Donegal		120	1.7%
Monaghan		105	1.5%

CSO Settlement / County – Students' Residence	Number of Trips	Percent of all Third Level Education Trips to Maynooth
Kilkenny	101	1.4%
Mayo	85	1.2%
Carlow	84	1.2%
Roscommon	72	1.0%
Sligo	62	0.9%
Galway County	50	0.7%
Tipperary	49	0.7%
Longford	46	0.7%
Leitrim	37	0.5%
Waterford City & County	37	0.5%
Other South Dublin (excl. Dublin City and Suburbs)	33	0.5%
Cork County	25	0.4%
Limerick City & County	25	0.4%
Clare	20	0.3%

CSO Settlement / County – Students' Residence	Number of Trips	Percent of all Third Level Education Trips to Maynooth
Kerry	13	0.2%
Galway City	9	0.1%
Other	8	0.1%
Total (excluding Dublin administrative area breakdown)	7,072	

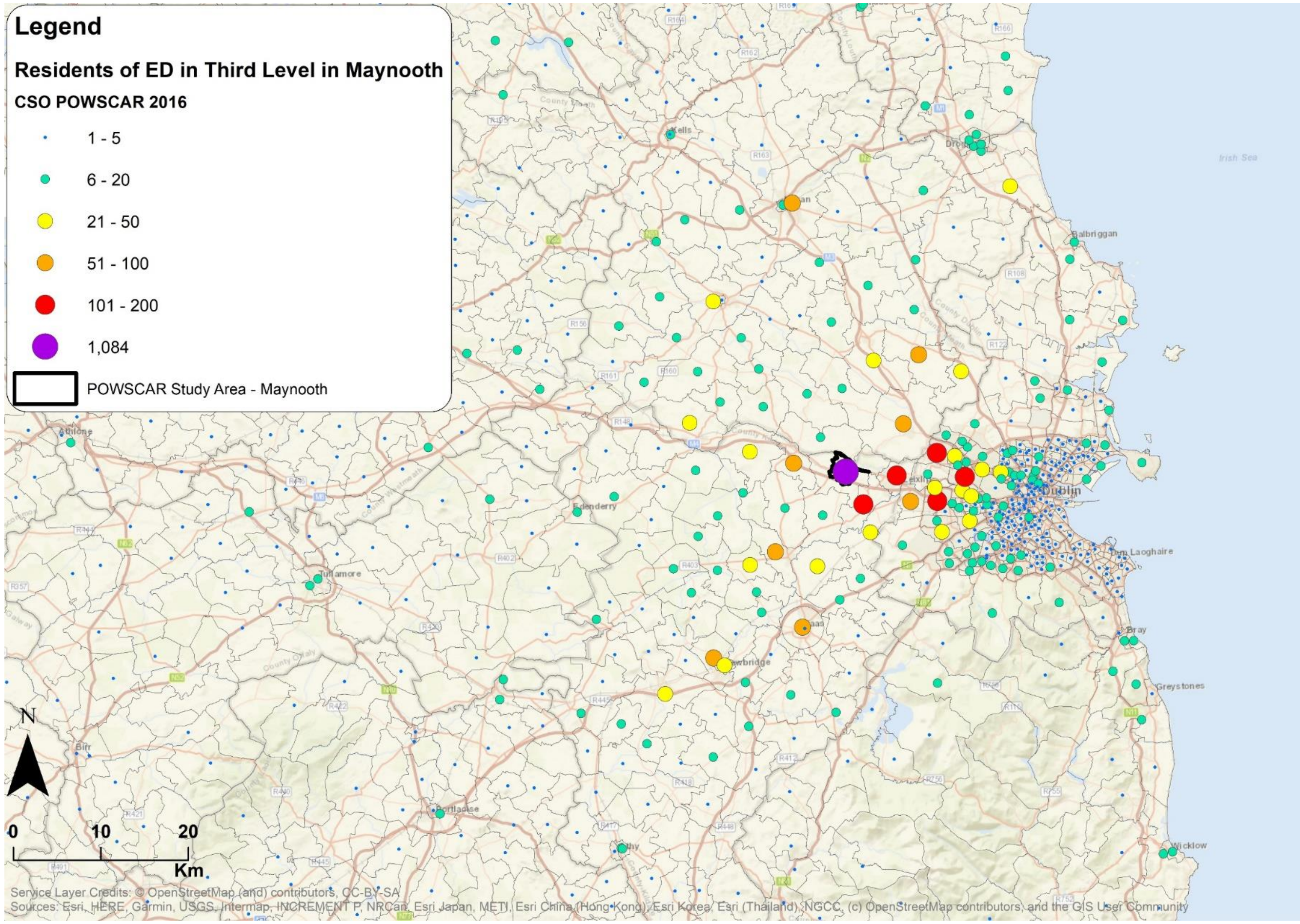


Figure 4-13 POWSCAR 2016 – Origin of Third Level Education Trips to Maynooth CSO Settlement (Detailed View)

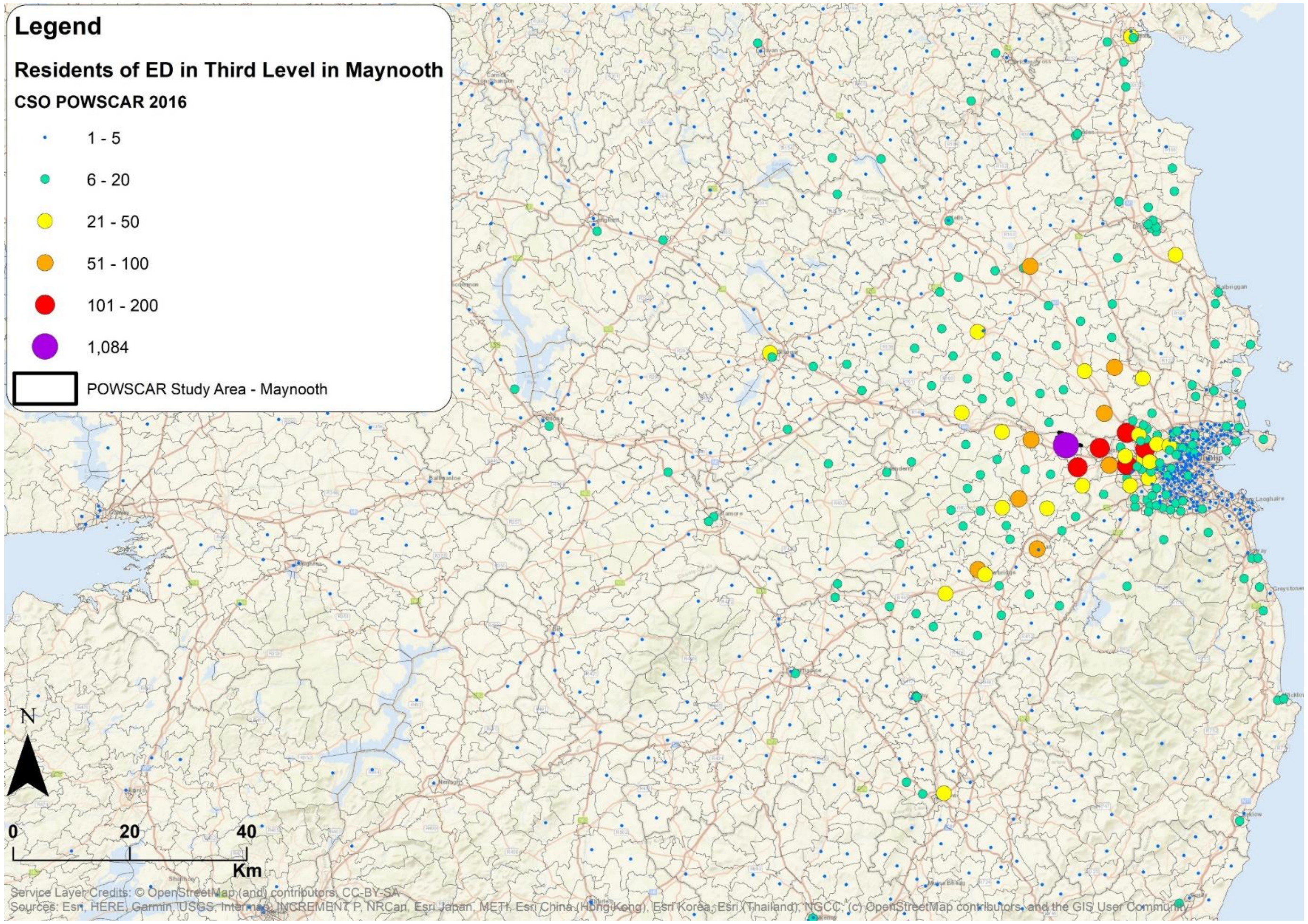


Figure 4-14 POWSCAR 2016 – Origin of Third Level Education Trips to Maynooth CSO Settlement (Larger Extent)

Figure 4-15 shows the modal split for students travelling to third level education in Maynooth based on POWSCAR 2016 data. More than one third of students travel by private motor vehicle and there is a need to reduce this private vehicle mode share by encouraging the use of public transport and active modes. In particular, there is potential to increase cycling mode share which is very low at just 3%.

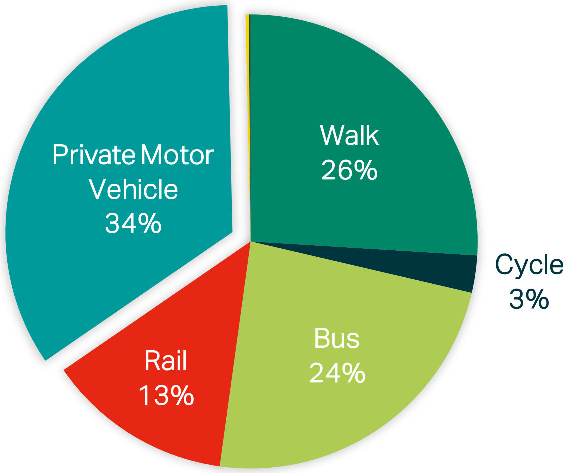


Figure 4-15 POWSCAR 2016 Modal Split for Trips to Third Level Education located in Maynooth (2016)

In addition to POWSCAR data, modal split information is also available from Maynooth University from their internal staff and student surveys about travel to college. Figure 4-16 shows how the modal split for travel to Maynooth University, as reported by staff and students responding to travel surveys has changed over time. The combined mode share of active modes and public transport increased from 40 percent in the 2009 survey to 67 percent in the 2018 survey. The proportion of respondents who travelled by car decreased from 60 percent in 2009 to 32 percent in 2018. Most of the increase in sustainable mode share is accounted for by the increase in bus mode share which was very significant. Less positively, there was a reduction in walking mode share and no change in cycling mode share, which is very low at 3 percent in 2018.

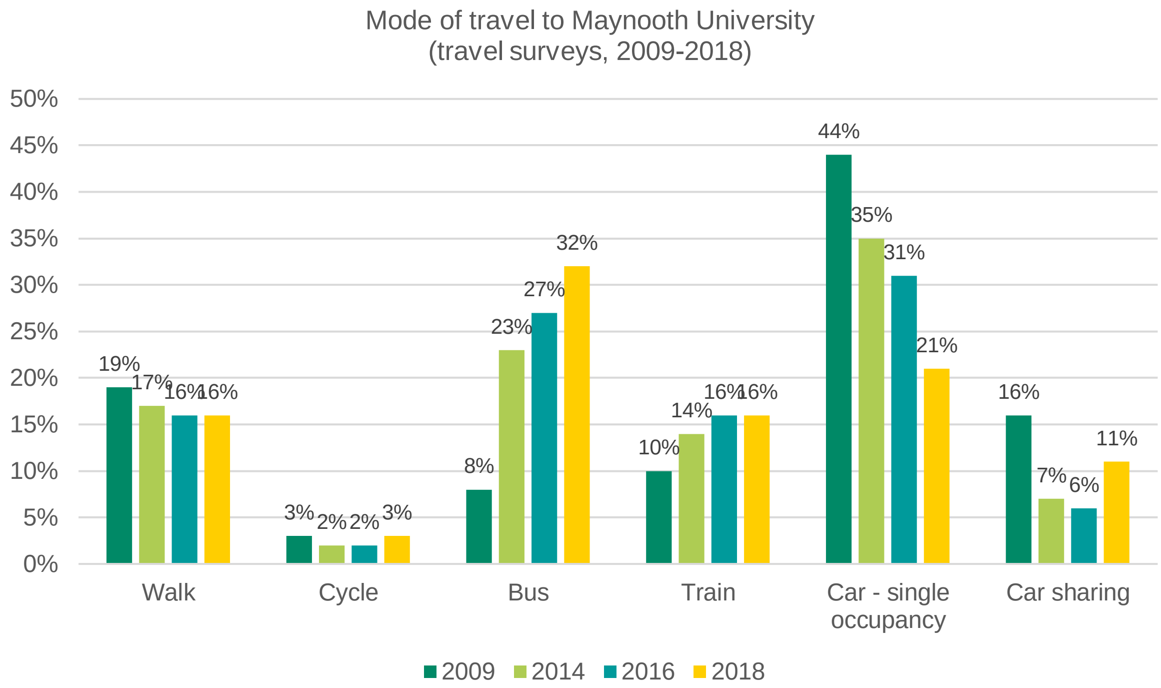


Figure 4-16 Usual mode of travel to Maynooth University (from university travel surveys)

4.4 Public Transport

4.4.1 Public Transport Policy Context

The creation of the Maynooth Public Transport Strategy will be influenced by the National Transport Authority's Greater Dublin Area Transport Strategy 2022 - 2042. The NTA's GDA Transport Strategy provides the following objectives for the region which will inform the development of public transport options in the MEABTA:

Relevant Bus Objectives from NTA GDA Strategy

- BUS4 - It is the intention of the NTA to deliver the new Dublin Area Bus Service Network starting in 2021 with a target completion date of 2024.
- BUS5 - It is the intention of the NTA to continually monitor the demand for bus services in the Dublin Area as part of the roll-out of the new service network and as part of the monitoring and periodic review of the Transport Strategy, and to enhance or amend the service network as appropriate.
- BUS10 - It is the intention of the NTA to continue to roll-out the program of bus stop and shelter provision, and to monitor potential for further expansion and upgrade during the lifetime of the strategy.
- BUS12 - The NTA and local authorities will implement bus priority measures in towns and villages in the GDA in order to reduce delays to bus services.

Relevant Rail Objectives from NTA GDA Strategy

- RAIL1 - The DART+ Programme will be implemented, providing electrified services to Drogheda in the north and Maynooth plus Celbridge in the west, in addition to an enhanced level of service to Greystones. The programme will include additional fleet, aligned with higher passenger demand, and a higher frequency of service on all lines.
- RAIL6 - The NTA, in conjunction with Irish Rail, will develop new rail stations at Cabra, Glasnevin, Heuston West, Kylemore, Woodbrook, west of Sallins, west of Louisa Bridge and west of Maynooth. Kishoge station will also open in the short term as development of the Clonburris SDZ is realised. Other stations will be considered where development patterns support such provision.
- RAIL7 –The NTA, in conjunction with Irish Rail, will upgrade, refurbish and maintain train stations across the GDA to ensure that they are of an appropriate standard and provide a good quality experience for passengers.

Relevant Interchange, Fares and Ticketing Objectives from NTA GDA Strategy

- INT3 – It is the intention of the NTA to secure the development of a network of regional level bus and rail-based Park and Ride facilities in the GDA at appropriate locations where the national road network meets, or is in close proximity to, high-capacity bus and rail services.
- INT5 - It is the intention of the NTA, in conjunction with local authorities and transport operators, to ensure that passengers wishing to change between services on the transport network are provided with a safe, convenient and seamless interchange experience
- INT6 – It is the intention of the NTA to revise the fare structure for transport in the GDA in the short-term. This new fare structure will be monitored throughout the period of the strategy and further changes implemented where appropriate.
- Includes a short-distance fare on single leg journeys (approximately 3kms or less) and a 90-minute fare that will allow a customer any combination of travel on Bus, Dart/Commuter Rail and Luas services
- INT7 – It is the intention of the NTA to deliver Next Generation Ticketing in the short term, facilitating seamless multimodal travel and reducing dwell times at bus stops. An account-based ticketing system is the preferred option for Next Generation Ticketing. This system aims to use cashless technology, allowing for payments to be made using cEMV (contactless credit and debit cards), mobile phones and tokens, all linked to a payment account.

4.4.2 Maynooth Bus Services

Maynooth is served by a number of bus services and operators offering connections to towns within Kildare, Dublin City and the rest of Ireland. Table 4-4 provides an overview of the origin and destination of each of the bus services that serve Maynooth and Figure 4-17 to Figure 4-29 show the routing of each of the services through the study area, apart from the Dublin Bus Nitelink service, 67N and the local link services. This information is based on pre-Covid 2019 GTFS public transport data, similar to the transport model, to avoid collecting evidence on the basis of temporary Covid-pandemic conditions.

Table 4-4: Summary of Bus Routes and Number of Services Serving Maynooth

Operator	Route No.	Origin	Destination	< 07:00	07:00 - 10:00	10:00 - 17:00	17:00 - 19:00	> 19:00	No. Services Daily
Bus Eireann	20	Galway	Dublin Airport	0	0	1	1	1	3
		Dublin Airport	Galway	0	1	3	0	0	4
	22	Dublin	Ballina	0	0	3	0	2	5
		Ballina	Dublin	0	1	2	1	1	5
	23	Dublin Airport	Sligo	0	0	1	0	0	1
		Sligo	Dublin Airport	0	0	0	0	1	1
	115	Mullingar	Dublin	4	6	14	4	5	33
		Dublin	Mullingar	2	6	14	4	6	32
	115C	Mullingar	Dublin	1	0	0	0	0	1
Dublin Bus	66	Merrion Sq.	Maynooth	2	7	16	4	9	38
		Maynooth	Merrion Sq.	2	7	15	5	10	39
	66e	Merrion Sq.	Maynooth	0	1	6	0	0	7
		Maynooth	Merrion Sq.	1	1	6	0	0	8
	66x	UCD Belfield	Maynooth	0	0	0	2	0	2
		Maynooth	UCD Belfield	0	2	0	0	0	2
	67	Maynooth	Merrion Sq.	2	6	14	4	9	35
		Merrion Sq.	Maynooth	4	6	14	4	10	38
	67x	UCD Belfield	Maynooth	0	0	1	4	0	5
		Maynooth	UCD Belfield	2	4	0	0	0	6

Operator	Route No.	Origin	Destination	< 07:00	07:00 - 10:00	10:00 - 17:00	17:00 - 19:00	> 19:00	No. Services Daily
	67N	Westmoreland St.	Celbridge / Maynooth	4	0	0	0	0	4
Dualway	767	Maynooth	Dublin Airport	6	6	10	2	3	27
		Dublin Airport	Maynooth	4	6	10	2	3	25
JJ Kavanagh	139	Naas	Blanchardstown	0	2	3	1	3	9
		Blanchardstown	Naas	0	2	3	1	3	9
Kearns	847	Portumna / Birr	Maynooth	1	1	0	0	0	2
		Maynooth	Portumna / Birr	0	0	0	1	0	1
Rural Transport Services		Clonbullogue	Maynooth University	0	1	0	0	0	1
		Maynooth University	Clonbullogue	0	0	0	1	0	1
		Edenderry	Maynooth University	0	1	0	0	0	1
		Maynooth University	Edenderry	0	0	0	1	0	1
		Coill Dubh	Maynooth University	0	1	0	0	0	1
		Maynooth University	Coill Dubh	0	0	0	1	0	1
		Maynooth Day Care		0	1	0	0	0	1
		Johnstown Bridge	Maynooth Day Care	0	1	0	0	0	1

Operator	Route No.	Origin	Destination	< 07:00	07:00 - 10:00	10:00 - 17:00	17:00 - 19:00	> 19:00	No. Services Daily
		Maynooth Day Care	Johnstown Bridge	0	0	1	0	0	1
Total - Arrivals / Departures				35	70	137	43	66	351

4.4.3 Bus Route Maps

In the figures below, route maps for the bus service listed in Table 4-4 are provided. In these maps, when the inbound and outbound route of a bus service makes use of the same road for their route, the thickness of the bottom routing has been increased and the top route thickness decreased to show where the bus routes overlap.

4.4.3.1 Bus Eireann Route Maps

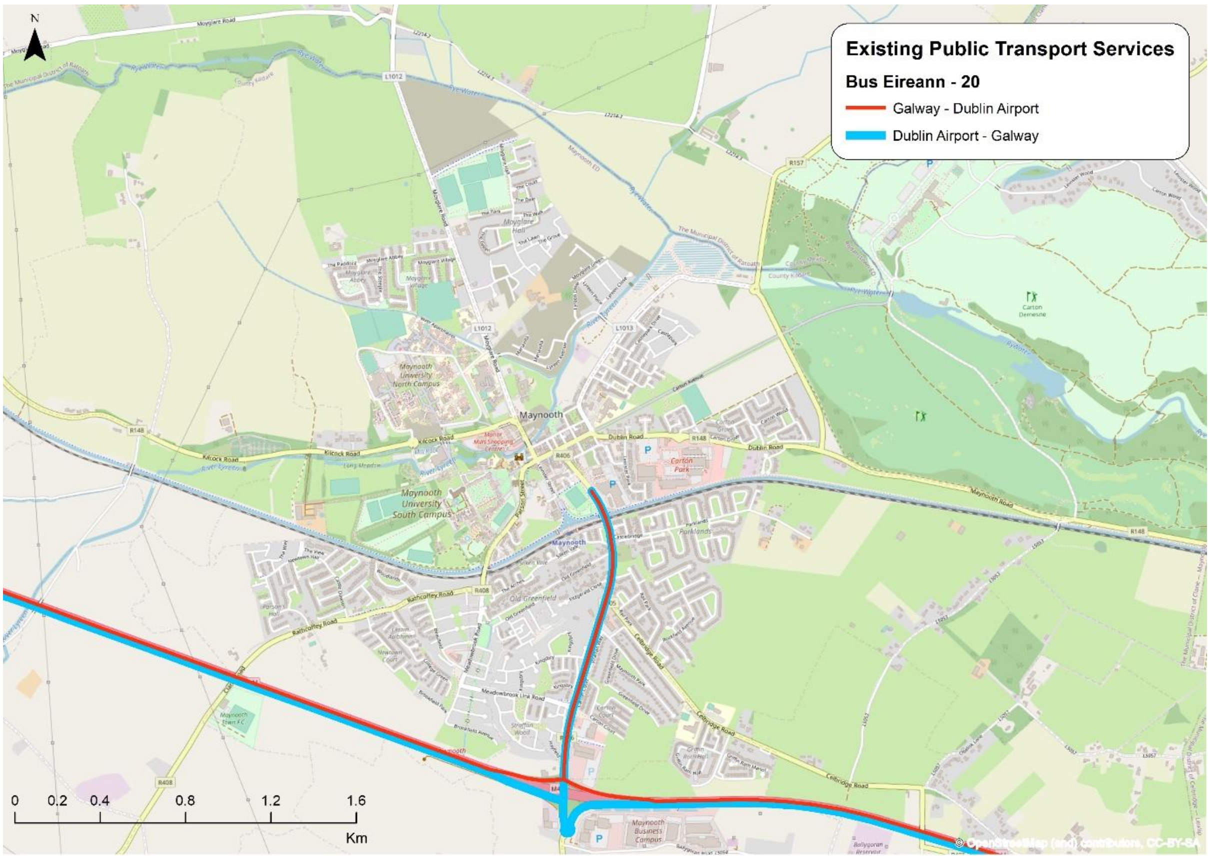


Figure 4-17: Bus Eireann Route 20 – Galway to Dublin Airport

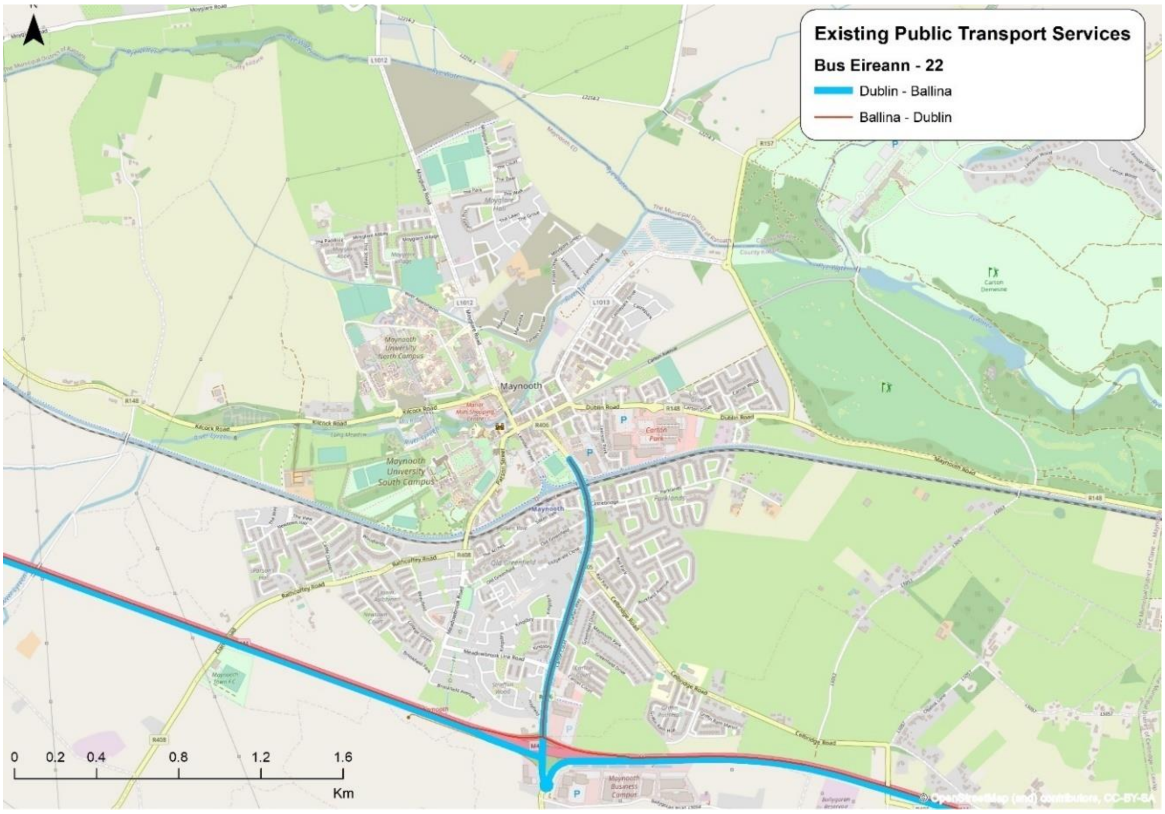


Figure 4-18: Bus Eireann Route 22 – Ballina to Dublin

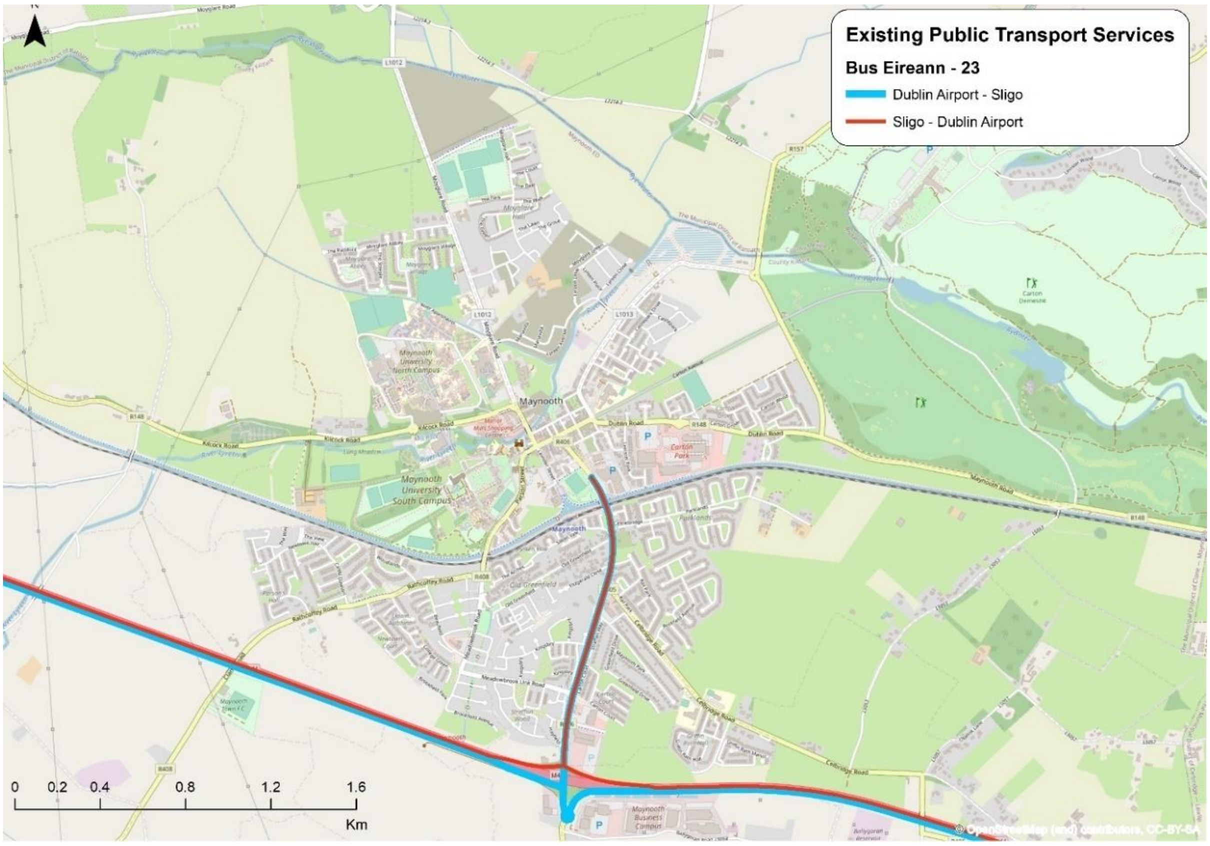


Figure 4-19: Bus Eireann Route 23 – Sligo to Dublin Airport

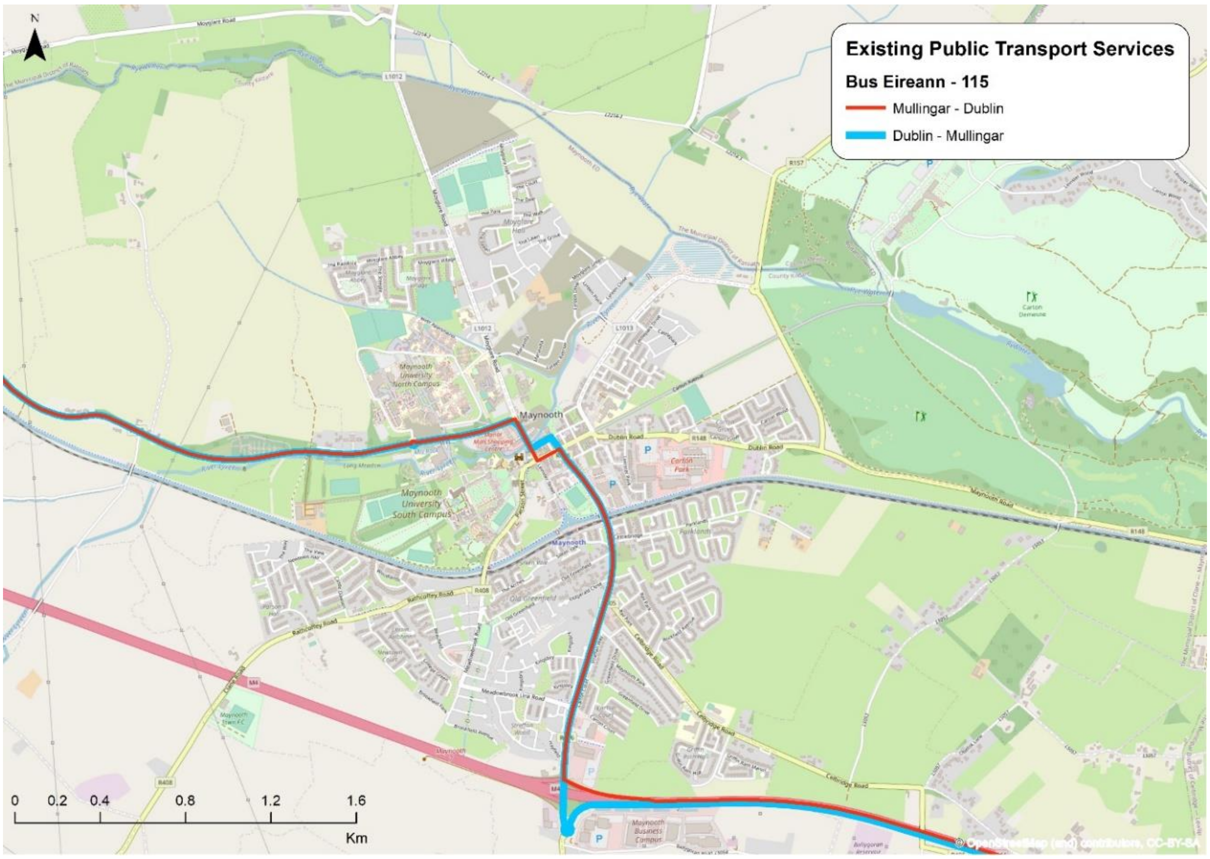


Figure 4-20: Bus Eireann Route 115 - Mullingar to Dublin

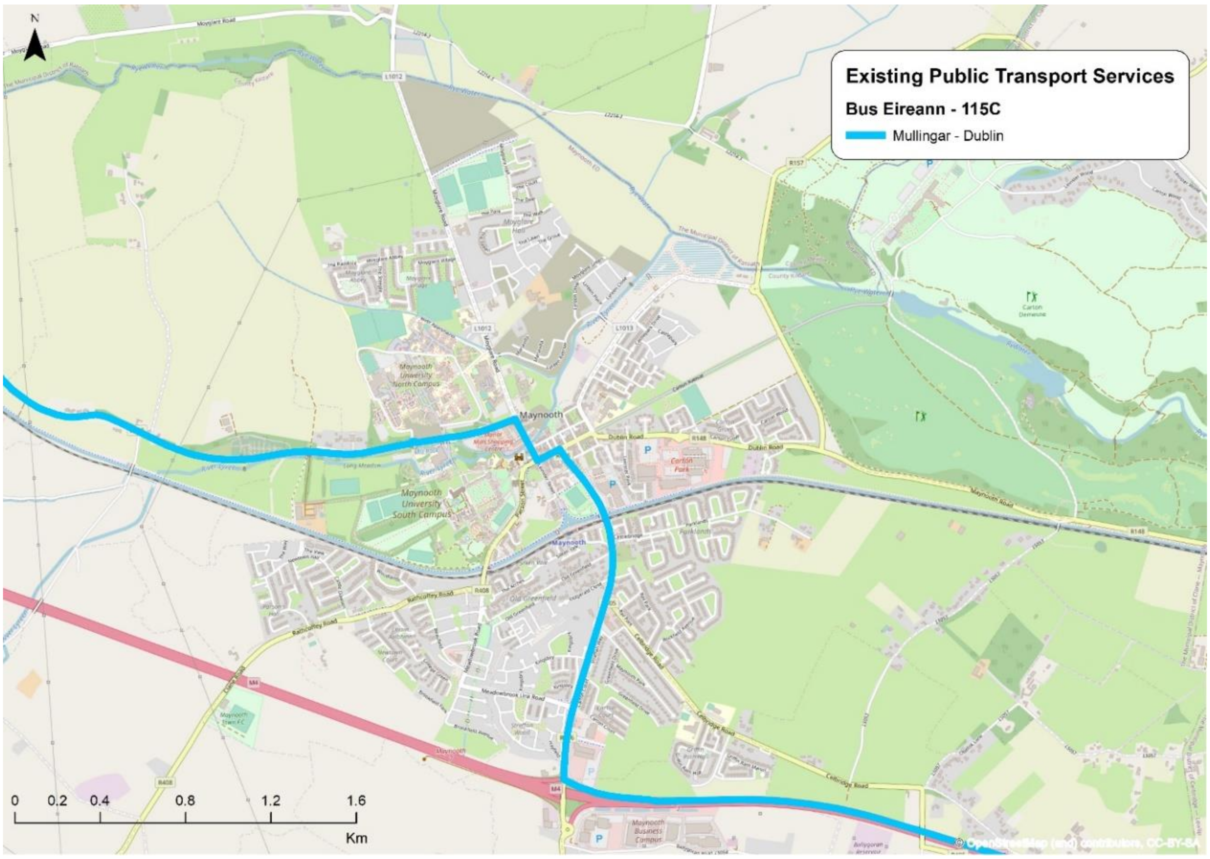


Figure 4-21: Bus Eireann Route 115C - Mullingar to Dublin

4.4.3.2 Dublin Bus Route Maps

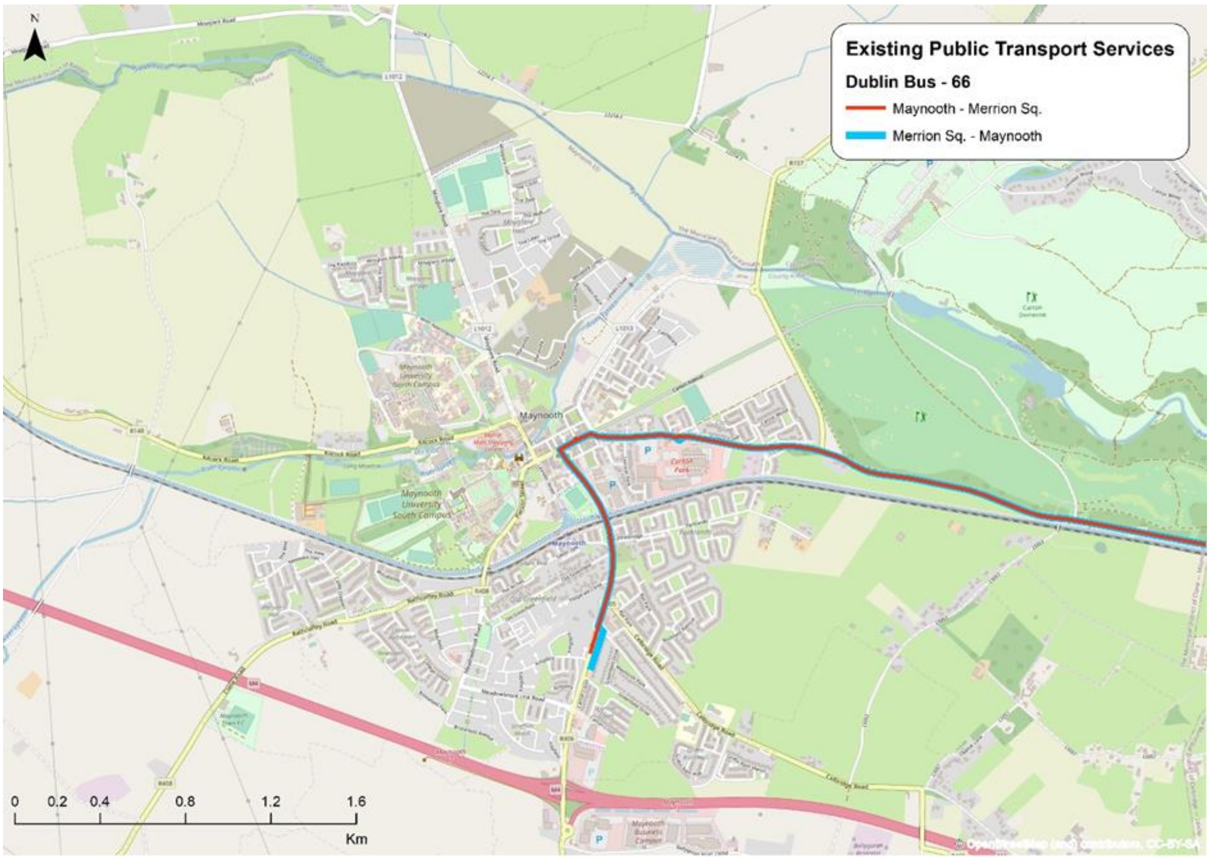


Figure 4-22: Dublin Bus Route 66 – Merrion Sq. to Maynooth

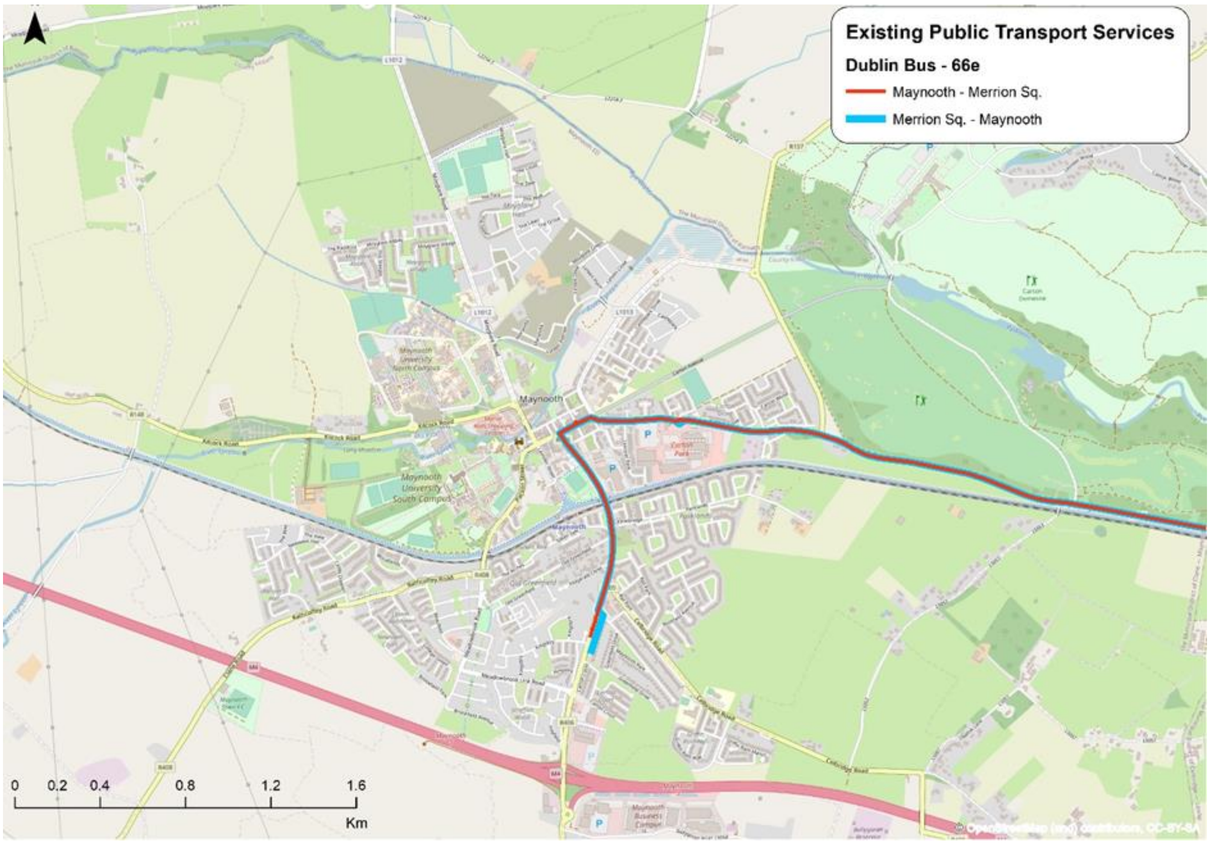


Figure 4-23: Dublin Coach Route 66e – Merrion Sq. to Maynooth

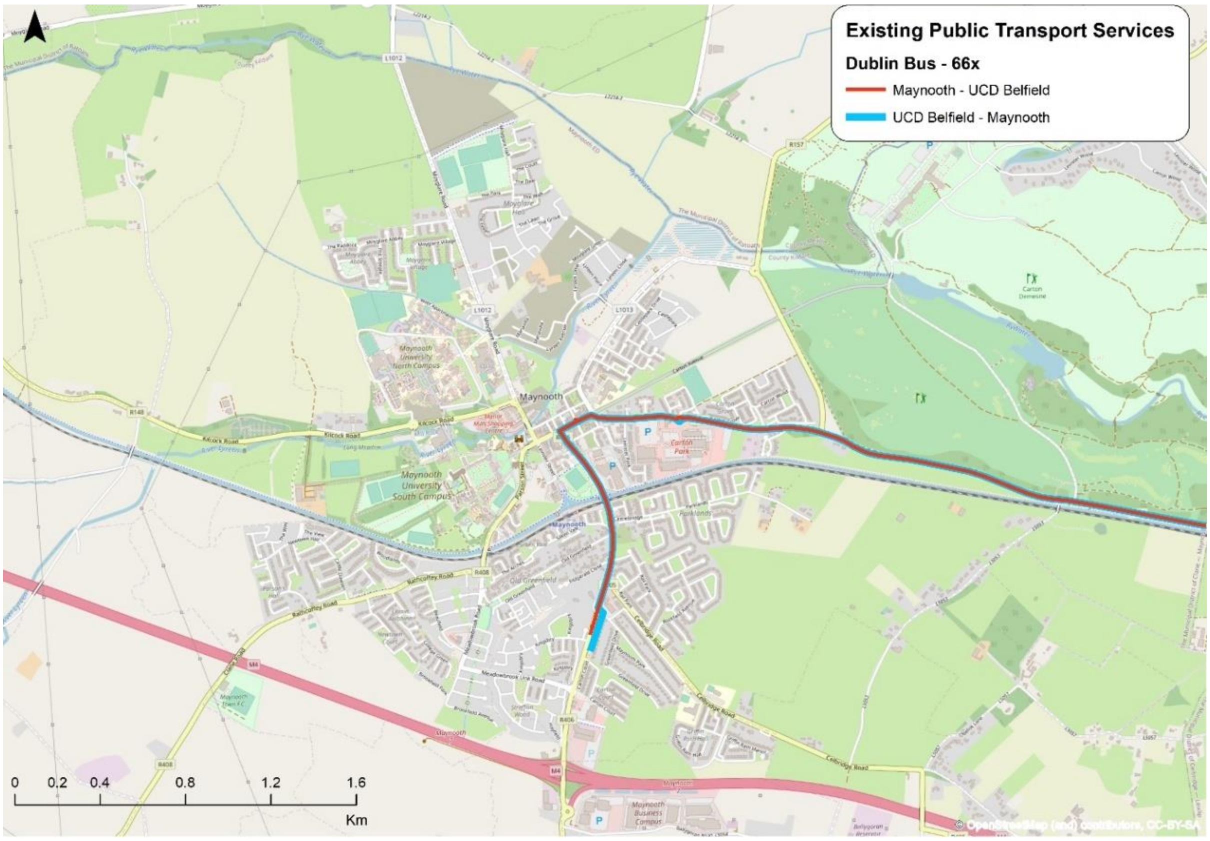


Figure 4-24: Dublin Coach Route 66x – UCD Belfield to Maynooth

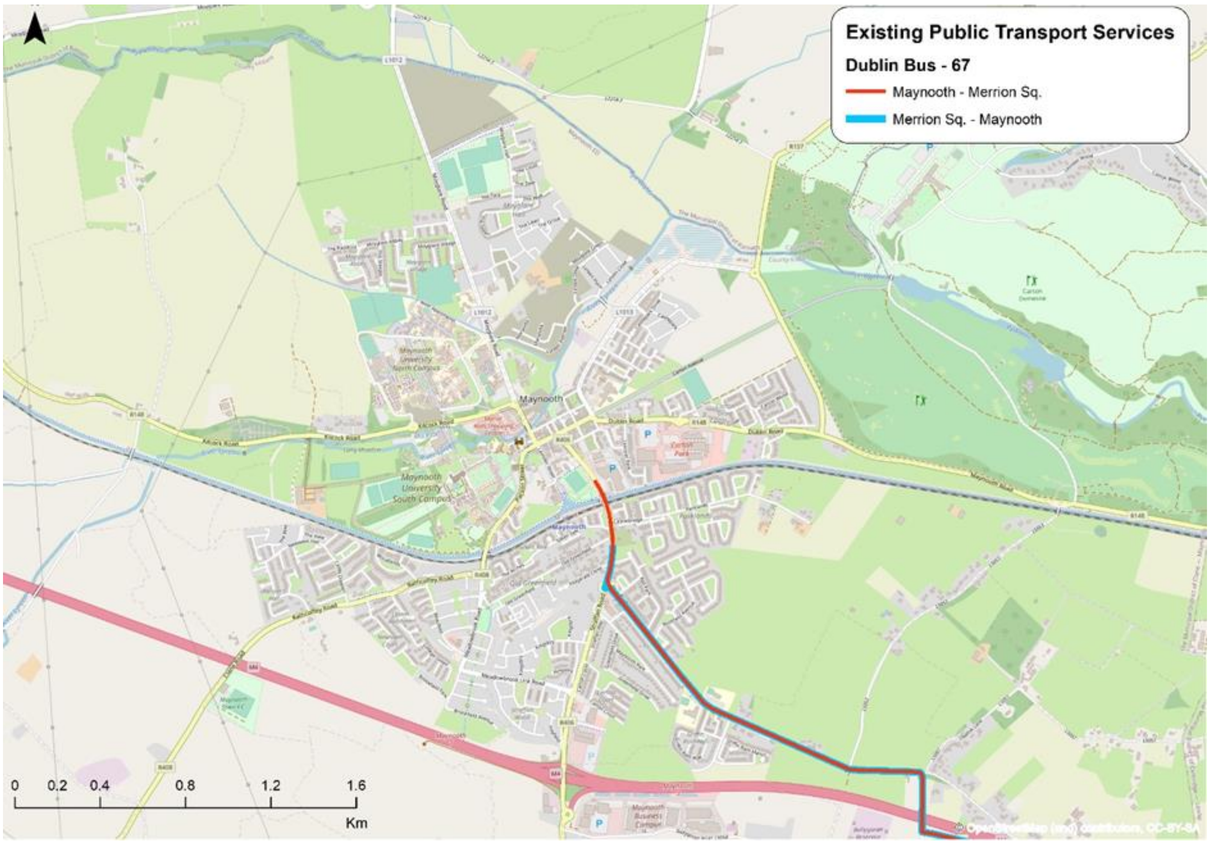


Figure 4-25: Dublin Coach Route 67 – Merrion Sq. to Maynooth

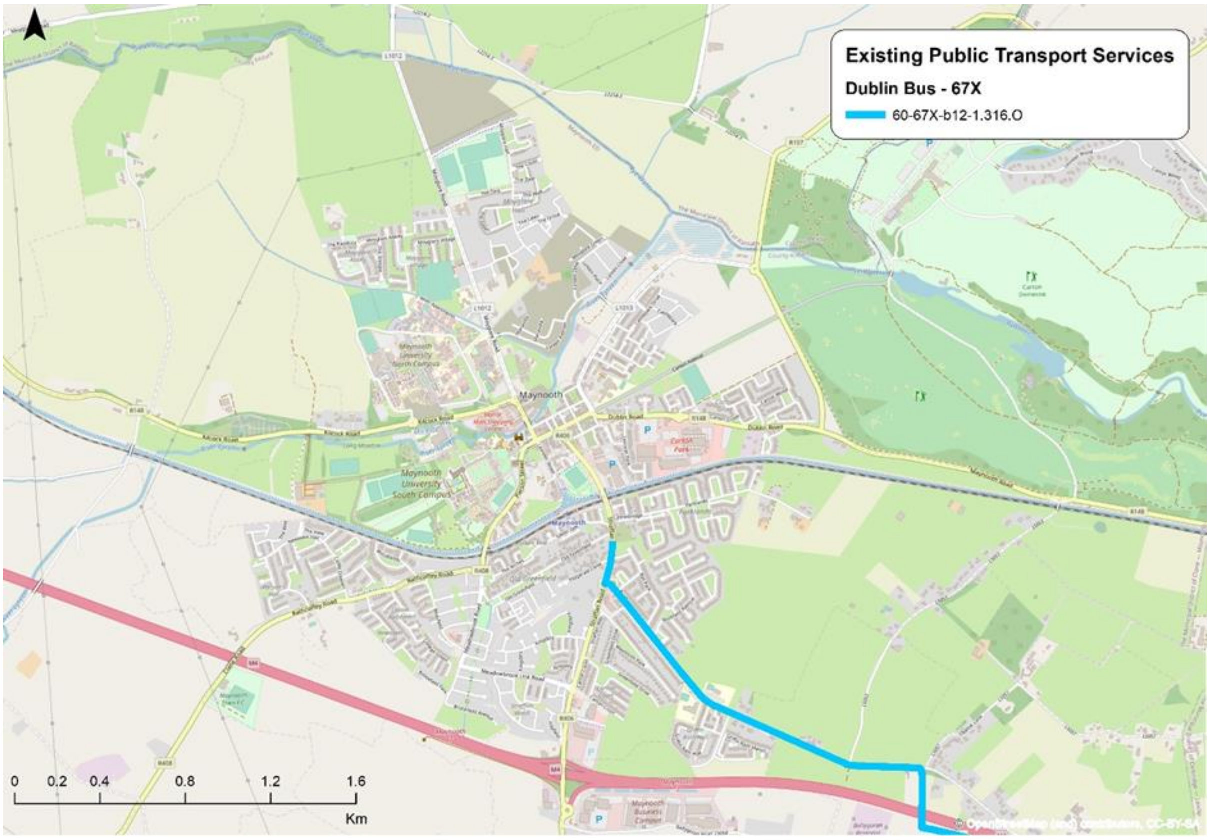


Figure 4-26: Dublin Coach Route 67x – UCD Belfield to Maynooth

4.4.3.3 Private Operator Route Maps

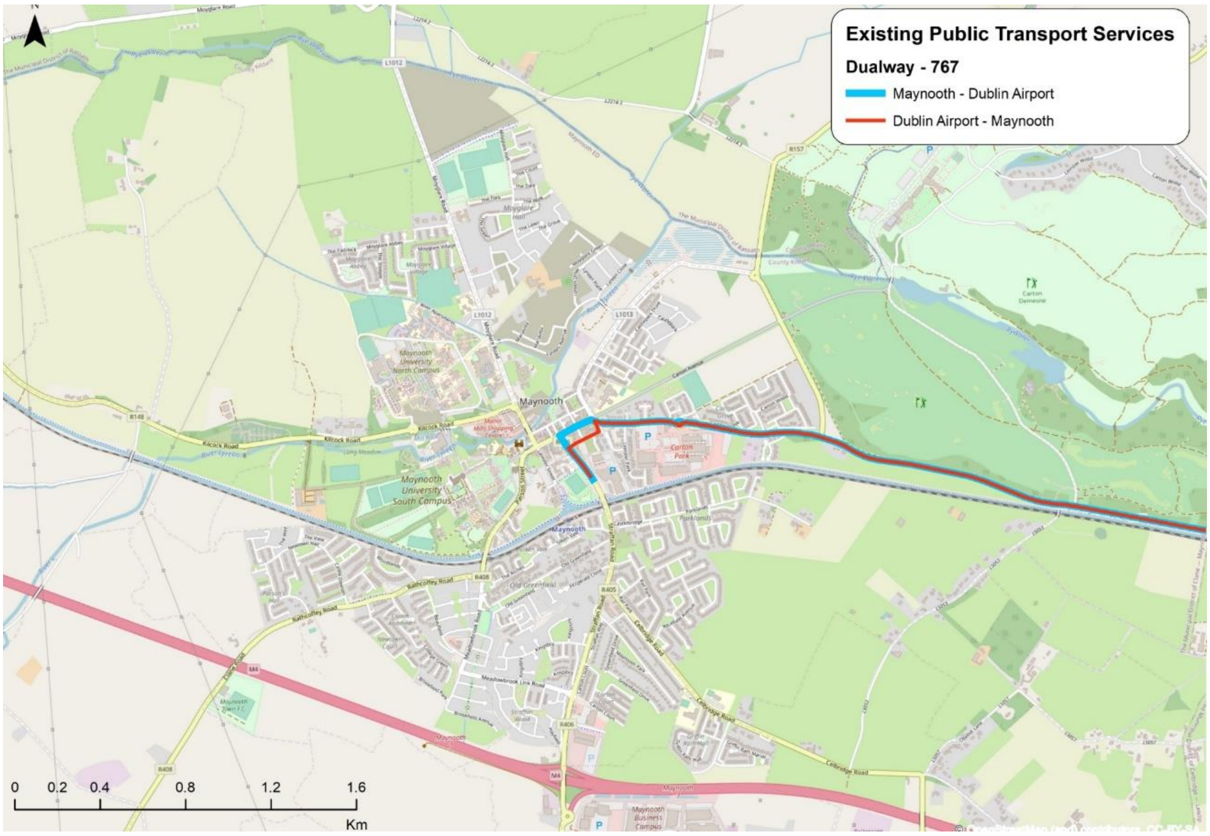


Figure 4-27: Dualway Route 767 – Maynooth to Dublin Airport

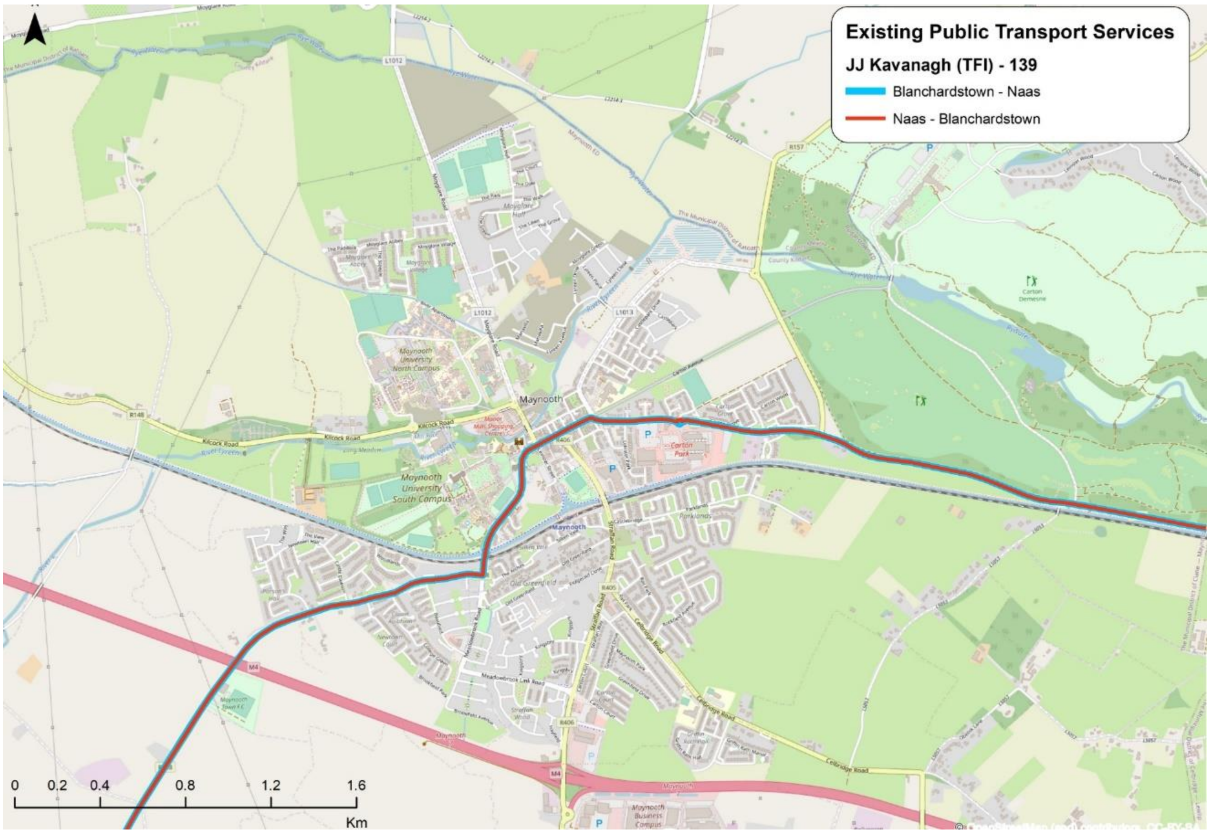


Figure 4-28: JJ Kavanagh (Transport for Ireland) Route 139 – Naas to Blanchardstown

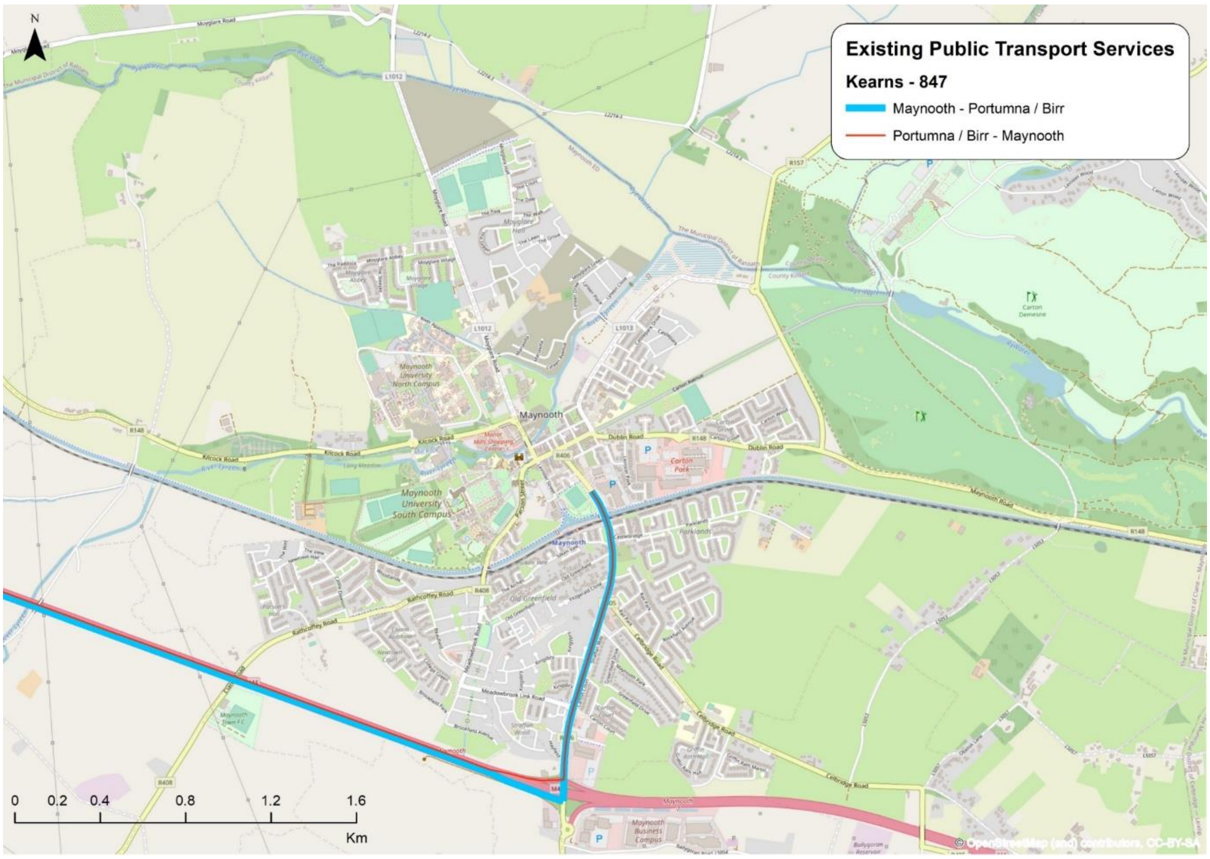


Figure 4-29: Kearns Route 847 – Maynooth to Portumna / Birr

4.4.4 University Bus Routes Serving Maynooth University

Maynooth is served by a number of university bus services offering connections to towns around the country to Maynooth University. Table 4-5 provides an overview of the origin and destination of each of the university bus services and days of operation. It should be noted that some of these services only operate during term time.

Table 4-5 Summary of University Bus Routes Serving Maynooth University

Operator	Route No.	Origin	Destination	Day	No. Services	Departure Time		
Streamline	Cavan-Meath-Maynooth	Cavan Town Cathedral	NUI Maynooth	Mon-Thurs	**1**	06:40		
		NUI Maynooth	Cavan Town Cathedral	Mon-Thurs	**1**	18:05		
		Kells Bus Stop	NUI Maynooth	Mon-Thurs	**1**	09:50		
		NUI Maynooth	Lavey Inn	Mon-Thurs	**1**	15:05		
		Cavan Town Cathedral	NUI Maynooth	Fri	**1**	06:40		
		NUI Maynooth	Cavan Town Cathedral	Fri	**2**	14:15	17:15	
		Cavan Town Cathedral	NUI Maynooth	Sun	**1**	18:15		
	Athboy-Trim-Summerhill-Maynooth	Athboy (Main Street)	NUI Maynooth	Mon-Thurs	**2**	07:55	10:00	
		NUI Maynooth	Athboy (Main Street)	Mon-Thurs	**2**	15:05	18:05	
		Athboy (Main Street)	NUI Maynooth	Fri	**1**	07:55		
		NUI Maynooth	Athboy (Main Street)	Fri	**2**	14:15	17:15	
	Dundalk-Drogheda-Maynooth	Dundalk McDonalds	Maynooth	Mon-Thurs	**1**	07:00		

Operator	Route No.	Origin	Destination	Day	No. Services	Departure Time		
		Maynooth	Drogheda North Road	Mon-Thurs	**1**	15:05		
		Dundalk McDonalds	Maynooth	Mon-Thurs	**1**	10:25		
		Maynooth	Dundalk McDonalds	Mon-Thurs	**1**	18:05		
		Dundalk McDonalds	Maynooth	Fri	**1**	07:00		
		Maynooth	Dundalk McDonalds	Fri	**2**	13:05	17:05	
		Dundalk McDonalds	Maynooth	Sun	**1**	18:00		
	Carrickmackross-Ardee-Collon-Slane-Kilmoon Cross-Maynooth	Carrickmackross (Main Street)	NUI Maynooth	Mon-Fri (?)	**1**	06:35		
		NUI Maynooth	Carrickmackross	Mon-Thurs	**1**	18:05		
		NUI Maynooth	Carrickmackross	Fri	**1**	17:20		
Slevins	Dundrum-Maynooth *	Dundrum	Maynooth	Mon-Thurs	**1**	07:15		
		Maynooth	Templeogue	Mon-Thurs	**2**	15:05	18:05	
		Templeogue	Maynooth	Mon-Thurs	**1**	10:35		

Operator	Route No.	Origin	Destination	Day	No. Services	Departure Time		
		Maynooth	Templeogue	Fri	**2**	13:05	17:05	
		Dundrum	Maynooth	Fri	**1**	07:15		
Wexford Bus	Gorey - NUI Maynooth	Gorey	NUI Maynooth	Mon-Fri	**1**	07:00		
		NUI Maynooth	Gory	Mon-Thurs	**1**	18:15		
		NUI Maynooth	Gory	Fri	**1**	17:15		
		Kilmacanogue	NUI Maynooth	Mon-Fri	**3**	10:30	13:20	15:25
		NUI Maynooth	Kilmacanogue	Mon-Fri	**3**	09:00	12:15	14:30
Aiden Johnston Coaches	Tipperary - NUI Maynooth *	Tipperary	NUI Maynooth	Sun	**1**	18:00		
		NUI Maynooth	Tipperary	Fri	**1**	16:10		
Piltown Coaches	NUM15 (Carrick - NUI Maynooth) *	Carrick-on-Suir	NUI Maynooth	Sun	**1**	17:20		
		NUI Maynooth	Carrick-on-Suir	Fri	**1**	15:30		
Ardcavan	Wexford-Maynooth *	Wexford	NUI Maynooth	Sun	**1**	18:00		

Operator	Route No.	Origin	Destination	Day	No. Services	Departure Time		
	Gorey - NUI Maynooth *	NUI Maynooth	Wexford	Fri	**1**	15:30		
		Gorey	NUI Maynooth	Sun	**1**	18:55		
		NUI Maynooth	Gorey	Fri	**1**	15:30		
A2B Coaches	Monaghan - NUI Maynooth *	Monaghan	NUI Maynooth	Sun	**1**	18:00		
		NUI Maynooth	Monaghan	Fri	**1**	17:10		
Total					**52**			

* Operates During Term Time only

4.4.5 Rail Services

Maynooth station is located on the main western rail line which connects Dublin with the towns of Longford and Sligo as well as the Dunboyne rail spur. Inbound services that stop at Maynooth station terminate at either Dublin Connolly or Dublin Pearse with one service terminating at Bray, all inbound services are shown in Table 4-6. In the outbound direction Maynooth station has a number of daily services to Longford, Mullingar and Sligo. All outbound services are shown in Table 4-7.

Table 4-6: Summary of Inbound Services to Dublin –serving Maynooth Station

Destination	< 07:00	07:00 - 10:00	10:00 - 17:00	17:00 - 19:00	> 19:00	No. Services Daily
Dublin Connolly	1	1	3	1	1	7
Dublin Connolly	0	0	0	2	0	2
Dublin Connolly	0	0	0	0	1	1
Dublin Connolly	3	4	11	3	0	21
Dublin Pearse	0	3	4	1	6	14
Grand Canal Dock	0	2	3	2	3	10

Table 4-7: Summary of Outbound Services from Dublin –serving Maynooth Station

Destination	< 07:00	07:00 - 10:00	10:00 - 17:00	17:00 - 19:00	> 19:00	No. Services Daily
Sligo	2	1	3	0	1	7
Longford	2	0	0	0	0	2
Maynooth	3	3	12	2	3	23
Maynooth	0	1	0	0	0	1
Maynooth	0	3	3	2	5	13

Figure 4-30 shows the boarding and alighting profile along the Maynooth Line, this data comes from the most recent Heavy Rail Census which was carried out in 2019. The data shows that Maynooth has just under 3,800 daily boarding's with the average number of daily boarding's for stations along the line being 3,360 a day and 3,784 daily alighting's and the average number of daily alighting's being 3,460 a day. Maynooth Station ranks 2nd overall in terms of the number of daily boarding's and alighting's along the Maynooth Line.

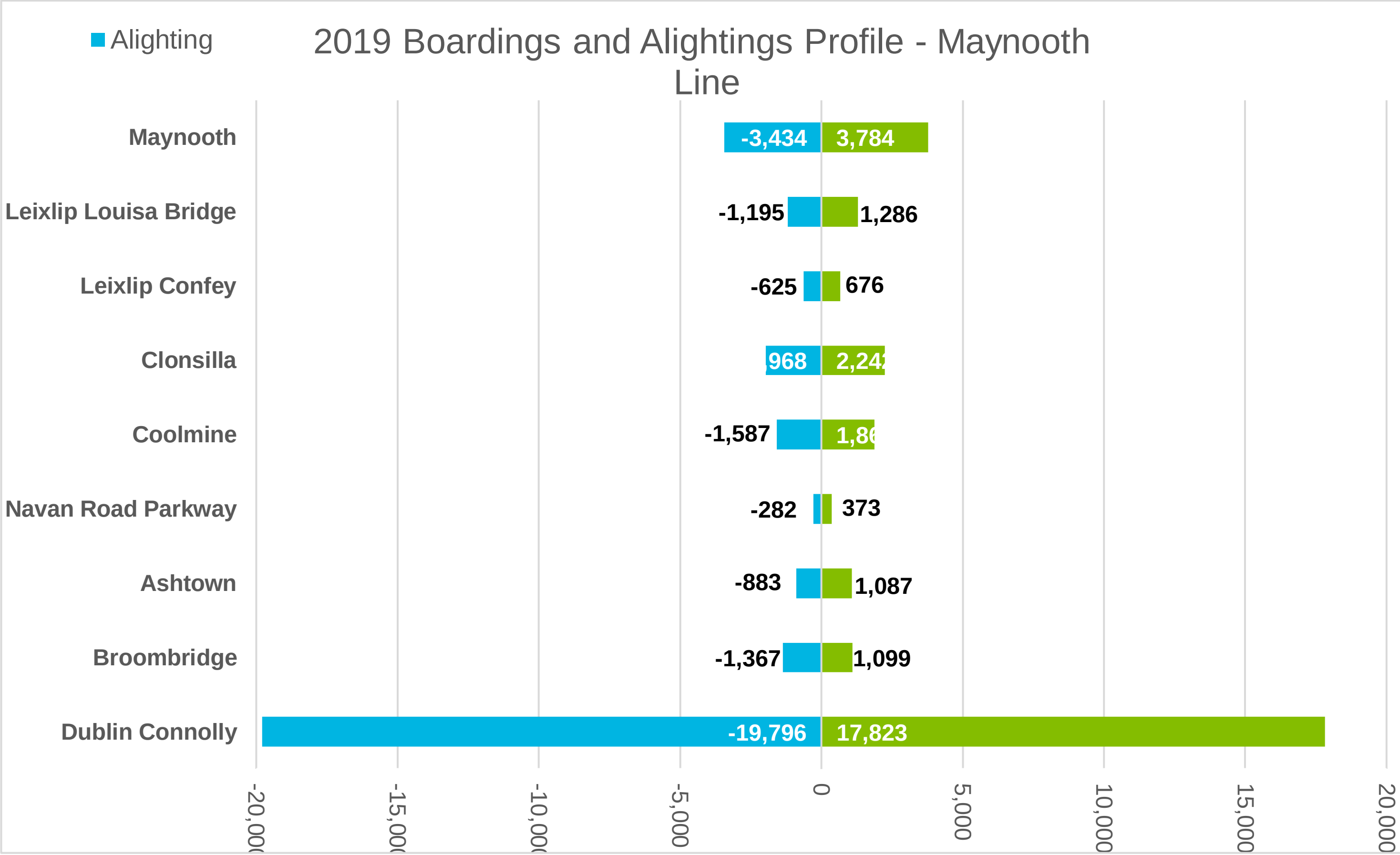


Figure 4-30: Boarding and Alighting Profile along the Maynooth Line (Heavy Rail Census, 2019)

4.4.6 Existing Maynooth Public Transport Network

As described in Sections 4.4.2 and 4.4.5, Maynooth is served by bus and rail services, with a summary of all routes in the town shown in Figure 4-31. While Maynooth as a whole is well serviced by public transport, within Maynooth, the north of the town has less access to public transport options when compared to the rest of the town and there is scope to improve bus access in this area.

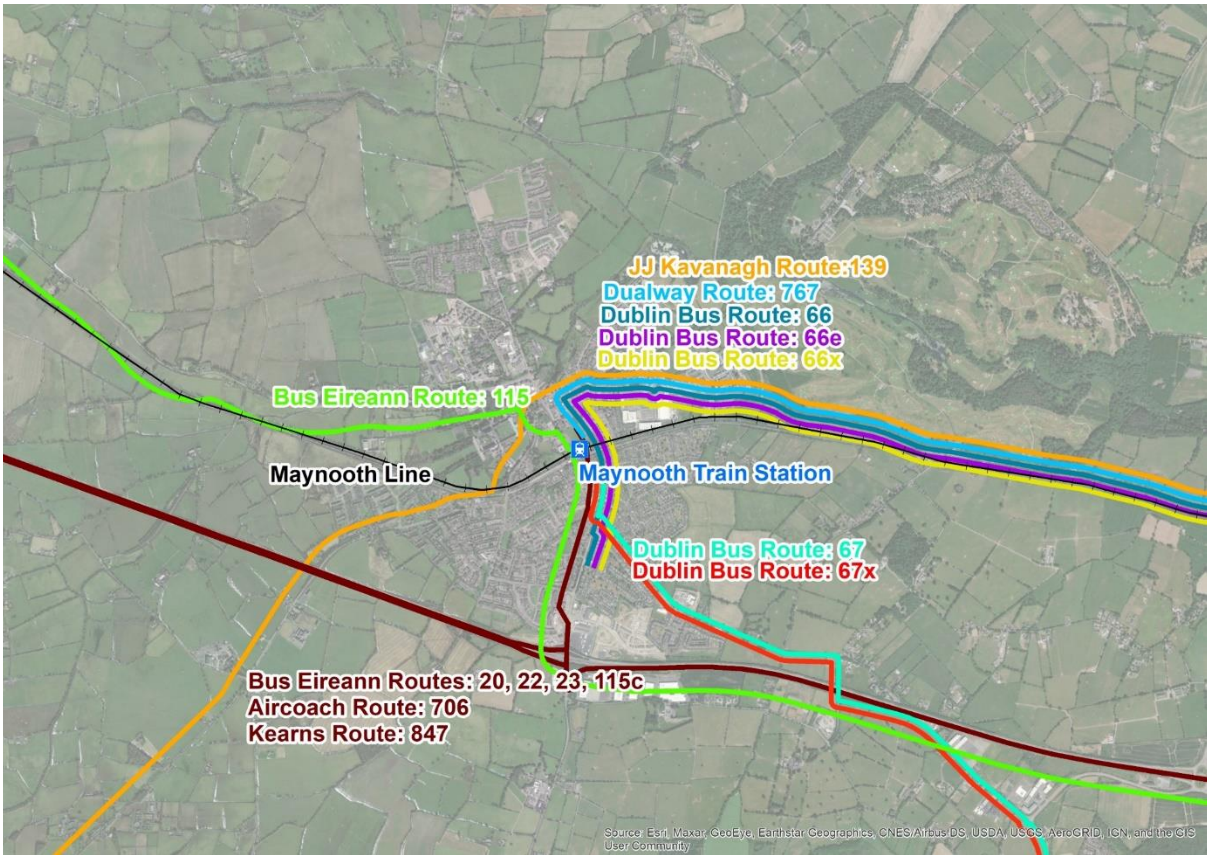


Figure 4-31 Main Existing Public Transport Routes Serving Maynooth

4.4.7 Planned Public Transport Changes

4.4.7.1 BusConnects

BusConnects is a programme of work developed by the NTA to improve bus services in Irish Cities. BusConnects Dublin involves a redesign of the existing network of bus services and the implementation of next generation bus corridors on a number of key corridors across the Dublin Area. In addition to the services and infrastructure elements of the programme, there are a number of other work packages focused on vehicles, fares and ticketing and bus stops.

The Dublin Bus services that currently serve Maynooth are included within the BusConnects Redesign. This will see current services replaced with the C3 service forming part of the overall C spine, in addition there will also be two peak only services and one orbital route (W6), which are outlined in Table 4-8 and shown in Figure 4-32. The new W6 bus service will provide a bus route for the north of Maynooth, which is currently outside the bus catchment area.

Part of the C spine was implemented early in 2022 which involves the renaming of services to C services with route 66 becoming C3 and 67 becoming C4. However, the W6 service which will connect Maynooth to Tallaght has not been implemented yet and as such the C4 service still operates via Celbridge until the implementation of the W6.

Table 4-8: BusConnects routes serving Maynooth with New frequencies

Spines & Branches		Weekday																		
Route no.	To and From	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
C3	Maynooth - City Centre - Ringsend	60	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	60

Peak-Only/ Express Routes			Weekday												
Route no.	To and From	Existing Similar Route	5	6	7	8	9	10	11	12	1	2	3	4	5
X25	Maynooth - Glen Easton - City Centre	66x			2									1	1
X26	Maynooth - City Centre - UCD	66x			3									1	2

Orbital Routes		Weekday																		
Route no.	To and From	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
W6	Maynooth - Celbridge - Citywest - Tallaght		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	60

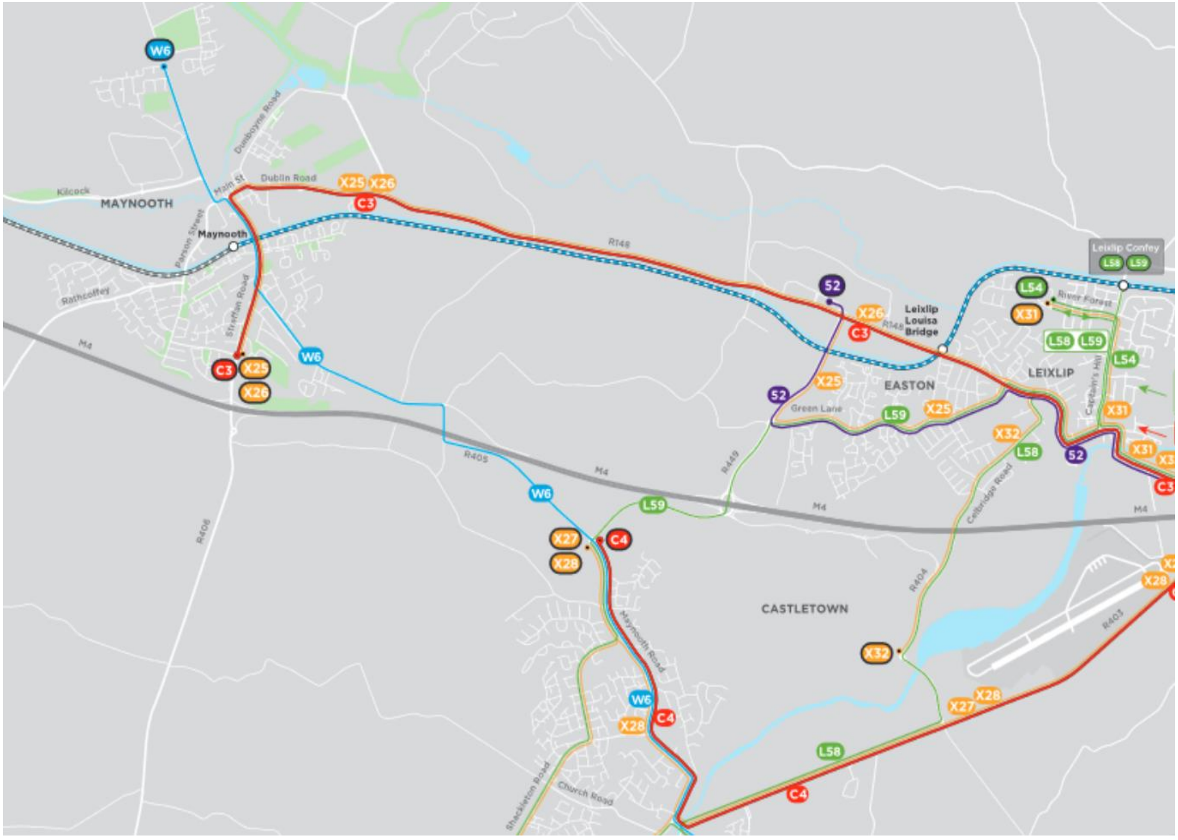


Figure 4-32: Maps showing new BusConnects Services for the Maynooth area

Table 4-9 compares the existing level of service provided by the current Dublin Bus routes serving Maynooth to the planned frequencies as part of the BusConnects project. The comparison is done across the entire day in the inbound direction towards Dublin. This analysis highlights that there will be a significant reduction in bus services levels from Maynooth to Dublin as a result of the BusConnects Strategy with a reduction of 49 services a day in the inbound direction.

Table 4-9: Change in Frequencies under BusConnects

Existing Dublin Bus Services						Planned under BusConnects				
Time	66	66e	66X	67	67X	Time	C3	X25	X26	Change in service levels
05:00	1	0	0	1	0	05:00	1	0	0	-1
06:00	1	1	0	3	2	06:00	2	0	0	-5
07:00	2	0	6	2	4	07:00	2	2	3	-7
08:00	3	0	0	2	0	08:00	2	0	0	-3
09:00	2	1	0	2	0	09:00	2	0	0	-3
10:00	2	1	0	2	0	10:00	2	0	0	-3
11:00	2	1	0	2	0	11:00	2	0	0	-3
12:00	1	1	0	1	0	12:00	2	0	0	-1
13:00	2	1	0	2	0	13:00	2	0	0	-3
14:00	2	1	0	2	0	14:00	2	0	0	-3
15:00	2	1	0	2	0	15:00	2	0	0	-3
16:00	3	0	0	2	0	16:00	2	1	1	-1
17:00	3	0	0	2	0	17:00	2	1	2	0
18:00	2	0	0	2	0	18:00	2	0	0	-2
19:00	3	0	0	2	0	19:00	2	0	0	-3
20:00	2	0	0	2	0	20:00	2	0	0	-2
21:00	2	0	0	2	0	21:00	2	0	0	-2
22:00	2	0	0	2	0	22:00	2	0	0	-2
23:00	1	0	0	2	0	23:00	1	0	0	-2
Total	**38**	**8**	**6**	**37**	**6**	**Total**	**36**	**4**	**6**	-49

Total Dublin Bus Inbound Services from Maynooth	190	Total Maynooth Inbound BusConnects Services	92	

Figure 4-33 shows the future public transport network in Maynooth once the BusConnects and DART+ projects have been completed, with other bus routes assumed to be unchanged.

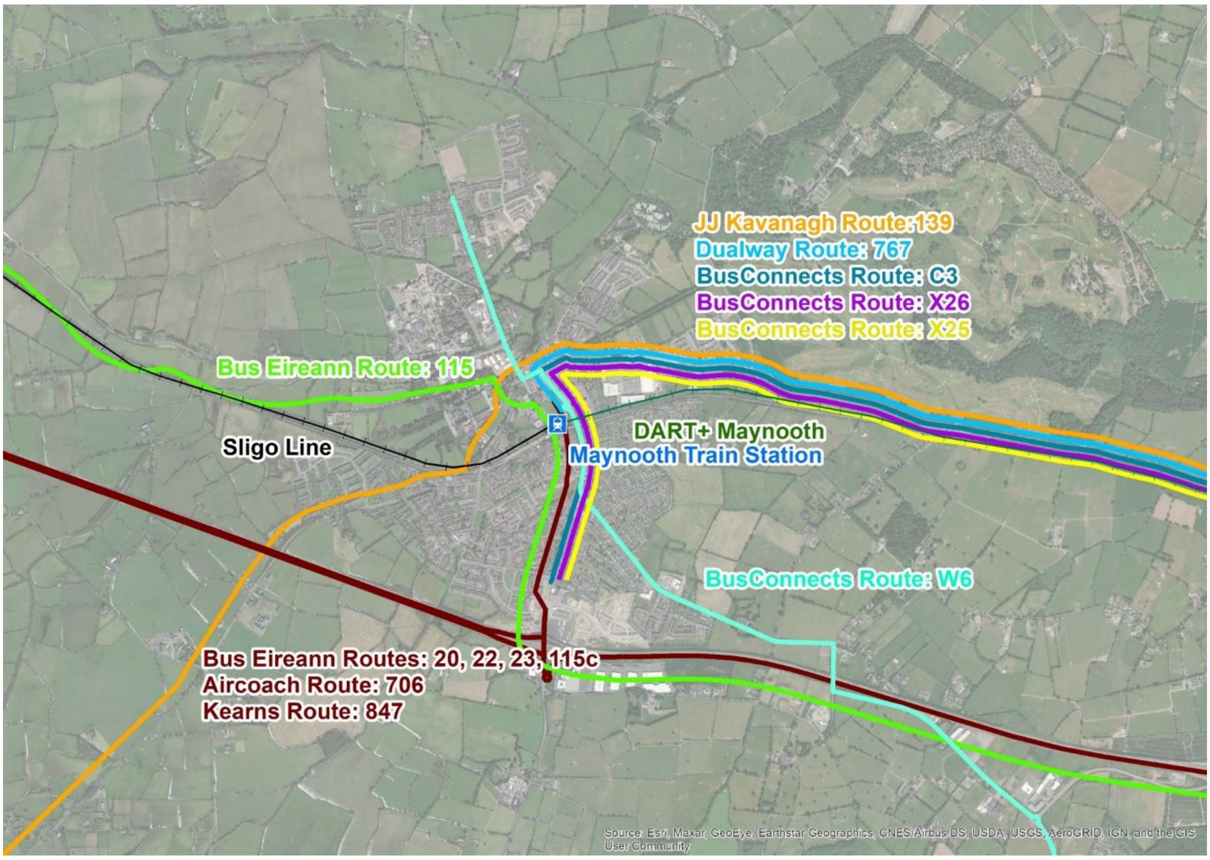


Figure 4-33 Future Public Transport Network in Maynooth with BusConnects

4.4.7.2 DART+ West

The Dart+ programme of projects aims to modernise and improve existing rail services in the Greater Dublin Area (GDA). Figure 4-34 shows an overview of the DART+ programme. It will provide a sustainable, electrified, reliable and more frequent rail service improving capacity on the existing rail corridors serving Dublin.

DART+ West includes DART service to Maynooth / M3 Parkway on the Maynooth / Sligo Line. The overall scope of the DART+ West project will include:

- Electrification of the Maynooth line from City Centre to Maynooth (40km approx.)
- City Centre enhancements at Connolly (platforms, junctions & station modifications) to increase train numbers per hour
- Subject to further assessment, the potential relocation of Docklands Station to a location adjacent to Spencer Dock Luas Stop to better serve all routes entering the City Centre
- Construction of a new DART depot facility west of Maynooth Station for the maintenance and stabling of trains
- Development of an interchange station with MetroLink at Glasnevin serving both the Maynooth Line and Kildare Line
- Elimination of level crossings to reduce rail/road conflict that limits train capacity
- Provide new grade-separated pedestrian, cycle crossings and vehicle crossings as required
- All civil and bridge works as necessary to accommodate electrification, corridor widenings and increased service level
- Upgrades to signalling and communications infrastructure to improve safety, and support increased frequency and reliability

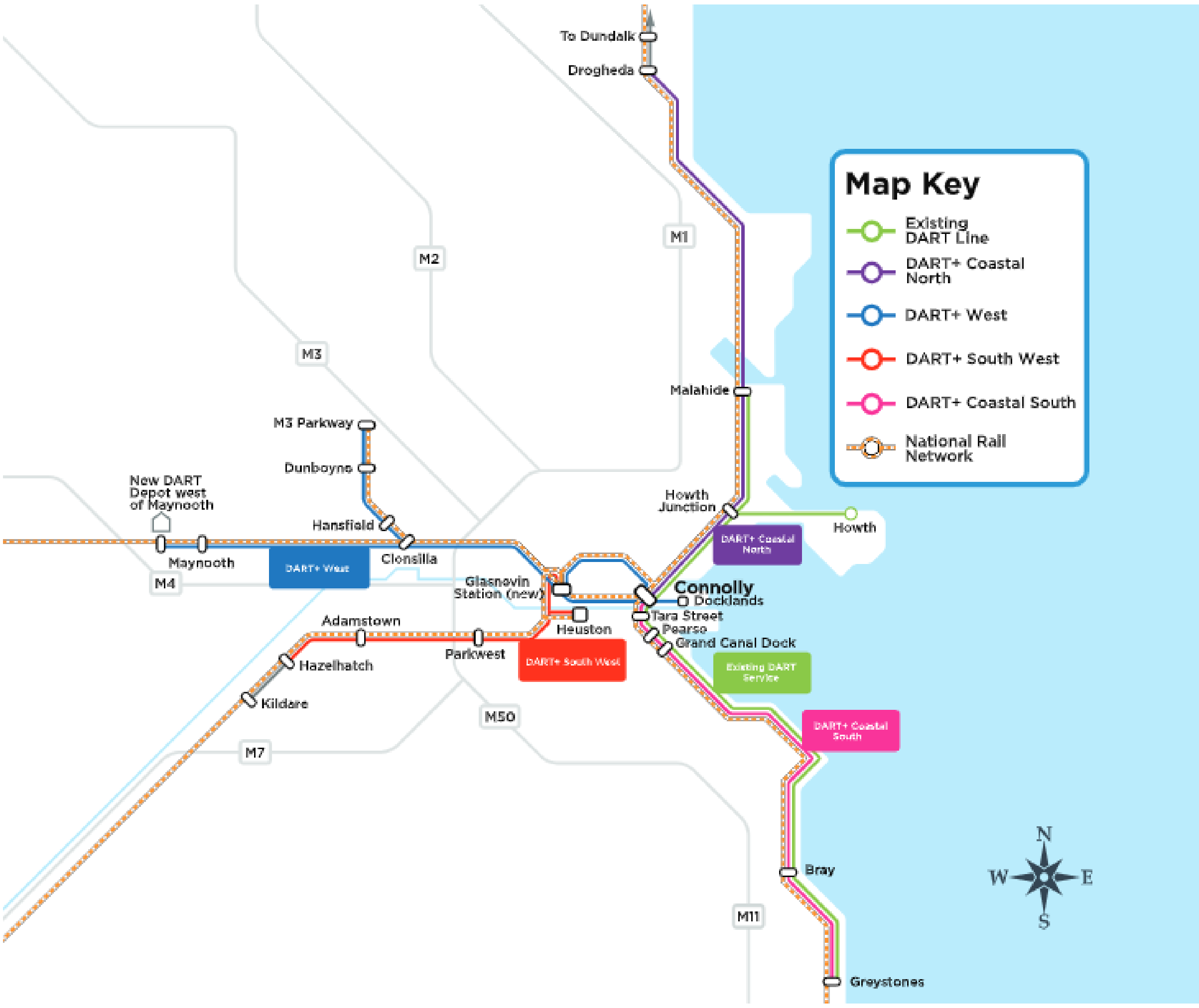


Figure 4-34: DART+ Programme Route Map

4.4.8 Public Transport Capacity

A capacity analysis of public transport in Maynooth was undertaken to allow comparisons to be drawn between existing public transport capacity and the proposed capacity under BusConnects. Operational capacity was calculated based on the number of existing services multiplied by the capacity of the vehicle used on that service. Assumptions of the analysis are listed below the relevant tables.

4.4.8.1 Existing Bus and Rail Capacity

Table 4-10 shows the existing capacity of inbound bus services from Maynooth. There is a total operational capacity of 12,190 for inbound bus services. Table 4-11 displays the existing capacity of the outbound bus services to Maynooth, with a total outbound operational capacity of 11,970.

Table 4-12 and Table 4-13 show the existing inbound and outbound capacities of the rail services to Maynooth respectively. The total operational capacity of the inbound services is 51,578 and 62,198 for the outbound services.

Table 4-10 Existing Inbound Bus Capacity

Inbound Service

Operator	Origin	Destination	No. of Services	Assumed Vehicle Capacity	Operational Capacity
Bus Eireann	Galway	Dublin Airport	3	55	165
	Ballina	Dublin City	5	55	275
	Sligo	Dublin Airport	1	55	55
	Mullingar	Dublin City	34	55	1,870
Dublin Bus	Maynooth	Dublin City	82	84	6,888
	Maynooth	UCD Belfield	8	84	672
Dualway	Maynooth	Dublin Airport	27	55	1,485
JJ Kavanagh	Naas	Blanchardstown	9	50	450
Kearns	Portumna / Birr	Maynooth	2	55	110
Aircoach	Galway	Dublin Airport	4	55	220
		Total Inbound Bus Capacity			12,190

Table 4-11 Existing Outbound Bus Capacity

Outbound

Operator	Origin	Destination	No. of Services	Assumed Vehicle Capacity	Operational Capacity
Bus Eireann	Dublin Airport	Galway	4	55	220
	Dublin City	Ballina	5	55	275
	Dublin Airport	Sligo	1	55	55
	Dublin City	Mullingar	32	55	1,760
Dublin Bus	Dublin City	Maynooth	83	84	6,972
	UCD Belfield	Maynooth	7	84	588
Dualway	Dublin Airport	Maynooth	25	55	1,375
JJ Kavanagh	Blanchardstown	Naas	9	50	450
Kearns	Maynooth	Portumna / Birr	1	55	55
Aircoach	Dublin Airport	Galway	4	55	220
		Total Outbound Bus Capacity			11,970

Existing Bus Capacity Assumptions:

- Excludes local link services and university coach services, focused on commuter services
- Based on 2019 GTFS data, except for Aircoach which uses data from 2021

Table 4-12 Existing Inbound Train Capacity

Inbound					
Set Size	Origin	Destination	No. of Services	Total capacity	Operational Capacity
4 ICR (Intercity)	Sligo	Dublin Connolly	7	530	3,710
7 ICR (Intercity)	Longford	Dublin Connolly	2	476	952
8x29000 (Diesel Commuter)	Maynooth	Dublin Connolly	23	1268	29,164
8x29000 (Diesel Commuter)	Maynooth	Dublin Pearse	13	1268	16,484
8x29000 (Diesel Commuter)	Maynooth	Bray	1	1268	1,268
	Total Capacity				51,578

Table 4-13 Existing Outbound Train Capacity

Outbound					
Set Size	**Origin**	**Destination**	**No. of Services**	**Total capacity**	**Operational Capacity**
4 ICR (Intercity)	Dublin Connolly	Sligo	7	530	3,710
7 ICR (Intercity)	Dublin Connolly	Longford	2	476	952
7 ICR (Intercity)	Dublin Connolly	Mullingar	1	476	476
8x29000 (Diesel Commuter)	Dublin Connolly	Maynooth	21	1268	26,628
8x29000 (Diesel Commuter)	Dublin Pearse	Maynooth	14	1268	17,752
8x29000 (Diesel Commuter)	Grand Canal Dock	Maynooth	10	1268	12,680
	Total Capacity				62,198

Existing Train Capacity Assumptions:

- Train coach capacities taken from service plan for DART+ West base year transport model (ERM)
- Assumes maximum possible capacity, this represents the best possible situation in respect to rail capacity

4.4.8.2 Proposed Bus Capacity

Table 4-14 shows the proposed capacity of the inbound bus services from Maynooth.

Table 4-15 displays the proposed capacity of the outbound bus services to Maynooth. Both inbound and outbound proposed bus services have operational capacities of 6,804.

Table 4-14 Proposed Inbound Bus Capacity

Inbound					
Route	**Origin**	**Destination**	**No. of Services**	**Assumed Vehicle Capacity**	**Operational Capacity**
C3	Maynooth	Ringsend (via City Centre)	36	84	3,024
X25	Maynooth	City Centre	4	84	336
X26	Maynooth	UCD	6	84	504
W6	Maynooth	Tallaght	35	84	2,940
		Total Capacity			6,804

Table 4-15 Proposed Outbound Bus Capacity

Outbound					
Route	**Origin**	**Destination**	**No. of Services**	**Assumed Vehicle Capacity**	**Operational Capacity**
C3	Ringsend (via City Centre)	Maynooth	36	84	3,024
X25	City Centre	Maynooth	4	84	336
X26	UCD	Maynooth	6	84	504
W6	Tallaght	Maynooth	35	84	2,940
		Total Capacity			6,804

Proposed Bus Capacity Assumptions:

- Frequency information for BusConnects is only provided in one direction, therefore the tables assume the same outbound and inbound capacity

4.4.8.3 Comparison of Existing and Proposed Capacity

Table 4-16 (inbound bus services) and Table 4-17 (outbound bus services) provide a comparison between the existing and proposed bus service capacities.

In the future, routes 66, 66E and the 67 will become routes C3 and the X25, while the 66X and the 67X are combined to become route X26. In both the inbound and outbound directions, the combination of bus routes leads to a considerable loss of operational capacity for Maynooth's bus services due to lower frequencies. The C3 and X25 have a reduced inbound capacity of 3,528 as compared to the capacity of the existing 66, 66E and 67 and the X26 has a reduced capacity of 168 as compared to the 66X and 67X. In the outbound direction the C3 and X25 have a reduced operational capacity of 3,612 as compared to the capacity of the existing 66, 66E and 67 and the X26 has a reduced capacity of 84 as compared to the 66X and 67X.

Table 4-16 Comparison of the Existing and Proposed Inbound Bus Capacity

Routes	Origin	Destination	No. of Services	Assumed Vehicle Capacity	Operational Capacity	Change in capacity
Existing Dublin Bus Inbound Capacity						
66+66E+67	Maynooth	Dublin City	82	84	6,888	
66X+67X	Maynooth	UCD Belfield	8	84	672	
Proposed BusConnects Inbound Capacity						
C3 + X25	Maynooth	Ringsend (via City Centre)	40	84	3,360	**-3,528**
X26	Maynooth	UCD Belfield	6	84	504	**-168**

Table 4-17 Comparison of the Existing and Proposed Outbound Bus Capacity

Routes	Origin	Destination	No. of Services	Assumed Vehicle Capacity	Operational Capacity	Change in capacity
Existing Dublin Bus Outbound Capacity						
66+66E+67	Dublin City	Maynooth	83	84	6,972	
66X+67X	UCD Belfield	Maynooth	7	84	588	
Proposed BusConnects Outbound Capacity						
C3 + X25	Ringsend (via City Centre)	Maynooth	40	84	3,360	**- 3,612**
X26	UCD	Maynooth	6	84	504	**- 84**

4.4.9 Public Transport Accessibility Analysis

This section assesses local public transport access, through the study of PTALs (Public Transport Accessibility Levels) as well as regional public transport access through the study of POWSCAR trip distribution data and future travel demand.

4.4.9.1 Public Transport Accessibility Levels (PTALs)

PTAL is a measure of the density of the public transport network. The analysis area is divided into a 100m grid and each square receives a score. An accessibility index is calculated for each public transport stop and route at the stop. The index consists of the walk time to the public transport stop, service frequency and the average wait time at the stop. It also includes a reliability factor, which is different for rail and bus. The values of each stop and route in a square are summed and translated to a standardised score, as seen in Figure 4.35 for 07:00 to 19:00 in Maynooth. The standardised scores range from 0 (worst) to 6b (best).

In Maynooth, the highest PTAL scores are near the train station south of the main street due to the access to both bus and rail at this location. In general, the areas directly north and south of the train station have better scores due to the accessibility and higher density of the public transport options and stops. There is a significant portion of the northern half of Maynooth that has a PTAL score of zero. This area has seen significant residential growth in recent years and is the location of the large new school campus. The Maynooth Business Campus, a location which draws a large number of daily workers, is also located in an area with a score of zero. There is also a large residential area in the south-west with a score of 1a, which is the second lowest score.

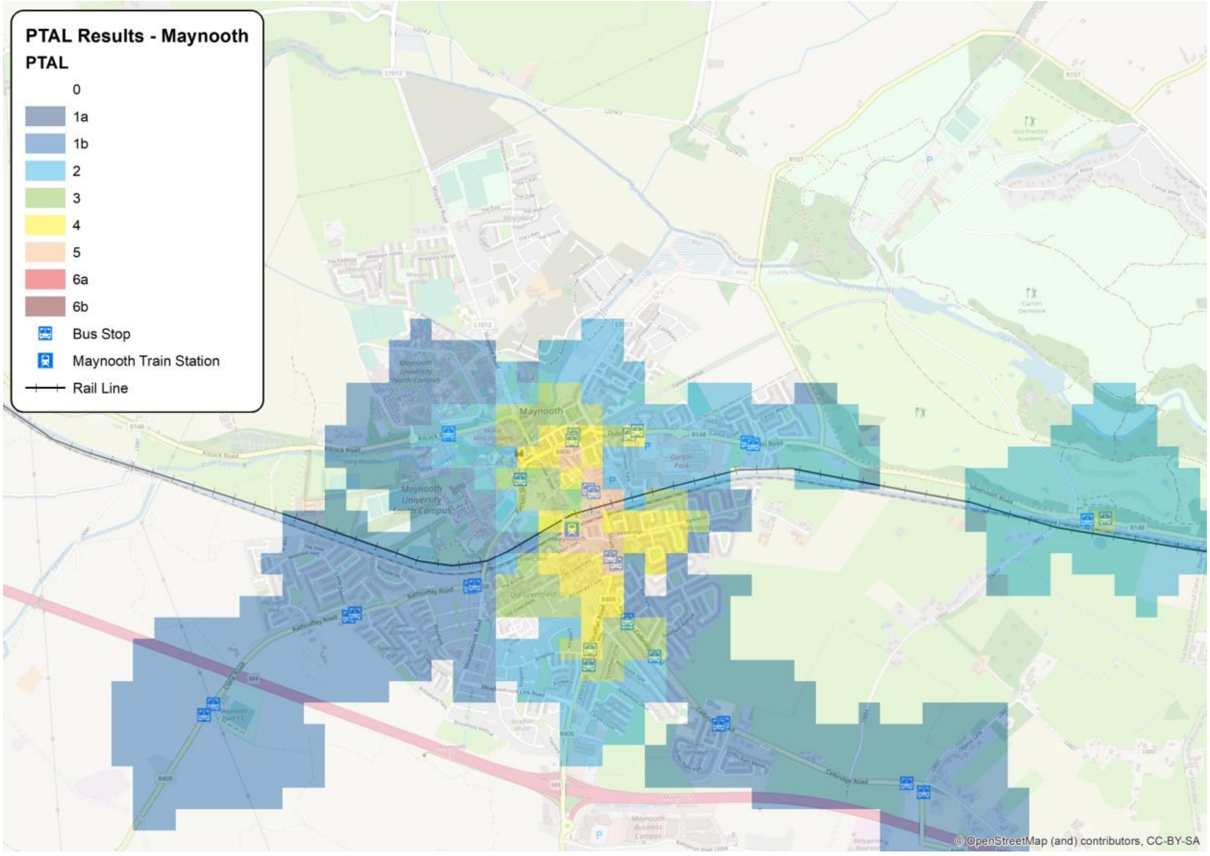


Figure 4.35 PTAL Results for Maynooth, 07:00 to 19:00

4.4.9.2 Public Transport and Trip Patterns Analysis – Outbound Trips from Maynooth

An analysis of work and third level commuting destinations was undertaken using POWSCAR Records from the 2016 census period. The purpose of the analysis is to identify where residents of Maynooth are commuting to and assess the quality of public transport options open to them in terms of frequency of services. This frequency analysis included both bus and rail-based services and a peak AM commuting hour of 07:30 to 08:30 was analysed in detail. This hour was chosen given the journey times from Maynooth to Dublin City and surrounding areas.

Figure 4.36 shows the frequency of public transport services stopping in Maynooth on their way to Dublin between 07:30 to 08:30. The most frequent bus options in this period are bus services operated by Dublin Bus offering departures from Maynooth every 20 minutes. Rail services from Maynooth to Dublin also operate at a 20-minute headway during this time. The analysis shows the level of public transport frequency during this key commuting hour is relatively low. It also highlights that services are largely of a radial nature, apart from the 139 bus service from Naas to Blanchardstown, which has one departure during this time period.

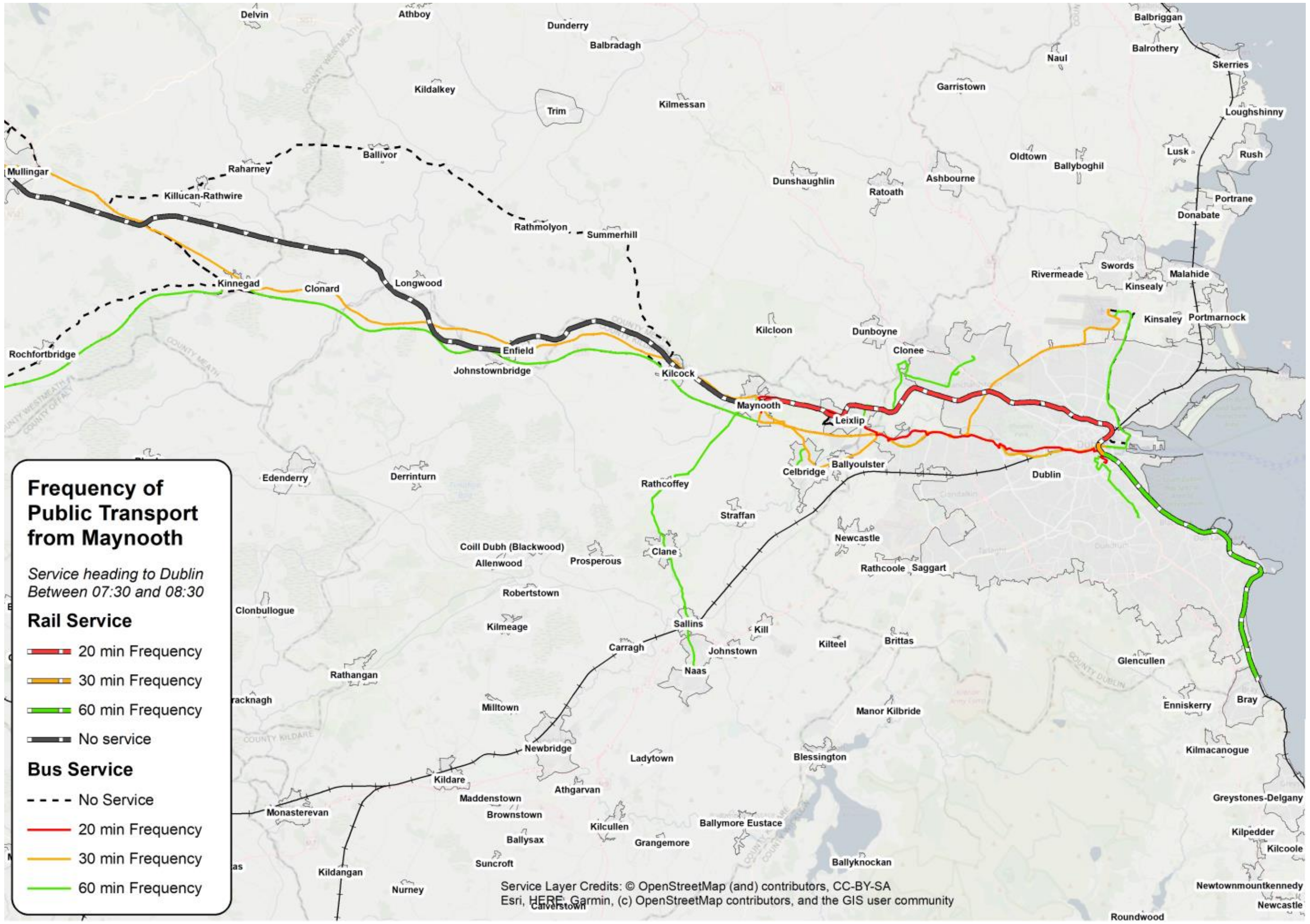


Figure 4.36 Frequency of Public Transport from Maynooth to Dublin between 07:30 - 08:30

Having coded the public transport services into frequency bands, POWSCAR destinations were then overlaid for residents of Maynooth. The analysis is shown in Figure 4.37 highlights that a large number of Maynooth residents commute within Maynooth itself, Leixlip and the Liffey Business Campus. In addition to these local destinations, a large number of Maynooth residents are commuting to Dublin city centre and areas to the south-east such as Tallaght.

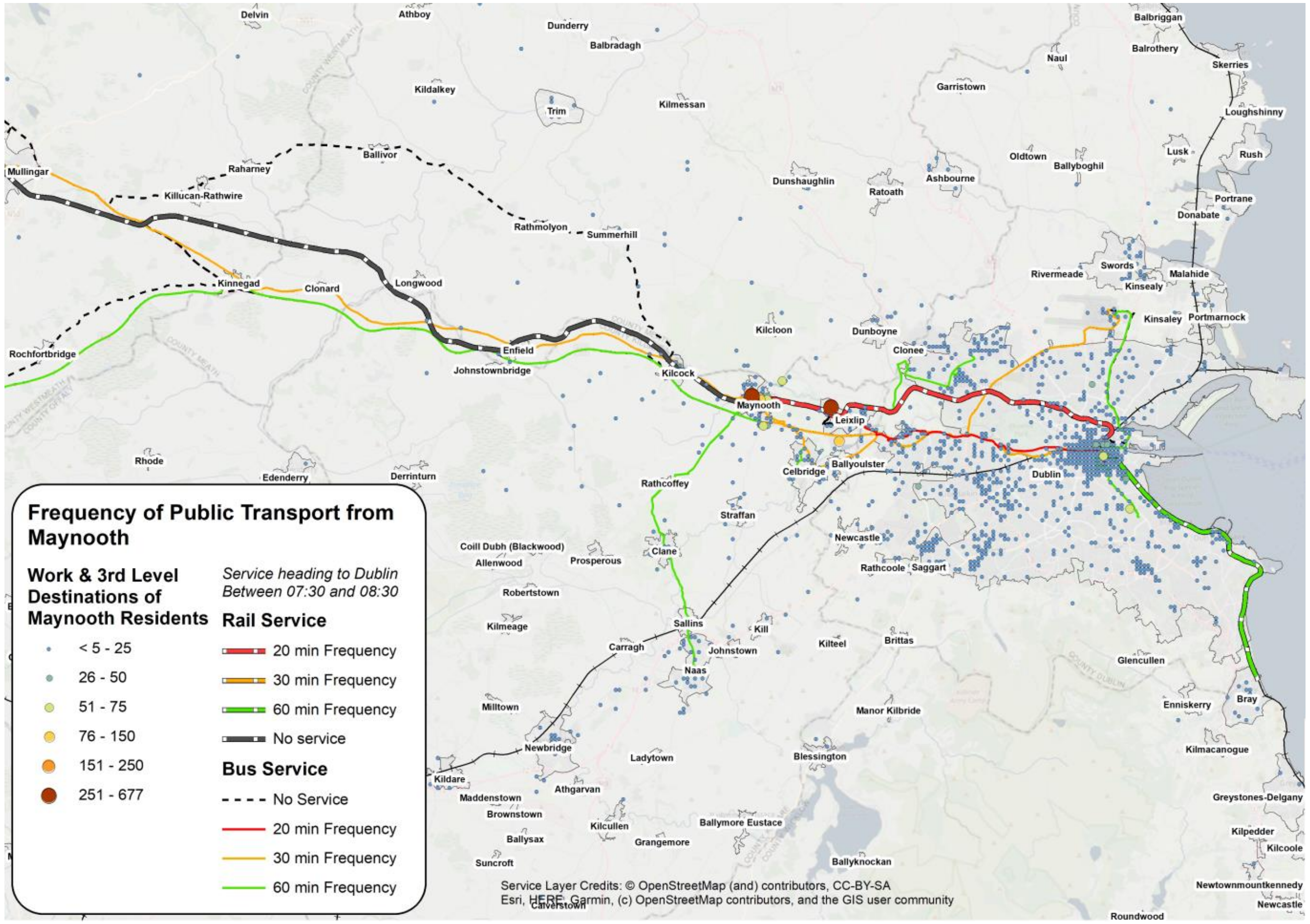


Figure 4.37 Frequency of Public Transport from Maynooth to Dublin between 07:30 - 08:30 with POWSCAR Destinations for Work and 3rd Level Trips

Using POWSCAR Records from the 2016 census period, an analysis of commuting destinations for work and third level commuters was undertaken. The purpose of the analysis is to identify where residents of Maynooth are commuting to and assess the quality of public transport options open to these commuters in terms of frequency of services.

Figure 4.38 shows the public transport services that operate between 07:30 – 08:30 and the Place of Work and Third Level destinations of residents of Maynooth for the top 20 destinations according to the NTA Settlements classification. The top 20 destinations account for 83% of trips leaving Maynooth. Table 4-18 includes the name of the NTA settlements and the total number of trips to each of these destinations.

Table 4-18 Top 20 Destinations of Maynooth Residents

NTA Settlement	2016 Outbound Trips
Maynooth	1,990
Southeast Quadrant of Dublin City Centre	565
Leixlip	418
Northeast Quadrant of Dublin City Centre	326
Northeast Kildare	242
Southwest Quadrant of Dublin City Centre	190
Ballycoolin	115
Celbridge	103
Ballyfermot	101
UCD	92
Ballsbridge	87
Northwest Quad	79
Liffey Valley	77
Ballymun	70
Sandyford	70
Tallaght	68
Naas	65
Cabra	58
North Docks	57
Blanchardstown	54

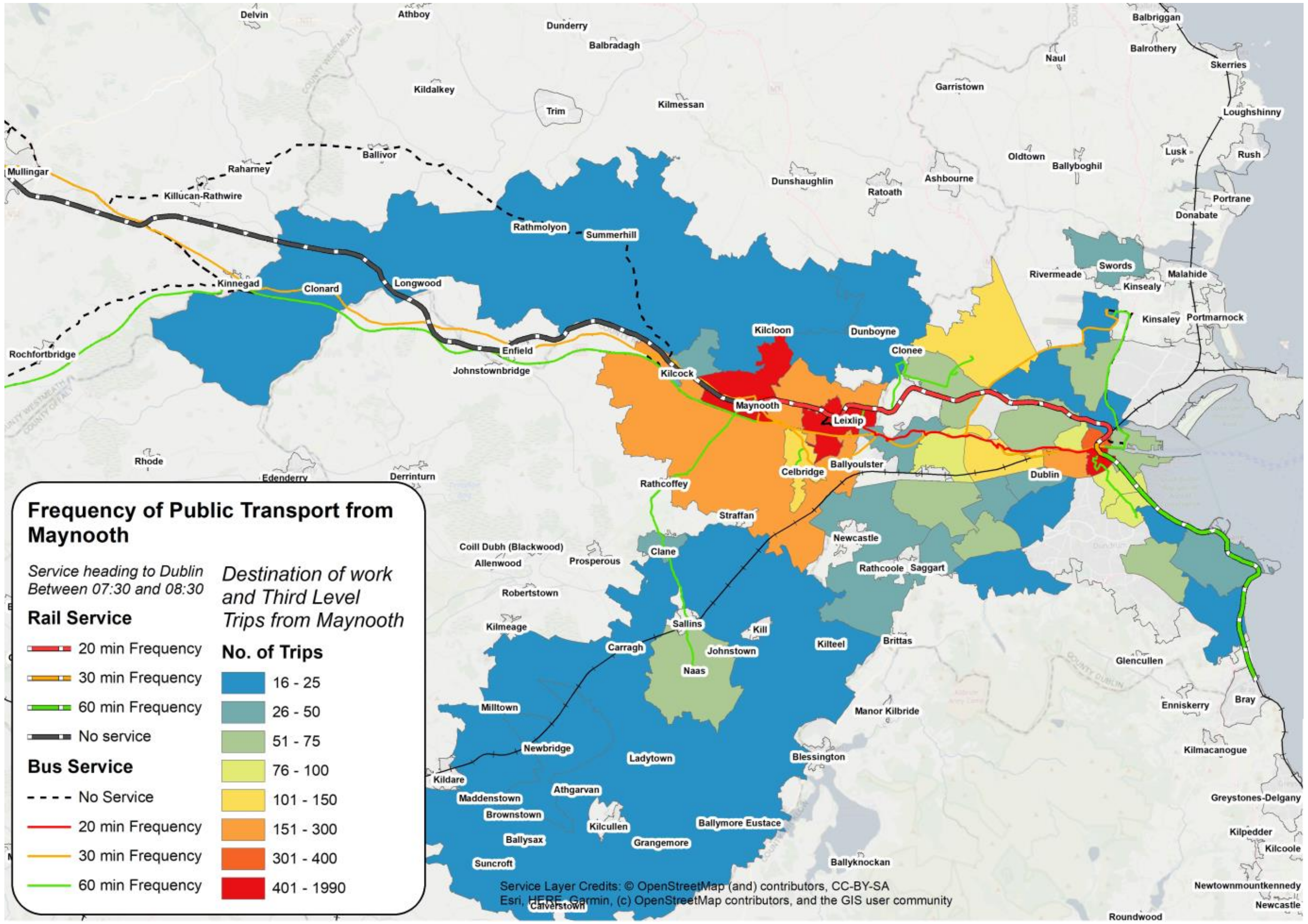


Figure 4.38 Frequency of public transport departing Maynooth between 07:30 – 08:30 and Place of Work and Third Level Destinations of Maynooth Residents

Having overlayed the POWSCAR destinations for Work and third level trips of Maynooth residents on AM peak hour 07:30 – 08:30 public transport services, these locations were then assessed to determine if they were accessible by public transport. The output of this analysis is shown in Table 4-19 and Figure 4.39 which highlights that 70% of destinations are within 500m of a bus stop or 1km of a train station. Table 4-19 shows that 70% of work and college trips from Maynooth are to locations which are accessible by public transport, although as noted previously, the frequency of these public transport connections is relatively low. The remaining 30% of trips from Maynooth are to destinations not served by public transport. While this demonstrates that the existing public transport does serve the majority of trips made in the AM peak there is still significant room for improvement to cover the remaining 30% of trips and to improve the frequency of services for the majority of trips.

The work and college destinations, categorised by access to public transport, are shown in Figure 4.39.

Table 4-19 Destinations of Maynooth Work and 3rd Level Trips Accessible by Public Transport between 07:30 -08:30

Work & 3rd Level Trips of Maynooth Residents	Total No. Trips	% Accessible
Accessible by Public Transport	4,045	70%
Not Accessible by Public Transport	1,772	30%
All Work & 3rd Level Trips	5,817	

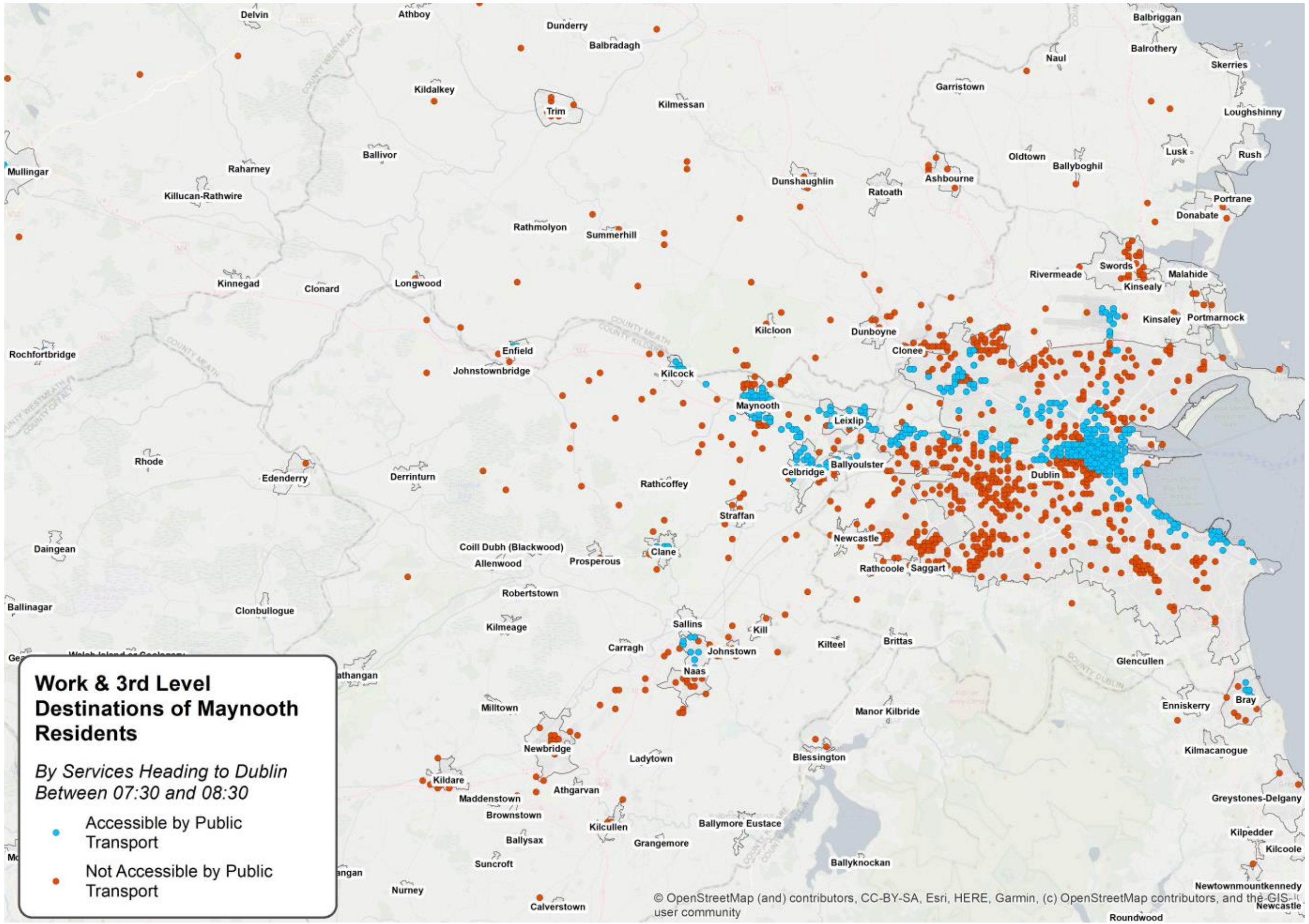


Figure 4.39 Destinations of Maynooth Work and 3rd Level Trips Coded by Accessibility using Public Transport between 07:30 - 08:30

4.4.9.3 Public Transport and Trip Patterns Analysis – Inbound Trips to Maynooth

A similar analysis was undertaken for inbound trips, examining 2016 POWSCAR records for work trips to Maynooth. Again, a morning hour of 07:30 – 08:30 was used for the analysis of public transport frequencies to Maynooth. Table 4-20 shows the origins and trip numbers for the top 20 origin locations for work and third level trips to Maynooth based on POWSCAR. The top 20 origin locations equate to 62% of all trips to Maynooth Town. As can be seen from the table, a large number of trips to Maynooth originate within County Kildare with a strong relationship between Maynooth, Celbridge and Leixlip evident. Table 4-20 also highlights the importance of other towns in close proximity to Maynooth such as Kilcock, Prosperous, Enfield, Naas and Newbridge.

Table 4-20 - Top 20 origin locations of work and third level trips to Maynooth

NTA Settlement	2016 Inbound Trips
Maynooth	2,092
Northeast Kildare	1,548
Celbridge	587
South Meath	519
Leixlip	503
Kilcock	448
Prosperous Environs	380
Enfield Environs	306
Lucan	252
Naas and Newbridge Environs	252
Blanchardstown	250
Liffey Valley	227
Dunboyne	201
Enfield	185
Westmeath Rural	183
Clane	169
Offaly Rural	147
Ballyfermot	121
Wexford Rural	121
Cavan Rural	113

Figure 4.40 shows the origins of work and third level education trips to Maynooth at the NTA Settlement level with the frequency of public transport services to Maynooth between 07:30 – 08:30 also shown. The figure highlights the strong concentration of trips to Maynooth within Kildare County and also emphasises the relationship of Maynooth to the Dublin Suburbs.

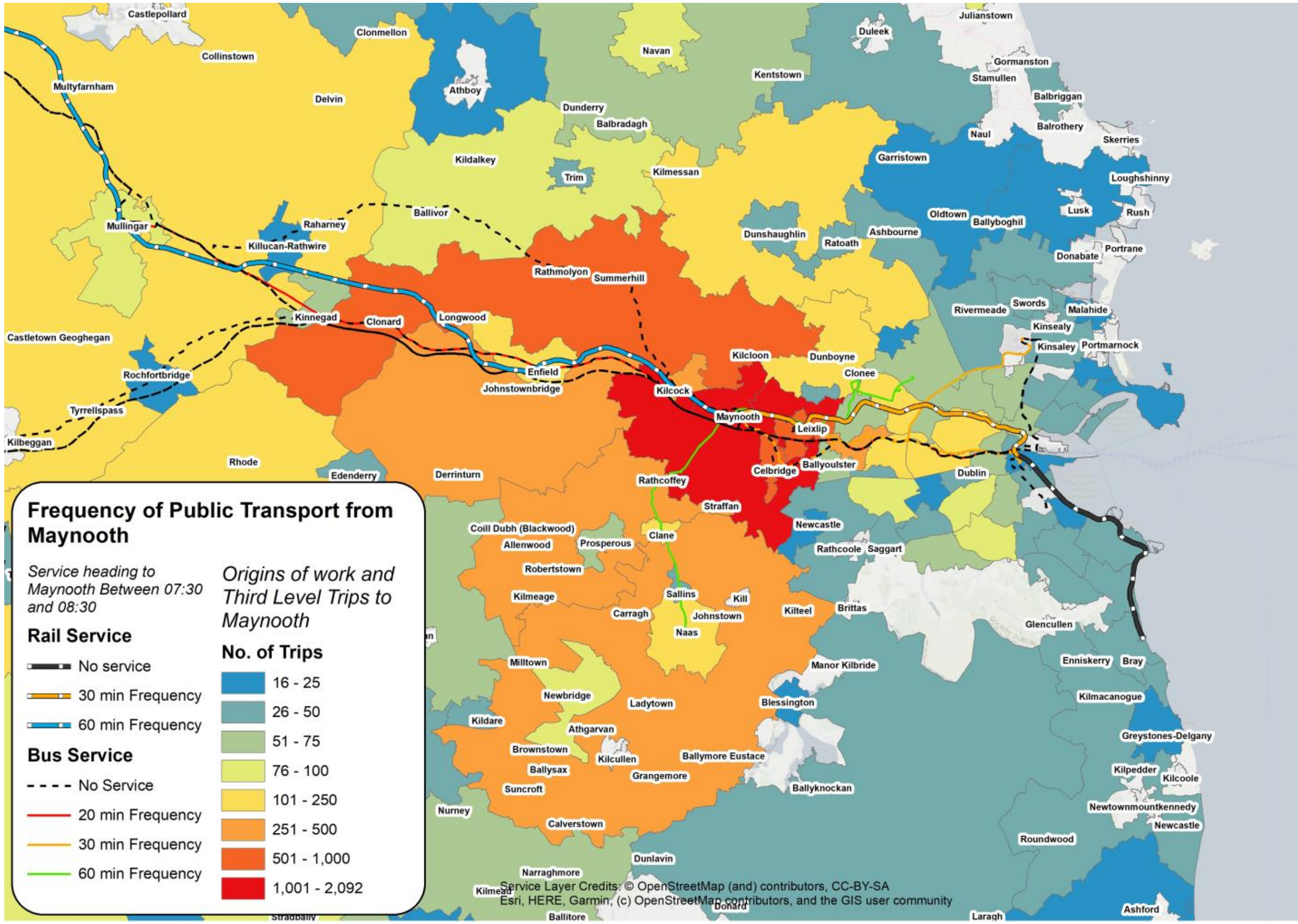


Figure 4.40 - Frequency of public transport serving Maynooth between 07:30 – 08:30 for work and third level trips to Maynooth

4.4.9.4 Summary of Public Transport and Trip Analysis

Table 4-21 presents a summary of the trip demand to and from Maynooth for the top 20 NTA settlements and highlights whether there is a public transport connection for this trip during the 07:30 – 08:30 time period. As can be seen from the table, 96% of trips to/from Maynooth in these locations have an existing public transport connection, however, as the analysis has shown, the frequency of the existing public transport connections during this time period are quite limited on most routes to and from Maynooth.

Table 4-21 – Summary of Trip Demand to and from Maynooth

NTA Settlement	Outbound Trips	Inbound Trips	Two Way Trip Demand	Existing Public Transport Connection between 07:30 - 08:30
Maynooth	1990	2092	4,082	Y
Southeast Quadrant of Dublin City Centre	565	16	581	Y
Leixlip	418	503	921	Y
Northeast Quadrant of Dublin City Centre	326	31	357	Y
Northeast Kildare	242	1548	1,790	Y
Southwest Quadrant of Dublin City Centre	190	67	257	Y
Ballycoolin	115	72	187	Y
Celbridge	103	587	690	Y
Ballyfermot	101	121	222	Y
UCD	92	0	92	N
Ballsbridge	87	30	117	Y
Northwest Quad	79	56	135	Y
Liffey Valley	77	227	304	Y
Ballymun	70	54	124	N
Sandyford	70	36	106	N
Tallaght	68	48	116	N
Naas	65	104	169	Y

NTA Settlement	Outbound Trips	Inbound Trips	Two Way Trip Demand	Existing Public Transport Connection between 07:30 - 08:30
Cabra	58	108	166	Y
North Docks	57	0	57	Y
Blanchardstown	54	250	304	Y
Two Way trip demand with public transport connection			**10,339**	**96%**
Two Way trip demand without public transport connection			**438**	**4%**

4.4.9.5 Examination of Future Trip Demand

An examination of future trip demand was also undertaken as part of this trip demand and public transport analysis. A future year of 2040 was chosen for this analysis to align with the growth rates from the National Planning framework. The purpose of this future year analysis is to examine how growth in trips up to 2040 may impact on the need for additional frequencies on public transport services from Maynooth. The analysis is based on work and third level trips from Maynooth and work and third level trips to Maynooth taken from the CSO's 2016 POWSCAR.

In order to examine the potential future trip demand, trips from each settlement were summed and then multiplied by the population growth for that settlement as assigned by the National Planning Framework. This process was carried out for outbound and inbound trips; however, all outbound trips were multiplied by the forecast % of population growth for Maynooth provided by the planning department to reflect the growth in demand. The analysis also assumes that the distribution of trips to and from Maynooth will remain constant up to 2040. The analysis is shown in Table 4-22.

It should be noted the 115c bus serves South Meath however there are no services during the 07:30 to 08:30 hour. While the 139 bus service passes through the south of Prosperous Environs there is only one stop at Rathcoffey and given there is a large amount of residential development in the west of Prosperous Environs it has been recorded as having no public transport service for these limiting factors. Similarly for Naas and Newbridge Environs, the 139 bus passes through this zone, however, it does not stop in this zone and only passes through a small portion of the zone and for these reasons it has been recoded as having no service.

Table 4-22 –Growth in Trips up to 2040 for Trips to and from Maynooth

NTA Settlement	2040 Outbound Trips				2040 Inbound Trips				Total 2016 Two-way Trip Demand	Total 2040 Two-way Trip Demand	Growth	Bus Service	Outbound Frequency (mins)	Inbound Frequency (mins)	Rail Connection
	2016 Outbound Trips	Population Growth 2016 to 2040	Trip Growth	Total Outbound Trip Demand	2016 Inbound Trips	Population Growth 2016 to 2040	Trip Growth	Total Inbound Trip Demand							
Maynooth	1,990	124%	2463	4,453	2,092	124%	2589	4,681	4,082	9,134	5,052				Y
Northeast Kildare	242		299	541	1,548	85%	1316	2,864	1,790	3,406	1,616	66	20	20	Y
Leixlip	418		517	935	503	87%	435	938	921	1,874	953	66	20	20	Y
Southeast Quadrant of Dublin City Centre	565		699	1,264	16	20%	3	19	581	1,283	702	66	20	20	Y
Celbridge	103		127	230	587	39%	229	816	690	1,046	356	67	30	30	N
Northeast Quadrant of Dublin City Centre	326		403	729	31	27%	8	39	357	769	412	66	20	20	Y
Kilcock	33		41	74	448	26%	118	566	481	640	159	115	30	20	N
South Meath	23		28	51	519	5%	28	547	542	598	56	No Service			N
Lucan	50		62	112	252	60%	152	404	302	516	214	66	20	20	N
Southwest Quadrant of Dublin City Centre	190		235	425	67	27%	18	85	257	510	253	66	20	20	N
Liffey Valley	77		95	172	227	33%	74	301	304	473	169	66	20	20	N
Prosperous Environs	15		19	34	380	10%	40	420	395	453	58	No Service			N
Blanchardstown	54		67	121	250	16%	39	289	304	410	106	139	60	60	Y
Ballyfermot	101		125	226	121	29%	35	156	222	382	160	66	20	20	N
Ballycoolin	115		142	257	72	41%	29	101	187	359	172	139	60	60	N
Enfield Environs	11		14	25	306	9%	26	332	317	357	40	No Service			N
Naas and Newbridge Environs	20		25	45	252	21%	54	306	272	351	79	No Service			N
Dunboyne	16		20	36	201	41%	83	284	217	319	102	No Service			N
Naas	65		80	145	104	37%	39	143	169	288	119	139	60	60	N
Adamstown	13		16	29	75	242%	181	256	88	285	197	No Service			N

Under BusConnects, the 66 will become the C3 and will operate at a 30-minute frequency which is a reduction of 3 services an hour currently to 2 service an hour. The 67 service will become the C4 which will no longer serve Maynooth, instead it will terminate at Celbridge with the W6 providing a connection from Maynooth to Celbridge operating at a frequency of 30 minutes.

4.5 Active Modes

4.5.1 Strava Data

Strava is an app which is used to measure walking, running and cycling trips primarily for recreational, exercise or social trips. The maps in this section present a summary of the total Strava trips which took place on each link in the Open Street Map network in 2019. The Strava data is just a sample of the total walking and cycling trips which will have taken place in the study area, but this data is a valuable tool to help us understand popular routes for active modes in the study area.

4.5.1.1 Walking/Running Trips

Figure 4-41 shows the total walking/running trips on each link in the network in 2019. Due to the Strava app being primarily used to track recreational, exercise or social trips; the most popular routes are the Royal Canal, Carton Avenue and the lands in Carton House. Various paths in the university campus are popular for walking/running as well as the Moyglare Road. Notably, there are a number of roads on the outskirts which do not have footpaths or safe infrastructure for pedestrians and yet still cater for a substantial number of trips on foot. These routes could potentially benefit from additional footpath infrastructure to increase safety for users and encourage further walking trips.

Figure 4-41 Strava Data – Total Walking/Running Trips in 2019

4.5.1.2 Cycling Trips

Figure 4-42 shows the total cycling trips on each link in the network in 2019. While the Royal Canal and Carton Avenue are used for cycling to a certain extent, the highest trip numbers are observed on the main approach roads and town centre where there can be insufficient cyclist infrastructure. This map highlights the need for the MEABTA to provide safe, segregated cycling infrastructure, where possible, on roads throughout the study area. It is important to recognise that these trips are primarily recreational, or social, trips and they represent just a sample of the total cyclist trips which are occurring in the study area.

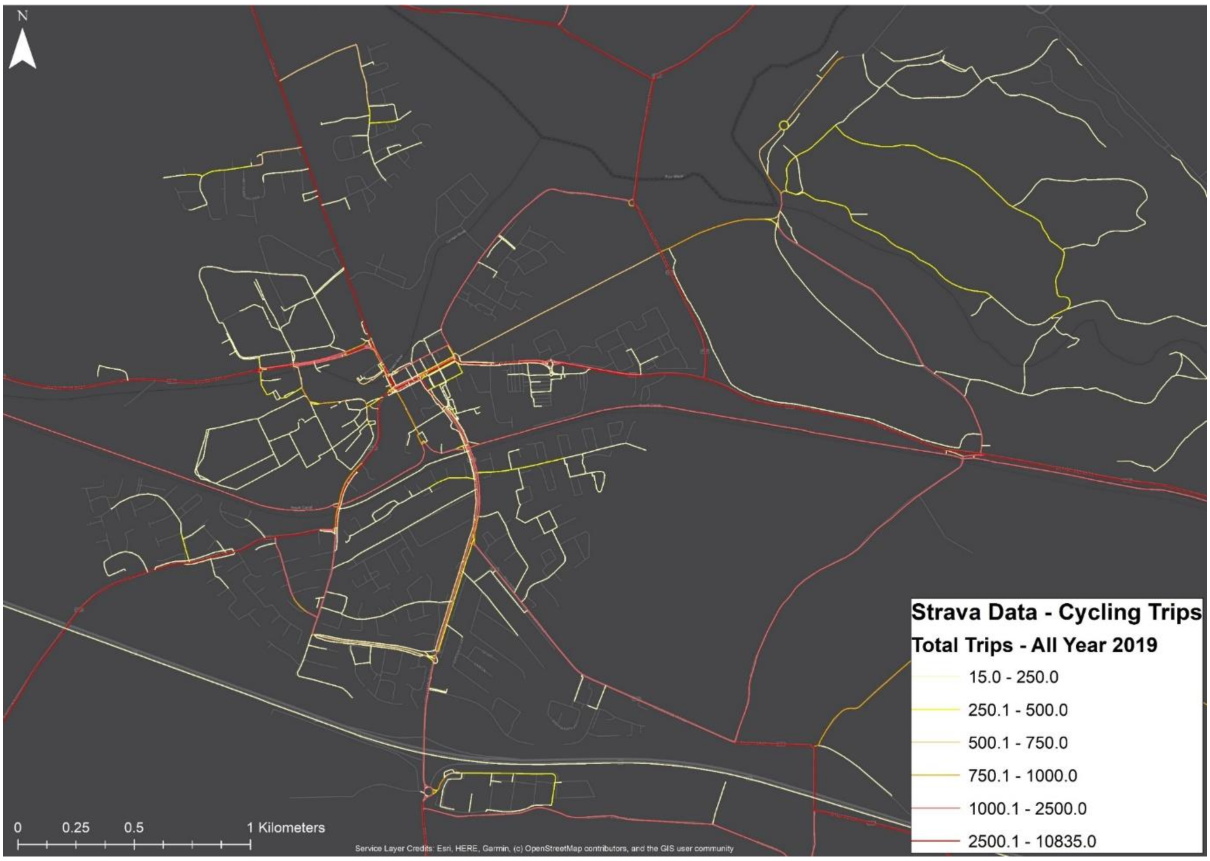


Figure 4-42 Strava Data – Total Cycling Trips in 2019

4.5.2 Permeability Assessment

In order to assess permeability and walking catchments in Maynooth, an accurate path network was developed. This path network is shown in Figure 4-43. The advantage of this path network is that it can accurately assess pedestrian movement, rather than simply representing walking distances on the road network. The path network covers all of the MEABTA study area and extends further east and west on the Royal Canal route. In general, the baseline path network ends where footpaths cease on the approach roads in the study area. The network was originally extracted from Open Street Map and then extensively modified using aerial photography, Google Street View and a site visit to identify paths, cut-throughs and public tracks. The path network is used to assess the 500m or 1km walking distance catchment for key destinations in Maynooth.

Figure 4-43 Maynooth Baseline Path Network

4.5.2.1 Key Permeability Barriers

Maynooth is spatially separated by three main linear barriers; the Royal Canal and railway line, the Lyreen River and the M4 motorway as shown in Figure 4-44. Although these linear corridors have several crossing points, they constrain permeability and improving access across them will be critical as the town expands. Within the town, there are also some large relatively impermeable blocks which can cause longer indirect trips for cyclists and pedestrians. Examples of this include the university lands, particularly the South Campus, and Carton Retail Park. There are also a number of cul-de-sac housing estates with perimeter walls throughout the study area which reduce permeability. Longer trip distances resulting from a lack of permeability encourage car use and inconvenience walkers and cyclists.

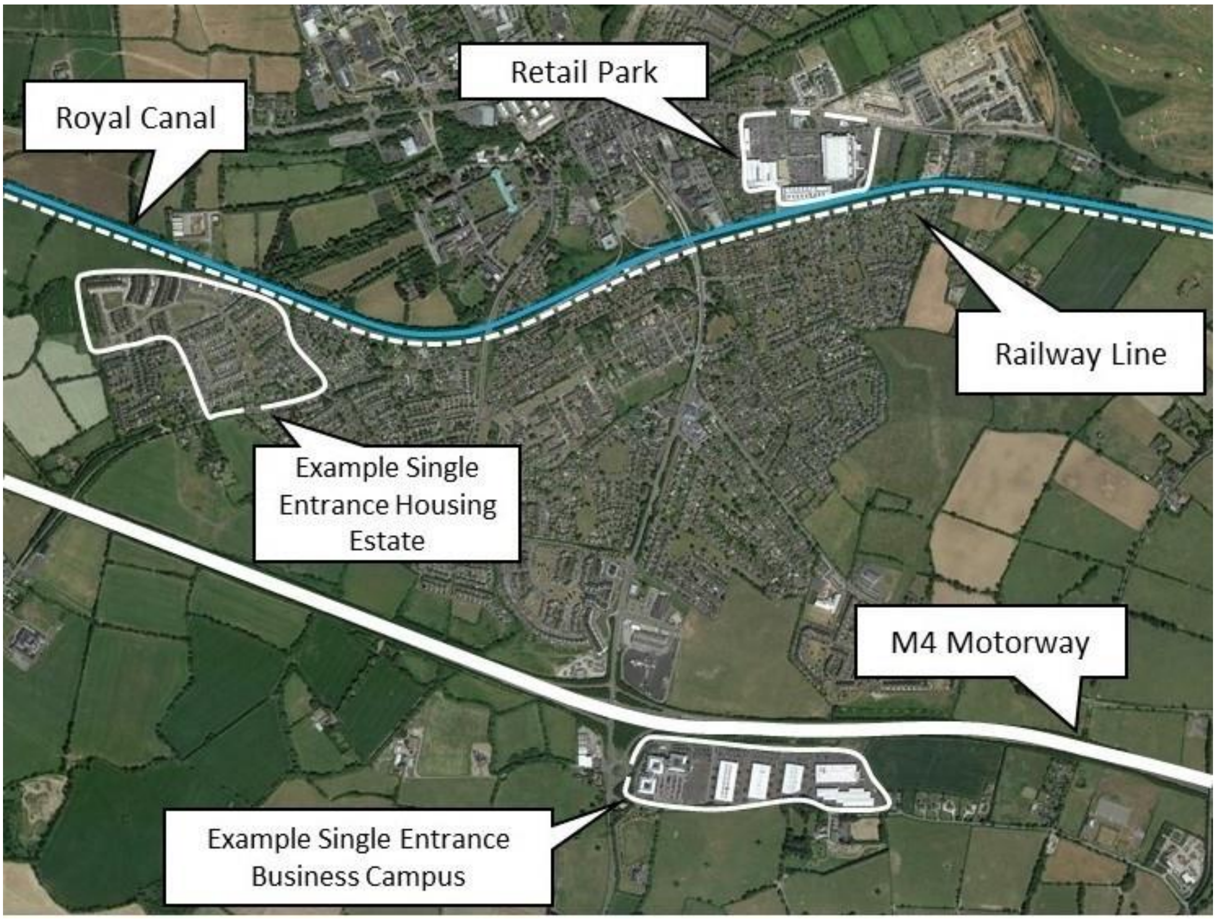


Figure 4-44 Identified Barriers to Permeability in the Study Area

4.5.2.2 Town Centre Catchment

Figure 4-45 shows the actual walking catchment for 1km trips to Maynooth Main Street. The centre point chosen to represent Main Street was Courthouse Square at the junction of Main Street and Straffan Road. Existing access to this location is relatively good when compared to the 1km circular buffer. The catchment is currently most constricted directly to the north of Main Street and partially to the south. There is significant student accommodation and residential developments under construction and granted permission in the northern area which when completed should improve access to the town centre from this area. The southern area is constricted due to a lack of canal crossings and permeability within the residential estate.

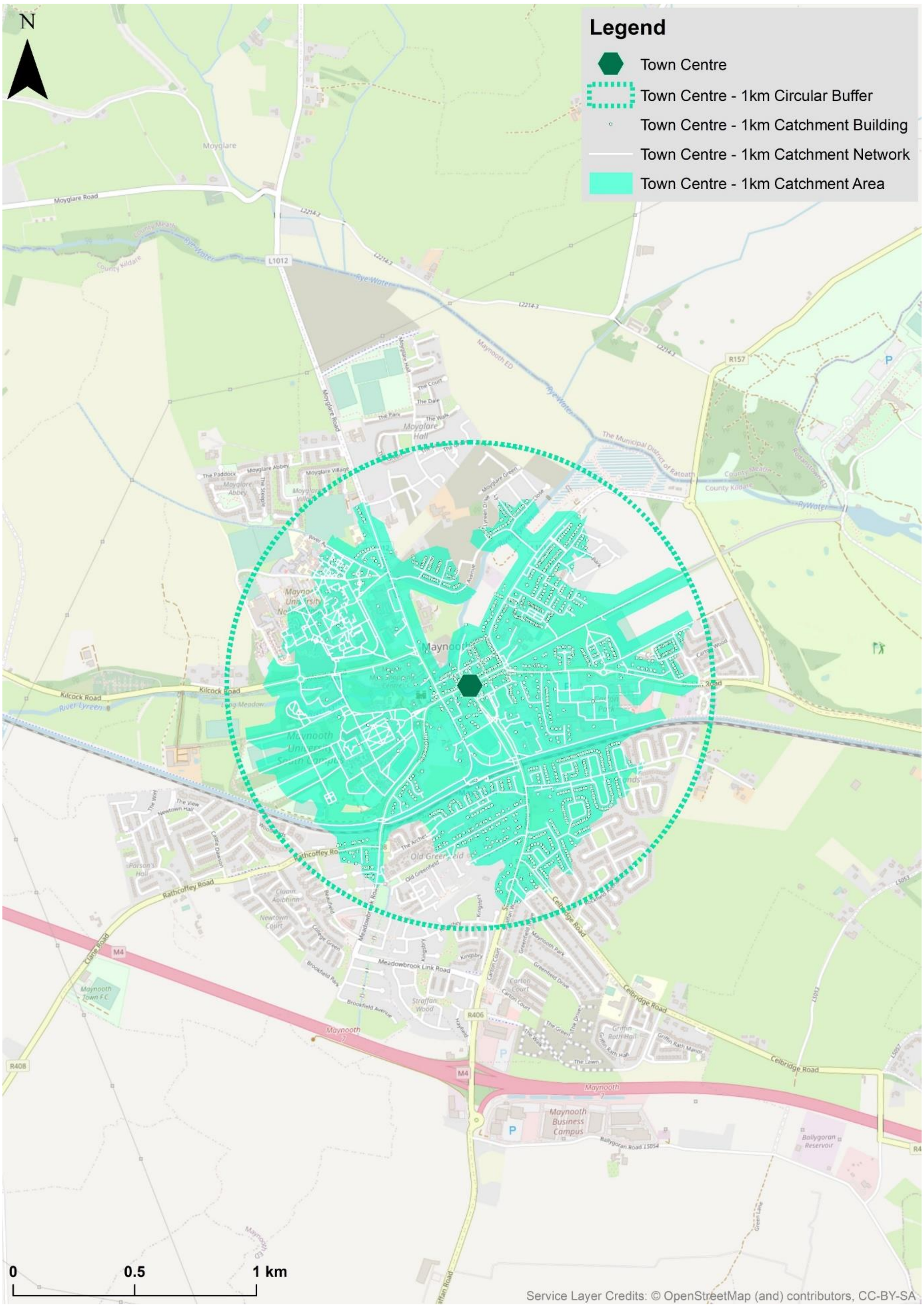


Figure 4-45 1km Walking Distance to the Town Centre

4.5.2.3 Supermarket Catchment

Figure 4-46 shows the actual walking catchment for 1km trips to supermarkets. The majority of supermarkets are located to the north of the canal and are quite central. There is one supermarket to the south of the canal and it is closer to the M4 than to Maynooth town centre. There is a large residential area on the southern side of the canal, to the west, which falls outside of the 1km walking catchment to any supermarket. Similarly, in the south-east there is a residential area which is currently within the 1km buffer but not covered by the 1km walking distance. There is a residential development currently under construction between this area and the nearest supermarket, which when completed may provide the improved permeability required to bring the existing residential area into the 1km walking catchment area.

In the north of the town, there are also significant residential areas both east and west of the Moyglare Road which are not covered by the 1km walking distance catchment. However, in the northeast, planned residential developments should provide increased permeability and better access to supermarkets from some parts of the existing residential area.

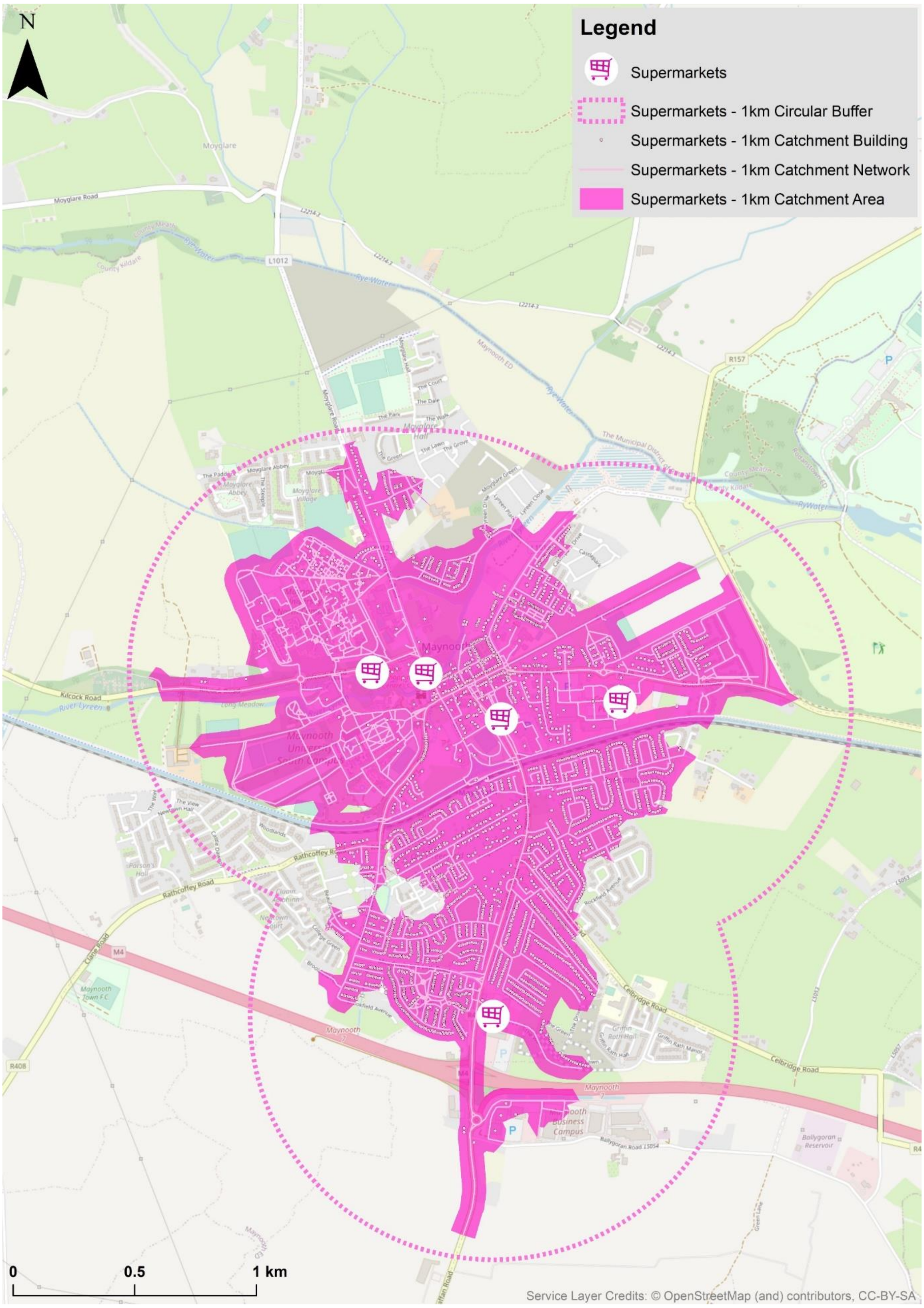


Figure 4-46 1km Walking Distance to Supermarkets

4.5.2.4 Train Station Catchment

Figure 4-47 shows the actual walking catchment for 1km trips to the train station. Existing access to the train station is reasonably good with access to the train station from the north and south, with a footbridge between the platforms. There is also an access from the Royal Canal Greenway.

There is opportunity to improve permeability and therefore access to the station in some areas such as the Carton Retail Park and residential areas north of the retail park as well as the residential estates to the south and north of the train station. Although not captured within the permeability assessment, there is also an opportunity to upgrade the current stepped footbridge at the train station in order to improve accessibility for individuals with mobility impairments as well as people travelling with buggies, bicycles, or awkward luggage.

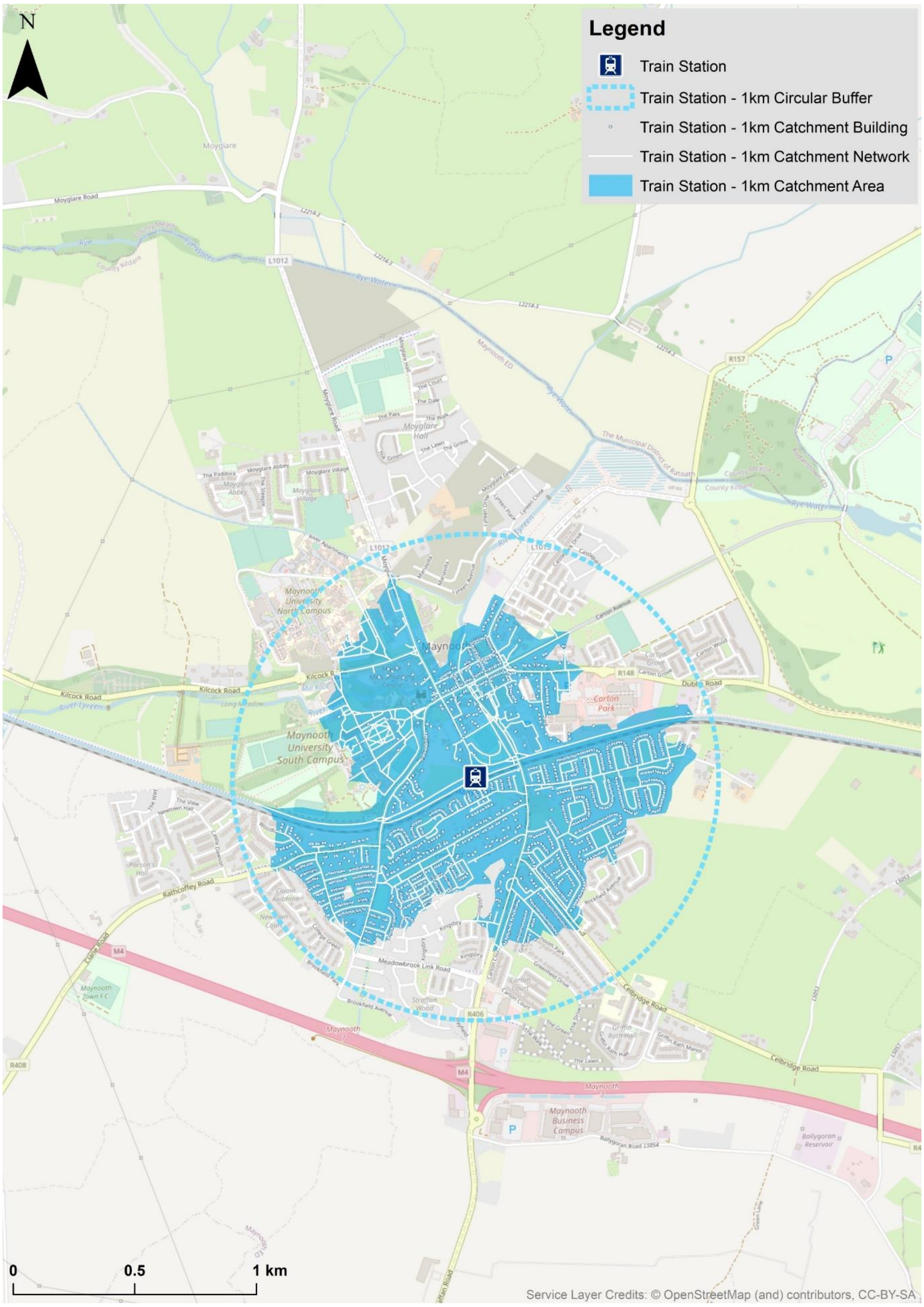


Figure 4-47 1km Walking Distance to the Train Station

4.5.2.5 Bus Stop Catchments

Figure 4-48 shows the actual walking catchment for 500 metre trips to bus stops in Maynooth. The catchment distance for bus stops, which is shorter than the 1km catchment assessed for other amenities as part of this study, is based on the Sustainable Residential Development in Urban Areas (2009) guidelines, which define a public transport corridor as 500 meters for a bus stop or 1km for light or heavy rail.

Existing bus stops in Maynooth are well distributed across the southern, eastern, western and central areas of the town, but are absent from areas north of the Main Street (except for the North Campus of NUI Maynooth). This distribution excludes significant residential development in the northern part of the town, along with the new primary and secondary schools' campus. There are two small pockets in the south of the town in which access to bus stops is restricted due to residential estate boundary walls and a lack of adequate paths. There is also an area south of the canal, in the east, without access to bus stops due to restrictions imposed by the canal. These three areas have the potential to benefit from connectivity improvements. In the rest of the town there is limited scope to improve the bus stop walking catchment through connectivity improvements alone, improvements may require the creation of additional bus stop locations. The existing BusConnects plan includes new bus stops in the north of the town which will significantly improve access to bus stops from this area.

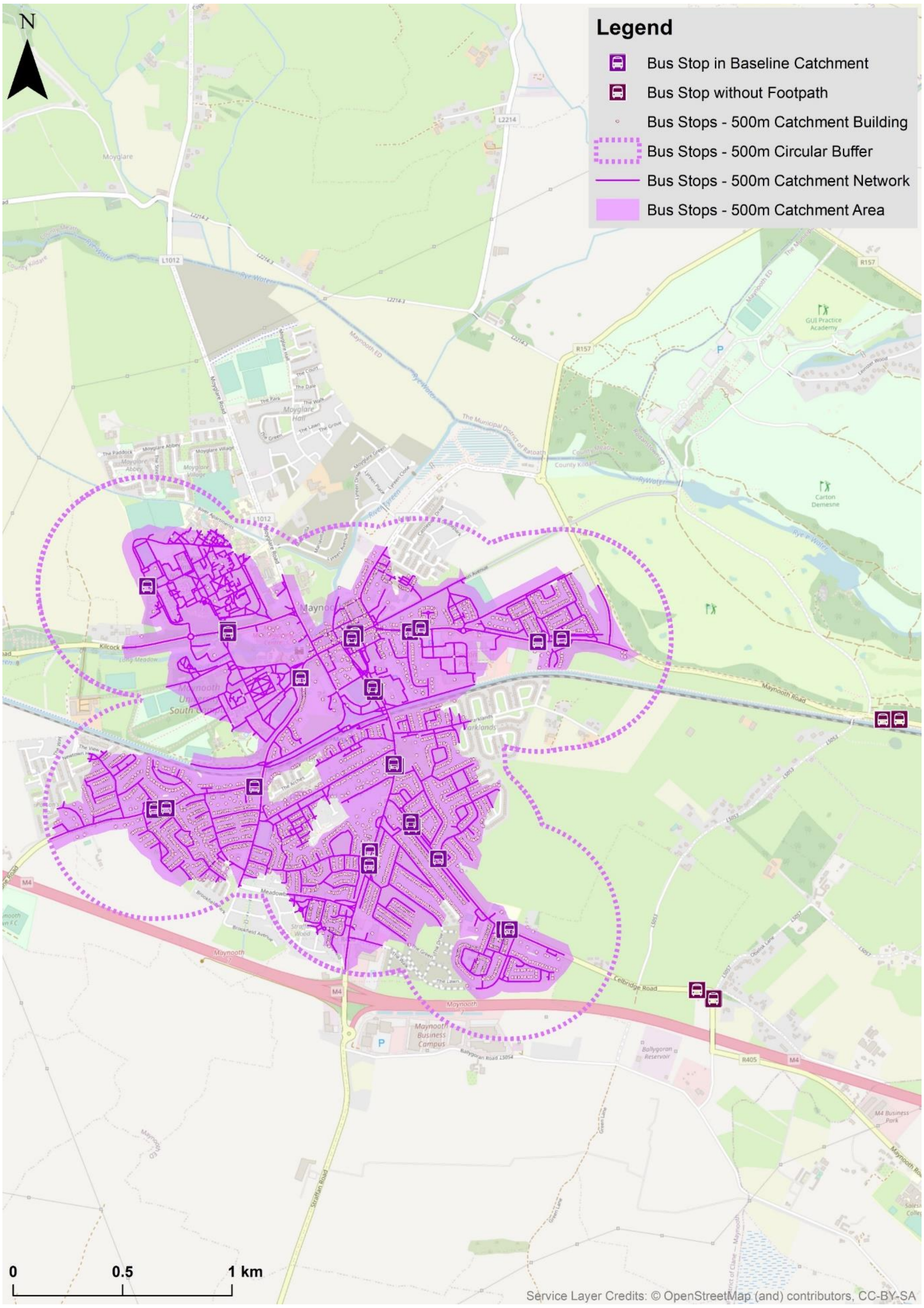


Figure 4-48 500m Walking Distance to Bus Stops

4.5.2.6 Primary Schools Catchments

Figure 4-49 shows the actual 1km walking catchment for trips to primary schools in Maynooth. An issue identified is the development of a large school complex to the north of Maynooth on the Moyglare Road which contains one of the five primary schools within the study area. This is located beyond a desirable walking distance from the majority of Maynooth’s residential areas, particularly for younger children.

Within the 1km buffer zones on the northern side of the canal, existing access to primary schools is good, with just a few small sections of residential development not within the 1km catchment area. On the southern side of the canal however, there is a significant portion of residential development within the 1km buffer zone that does not have access to a primary school within 1km walking distance. There is also a significant quantity of residential development that lies outside of even the 1km buffer zone of any primary school. There is a residential estate under construction to the west of the primary schools in the south of the town and this will improve connectivity from some of the existing residential areas to the west of these schools which are not currently within the 1km walking distance catchment area.

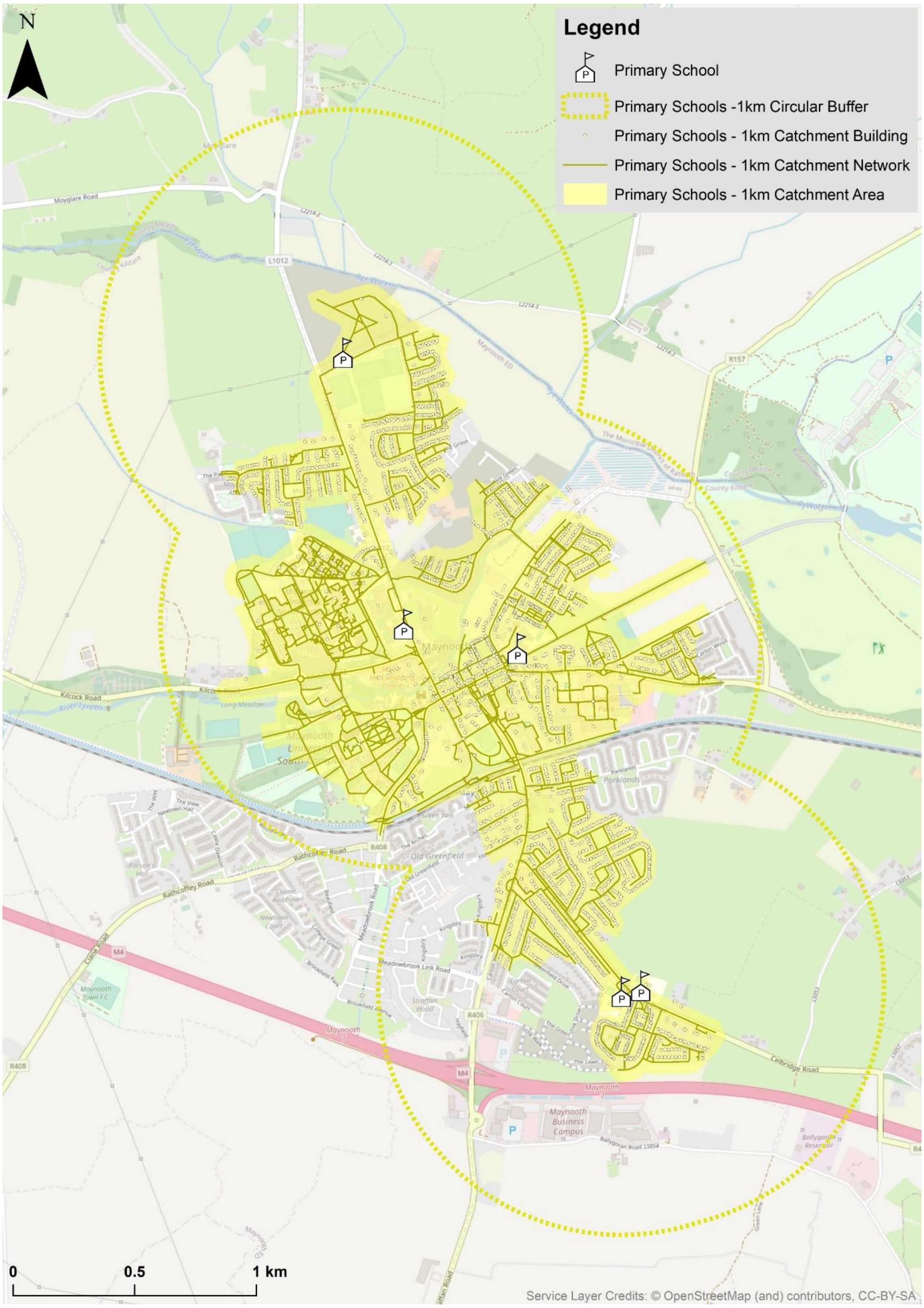


Figure 4-49 1km Walking Distance to Primary Schools

4.5.2.7 Secondary School Catchment

Figure 4-50 shows the actual 1km walking catchment for trips to secondary schools in Maynooth. The new school complex developed to the north of the town contains two of the three secondary schools which are too far away from many of the town's residential areas to allow students to easily walk to school. The overall 1km walking catchment for secondary schools is significantly smaller than the 1km buffer zone. Almost all of the residential areas south of the canal are not covered by the secondary school 1km catchment area and a significant portion of the area south of the canal does not fall within the 1km buffer zone. In addition, the centrally located secondary school is Gaelcholáiste Mhaigh Nuad, an Irish-medium school. This distribution of secondary schools means that the 1km walking catchment for English-medium secondary schools is even more constrained, significantly more so than primary schools.

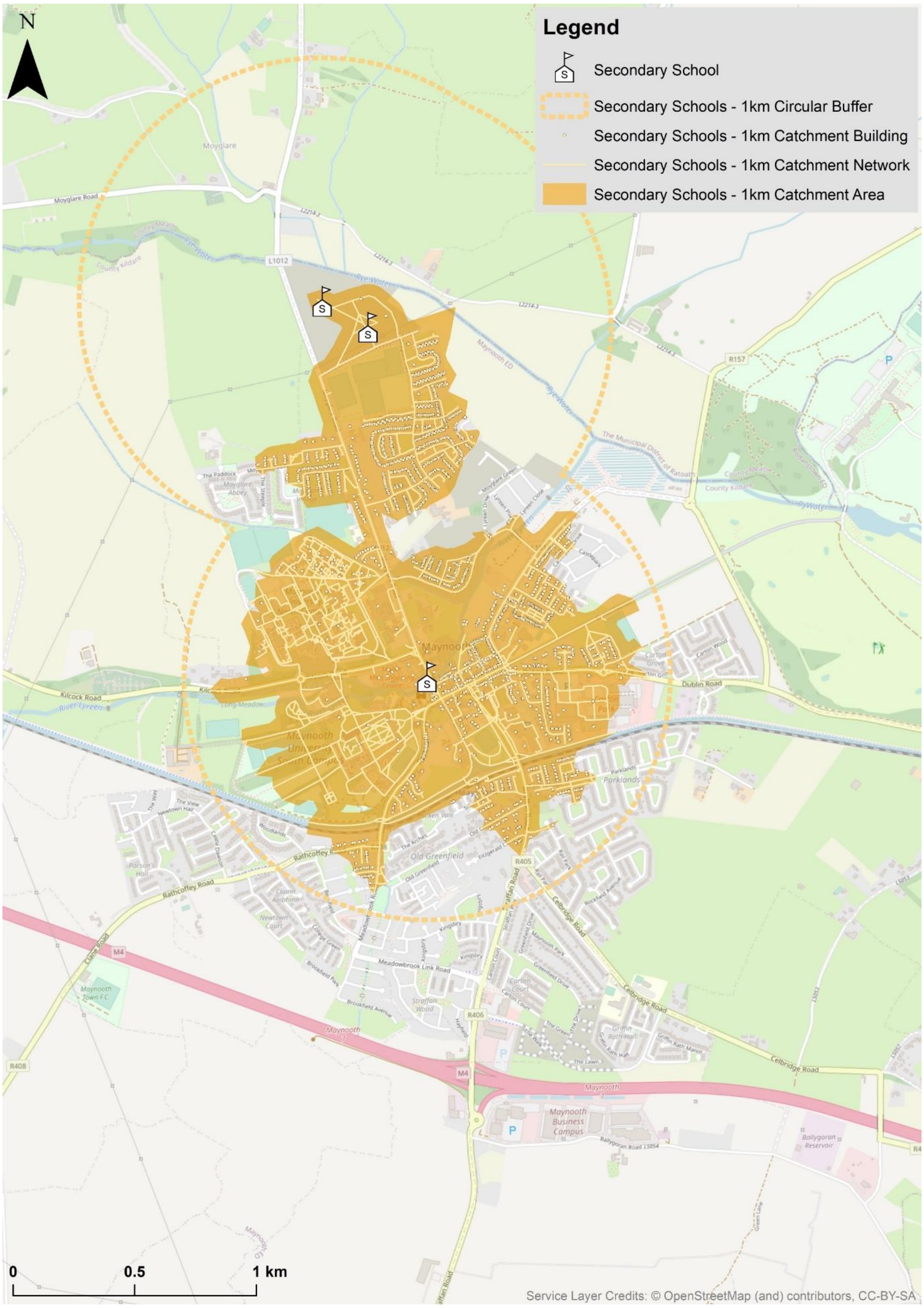


Figure 4-50 1km Walking Distance to Secondary Schools

4.5.2.8 University Catchment

Figure 4-51 and Figure 4-52 show the actual 1km walking catchments for the north and south campuses of Maynooth University respectively. On the north campus the Arts Building was chosen for the catchment analysis as this building is reasonably centrally located on the campus. On the south campus, St. Patrick’s House is the point used as it is centrally located on the campus.

The catchment area of the north campus covers the south campus, Maynooth town centre and some small pockets of residential areas. The majority of residential areas do not have access to the centre of the north campus within 1km of walking. The sports grounds, river and cul-de-sac housing estates to the north and the canal to the south are barriers to accessing the north campus.

Access to the south campus is severely restricted due to the limited number of entrance points and the canal to the south of the campus. The 1km catchment encompasses the north campus as well as Maynooth town centre but does not encompass most of Maynooth’s residential areas.

No residential areas on the southern side of the canal are included in the 1km walking distance catchment for either the north or south NUI Maynooth Campus.

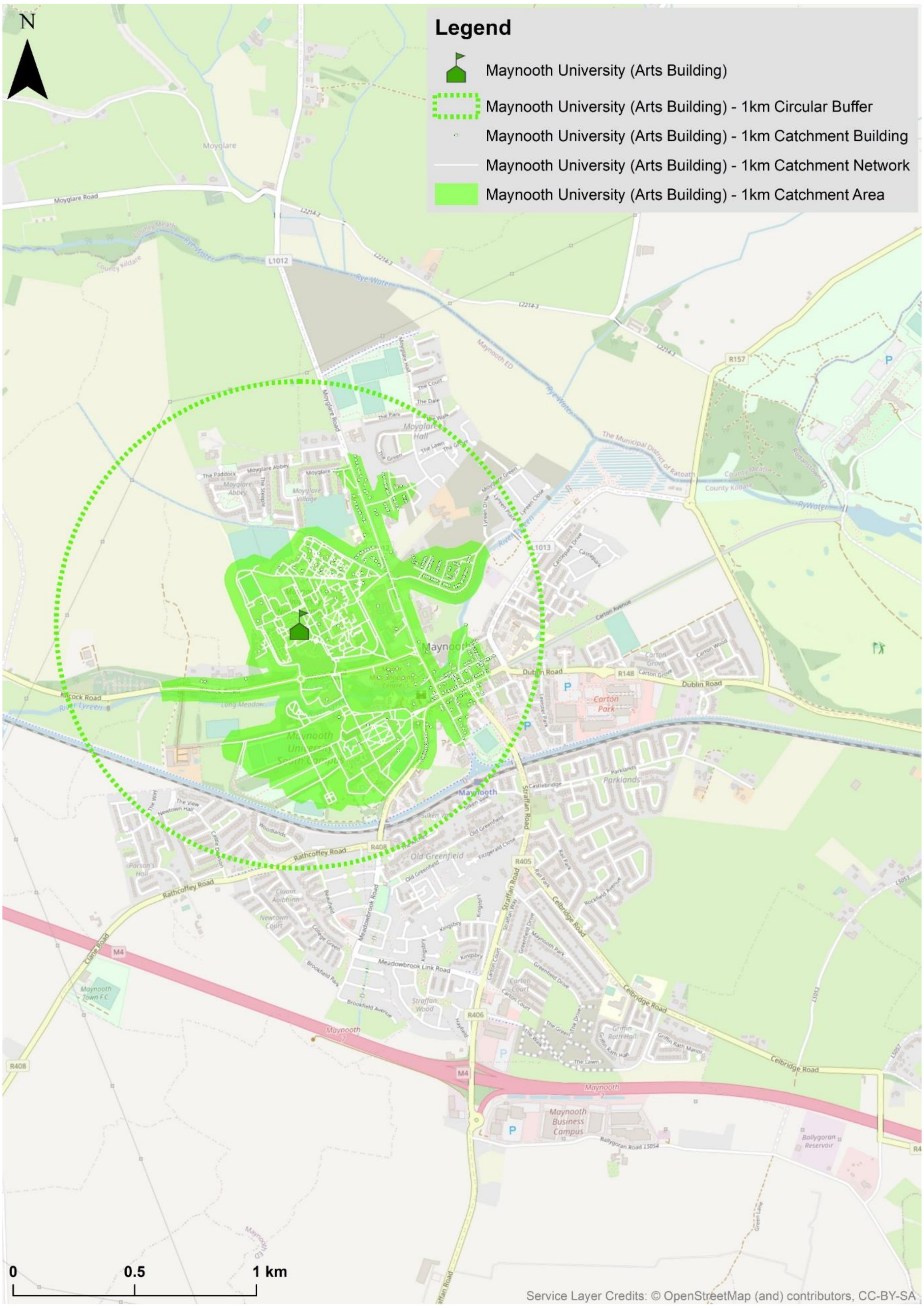


Figure 4-51 1km Walking Distance to NUI Maynooth (North Campus)

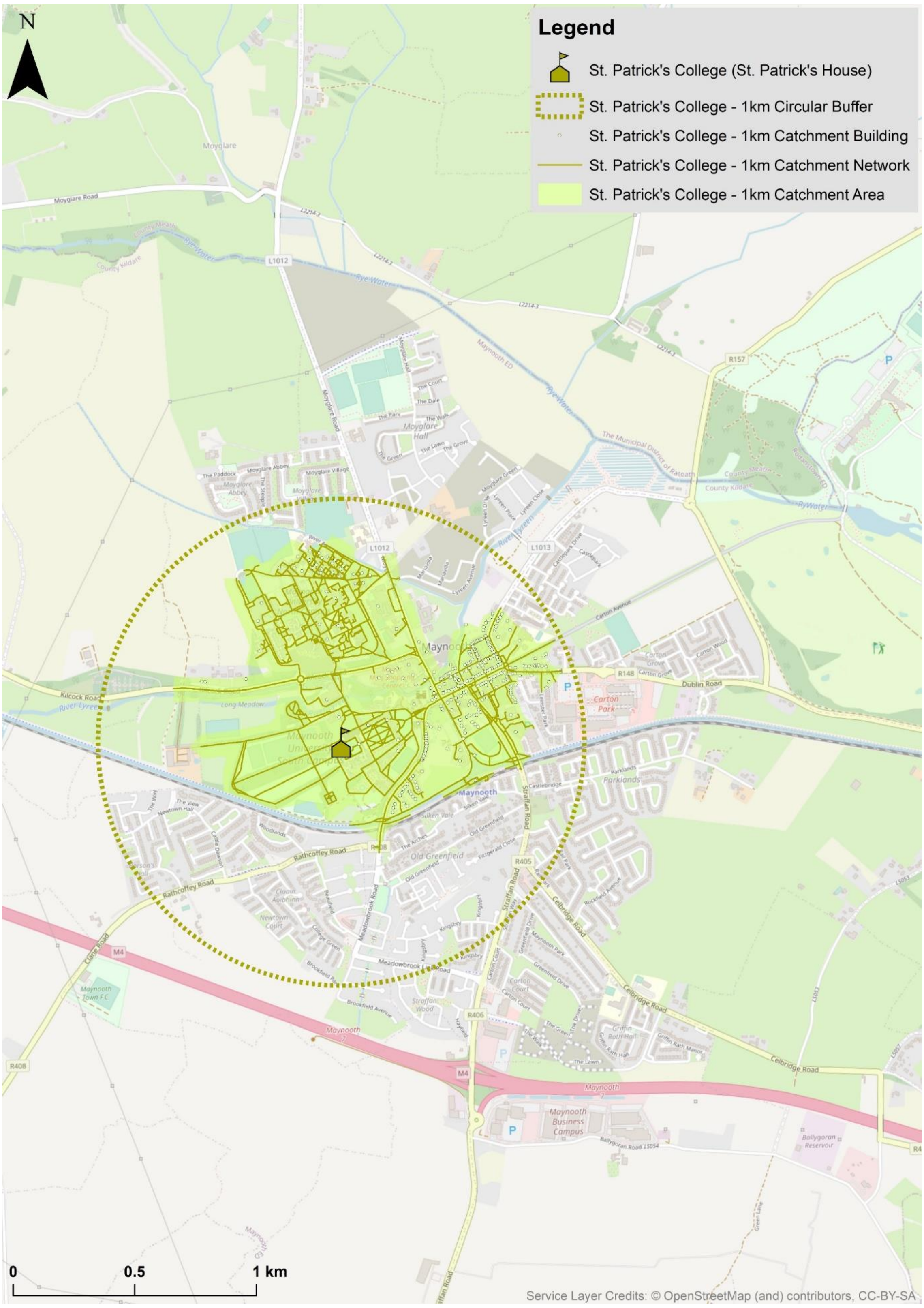


Figure 4-52 1km Walking Distance to NUI Maynooth (St. Patrick's - South Campus)

4.5.2.9 Permeability Statistics

The MEABTA study area encompasses 6,047 residential addresses, 446 commercial addresses and 119 addresses which are categorised within the GeoDirectory (2021) database as 'mixed use'. Table 4-23 provides an overview of the walking/cycling catchment for key locations throughout Maynooth. This provides a count of the number of residential, commercial and mixed addresses in each catchment area using the GeoDirectory database. The table also provides a breakdown of the percentage of total addresses in the study area which are within walking distance of each location. This highlights that access to both the north and south campus of Maynooth University is poor relative to other key destinations, as the 1km walking catchment covers less than 20% of total addresses and only 13% of residential addresses within the study area. The coverage for the train station and the town centre is better at approximately 35% of all addresses. The proportion of residential addresses within 1km of at least one secondary school is similar, at 34%. However, as noted previously, the secondary school 1km catchment area includes an Irish-medium secondary school in the town centre, and if only address points which are within 1km of an English-medium secondary school were counted in the calculation, the proportion of all address points in the catchment would be significantly lower.

Access to bus stops, primary schools and supermarkets is relatively good with almost 60% of all addresses and approximately 55% of residential addresses within their catchments. However, this still means that approximately 45% of residential addresses do not have access to these key services within a 1km walking distance.

Table 4-23 GeoDirectory Statistics for Building Coverage of Key Services

	Existing Path Network Catchment (Address Points)				% Total Study Area Buildings			
	Residential	Commercial	Mixed Use	Total	Residential	Commercial	Mixed-use	Total
All Buildings	6,047	446	119	6612				
Bus Stops - 500m	3,404	286	101	3791	56%	64%	85%	57%
Train Station - 1km	1,839	256	66	2161	30%	57%	55%	33%
Primary Schools - 1km	3,260	287	102	3649	54%	64%	86%	55%
Secondary Schools - 1km	2,064	274	90	2428	34%	61%	76%	37%
Maynooth University (North Campus) - 1km	761	175	54	990	13%	39%	45%	15%
Maynooth University/ St. Patrick's College – South Campus - 1km	783	236	82	1101	13%	53%	69%	17%
Town Centre - 1km	1,759	272	87	2118	29%	61%	73%	32%
Supermarkets - 1km	3,373	311	95	3779	56%	70%	80%	57%

4.5.3 Accessibility to Opportunities and Services (ATOS) Assessment

To supplement the walking catchment analysis described in Section 4.5.2, walking accessibility was also examined using the ATOS tool. This section first introduces the tool and the methodology used for this analysis before presenting the results of the analysis for each type of service.

ATOS (Accessibility to Opportunities and Services) is a tool maintained by the NTA to investigate accessibility to a range of different services and opportunities by active modes including Employment, Primary Education, Post Primary Education, GPs, Food Shopping and Open Spaces. The tool is based on a methodology originally developed by Transport for London (TfL), but some minor adjustments have been made by the NTA to make it more suitable for use outside of large metropolitan areas in Ireland.

The baseline path network shown previously in Figure 4-43 was used for the baseline ATOS assessments. Similar to the standard permeability assessment, the ATOS assessment will be repeated using the proposed future path network following the development of the walking/permeability strategy in order to assess how proposed changes improve accessibility to services from different parts of the study area.

The locations of schools and supermarkets used in the ATOS assessments were the same as those identified for the 1km walking catchment analysis described in the previous section. GP services were identified by the NTA using GeoDirectory (NACE Q86.21); while the locations chosen for the Open Space assessment were also identified by the NTA and were based on the previous Development Plan, with the addition of the entrance to Carton House. The Census Workplace Zones file produced by the CSO provides information on employment.

For each calculation (other than employment), the number of different services of the particular service type which should be located by the tool and an acceptable walk or cycle time have to be specified. For this assessment, a walk time of 20 minutes was specified for all service types. The number of services was set to two in the case of primary schools, secondary schools and GPs, and was set to one in the case of food shopping and open spaces.

The spatially defined origin for the application of ATOS is based on a 100m grid. For most service types (excluding employment), the tool calculates the average journey time from the centroid of each grid square (origin) to the nearest (x number of) services within the specified travel time cut-off from the origin. If the specified number of services to be reached is greater than 1, the travel time is the average of the travel times from the origin to the nearest (x number of) services. Scoring for each origin (grid square) is calculated based on how the average travel time for the square compares to the overall average across all squares which are within the cut off time of at least one service, as shown in Table 4-24.

When the NTA designed the tool, they decided that although the parameters allow the user to specify that two or more destinations should be located, if a particular origin grid square is within range of at least one service but fewer than the specified number, it is not excluded from the calculations completely. Instead, a negative weighting is applied to the origin's calculated travel times prior to the final comparison with the over-all average and standard deviation. For example, if the selection criteria are 'nearest two schools', but only one school is located within the cut-off time, the deficit is considered to be 50 percent and a corresponding negative weighting of 1.5 is applied to the travel time for that origin grid square.

Table 4-24 ATOS Score Ranges (All Destination Types Excluding Employment)

ATOS Score	Score Range	Map Colour
A	More than one standard deviation below the average	
B	Below the average, but not by more than one standard deviation	
C	Average or above, but not by more than one standard deviation	
D	Between one and two standard deviations above the average	
E	More than two standard deviations above the average	
NULL	More than specified maximum travel time	

The ATOS scoring for access to employment (number of accessible jobs) follows a different methodology to the methodology used for other types of destinations. The main dataset used to assess access to employment is the Workplace Zones (WPZ) file produced by the CSO. This is made up of polygons which contain information on the number of jobs within each WPZ. This allows for the job density of each WPZ to be calculated (Total Jobs/WPZ area in metres). A Network Service Area is then calculated for each origin grid square. For each WPZ accessible from the origin's service area, the WPZ Accessible Jobs is: Accessible WPZ Area (metres) x WPZ Employment Density. Individual WPZ accessible jobs results are then aggregated to get an overall jobs result for each origin grid quare. The average accessible jobs and standard deviation of accessible jobs across all origin grid squares is calculated. Scoring for each origin (grid square) is then calculated based on Table 4-25. Note that this is inverse to the scoring used for other types of destinations, because in this case a higher value is better – i.e., more accessible jobs.

Table 4-25 ATOS Score Ranges (Number of accessible jobs)

ATOS Score	Score Range	Map Colour
A	More than one standard deviation above the average	
B	Above the average, but not by more than one standard deviation	
C	Average or below, but not by more than one standard deviation	
D	Between one and two standard deviations below the average	
E	More than two standard deviations below the average	

4.5.3.1 ATOS Assessment - Employment

Figure 4-53 shows the results of the ATOS analysis for walking accessibility to employment. As would be expected, areas closer to, and with direct routes to, the town centre and Maynooth University score more highly than peripheral areas further from the town centre, particularly as some of the more peripheral areas also have limited permeability and lack direct routes to the town centre and/or other important employment destinations.

A possible limitation of the ATOS access to employment methodology can be seen to the south of the town, as the area within and surrounding Maynooth business campus has a low score. This may be partly due to the fact that one of the main

Workplace Zones covering the business park is undeveloped for a significant proportion of its total area. This means that the overall job density of this WPZ is low and this feeds into the ATOS calculation, despite the fact that job density is much higher in the specific part of the WPZ which is in the twenty-minute walking catchment area of nearby grid squares.

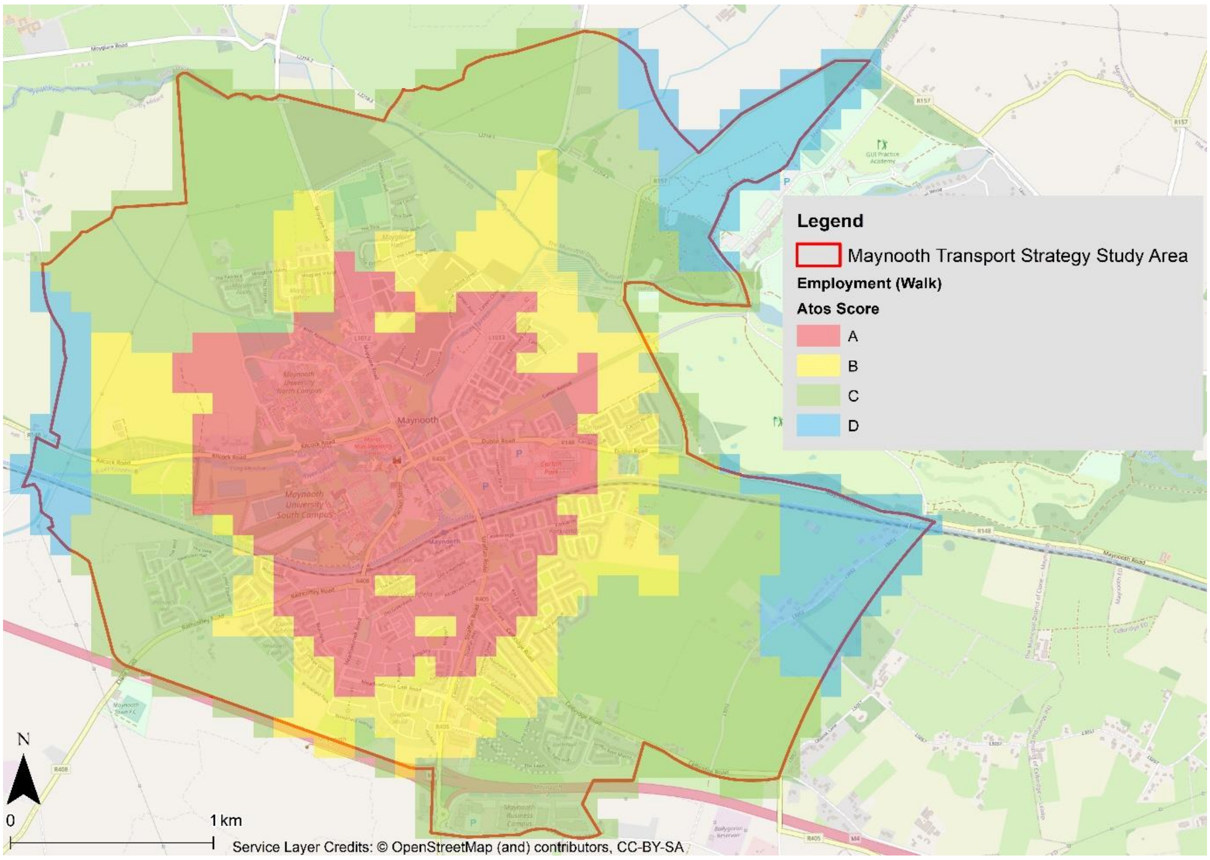


Figure 4-53 ATOS Analysis of Walking Accessibility to Employment

4.5.3.2 ATOS Assessment – Primary Schools

Figure 4-54 shows the results of the ATOS analysis for walking accessibility to primary schools in Maynooth. The tool was set to search for the two nearest primary schools to each grid square (within a twenty-minute walking distance). Approximately half of all origin grid squares (48 percent) have two primary schools within a twenty-minute walk. Another 17 percent of grid squares have access to one primary school within a twenty-minute walk. Of these, the majority have a C or a D rating. However, there are some grid squares to the north of the town which have an A or a B rating despite only one primary school being accessible due to their proximity to Gaelscoil Ruairí.

Thirty five percent of grid squares have no primary school within a twenty-minute walk. Of these, many are in undeveloped areas or commercial areas without residential development (e.g., Maynooth Business Campus). However, there are significant residential areas in the southwest of the study area from which no primary school can be accessed within twenty minutes of walking.

The fact that the two primary schools located within the town centre are both single-sex schools also has an impact on accessibility and this is not accounted for in the ATOS analysis. Some households living in grid squares which are coloured on the map will only have access to one of the two town centre schools within a twenty-minute walk and this may not be the appropriate school for their child.

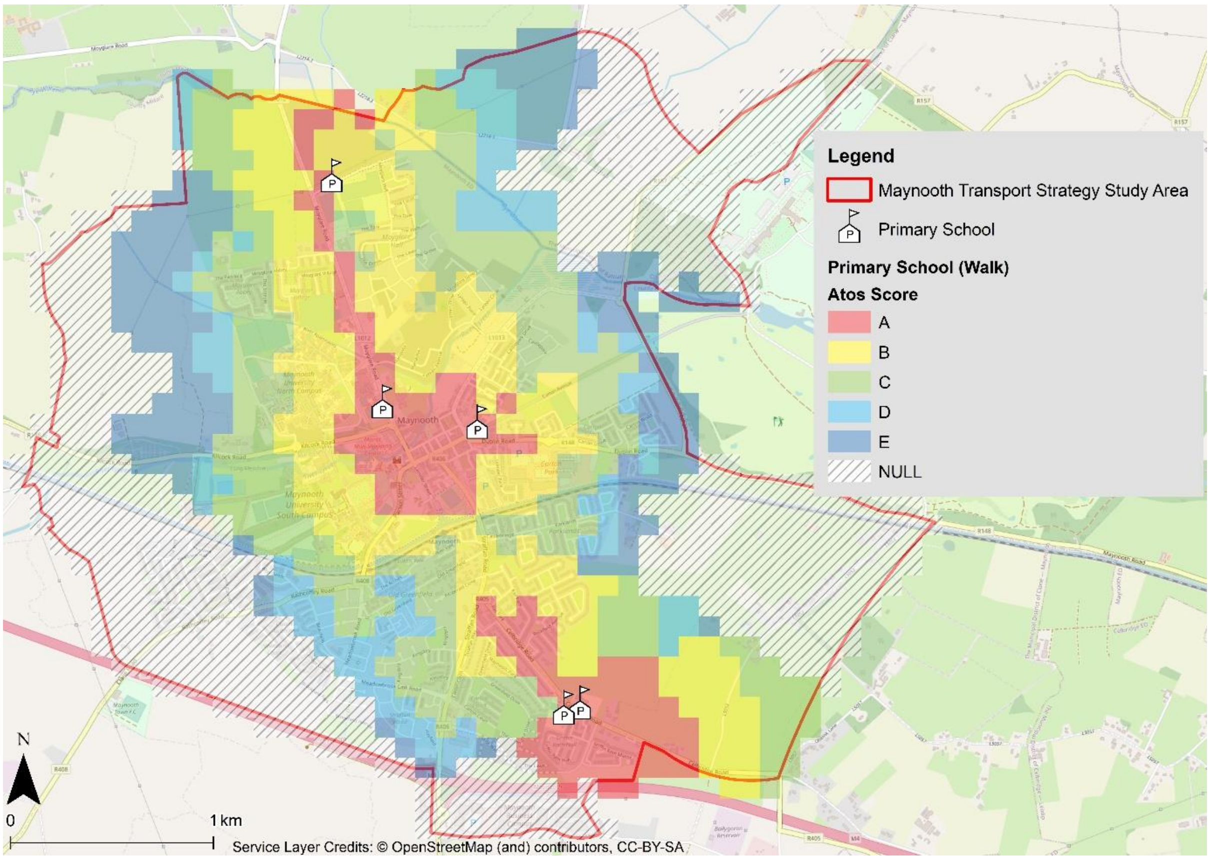


Figure 4-54 ATOS Analysis of Walking Accessibility to Primary Schools

4.5.3.3 ATOS Assessment – Secondary Schools

Figure 4-55 shows the results of the ATOS analysis for walking accessibility to secondary schools in Maynooth. The tool was set to search for the two nearest secondary schools to each grid square (within a twenty-minute walking distance). Almost half of all grid squares in the study area (48 percent) do not have access to any secondary school within a twenty-minute walk. Eighteen percent of grid squares have access to two secondary schools within a twenty-minute walk. One third of grid squares have access to one secondary school within a twenty-minute walk. However, a majority of the grid squares which only have access to one secondary school have access to Gaelcholáiste Mhaigh Nuad, an Irish-medium school. The proportion of the overall study area from which pupils can access an English medium secondary school within a twenty-minute walk is very low, due to the peripheral location of the new Maynooth Education Campus.

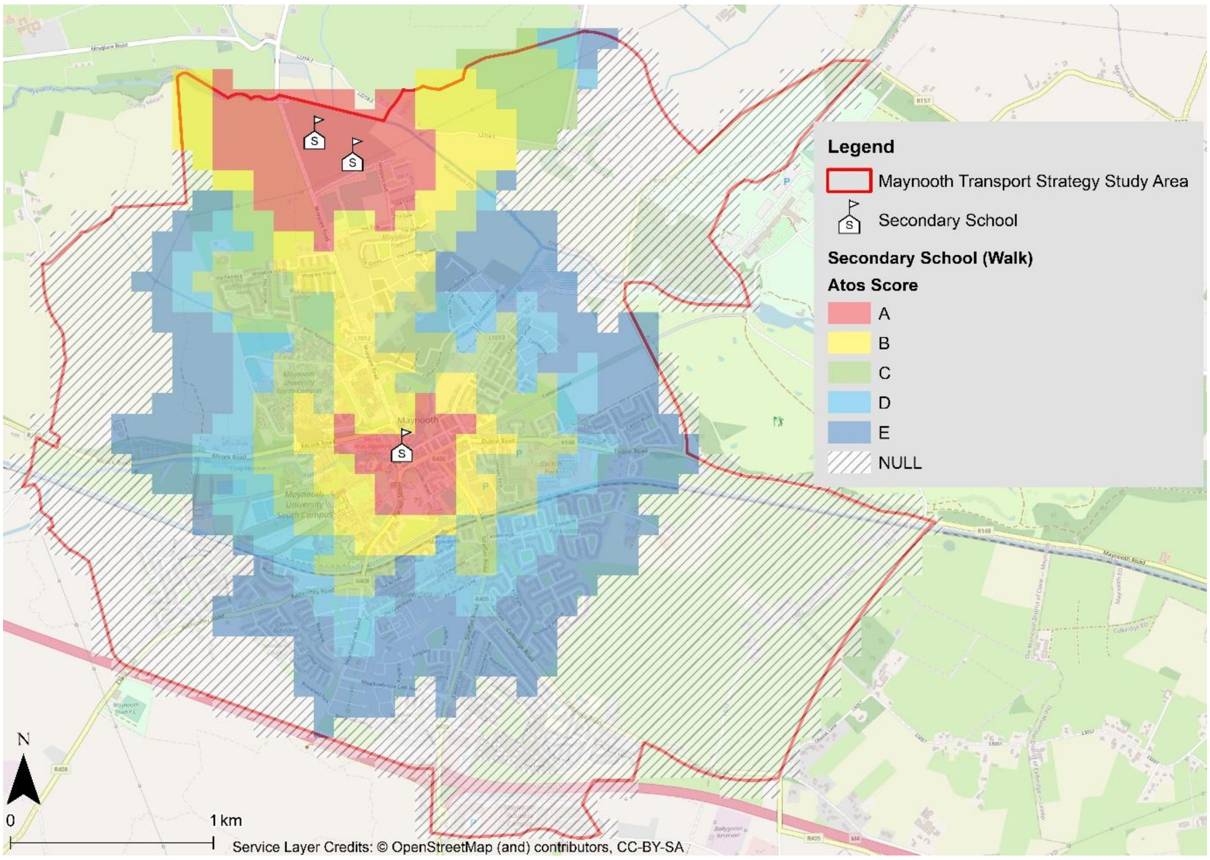


Figure 4-55 ATOS Analysis of Walking Accessibility to Secondary Schools

4.5.3.4 ATOS Assessment – GP Services

Figure 4-56 shows the results of the ATOS analysis for walking accessibility to GP services in Maynooth. The tool was set to search for the two nearest GP services to each grid square (within a twenty-minute walking distance). The map shows that GP services are reasonably well distributed around the central part of the study area. Over sixty percent of all grid squares within the study area can access at least one GP service within a twenty-minute walk with the majority of these (44 percent of all grid squares) having access to at least two services. Just under forty percent of all grid squares in the study area do not have access to any GP service within a twenty-minute walk. However, these are almost all in undeveloped areas or areas without significant residential development.

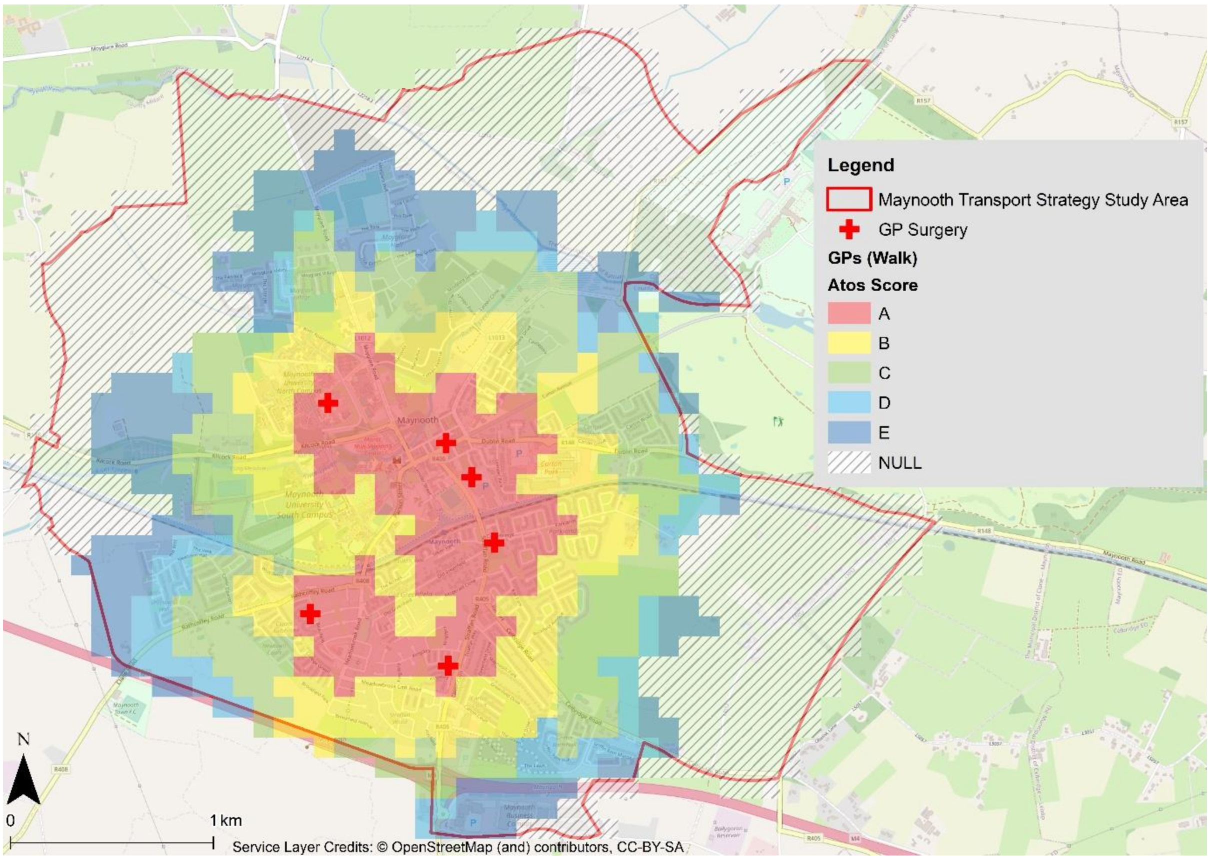


Figure 4-56 ATOS Analysis of Walking Accessibility to GP Services

4.5.3.5 ATOS Assessment - Supermarkets

Figure 4-57 shows the results of the ATOS analysis for walking accessibility to supermarkets in Maynooth. In contrast to the analysis undertaken for access to schools and GP services, in this case the tool was set to search for only the nearest supermarket to each grid square. The map shows that supermarkets are concentrated mainly in the central part of the study area. Just over half of all grid squares in the study area have access to a supermarket within twenty minutes of walking. While the majority of grid squares which do not have access to a supermarket within twenty minutes of walking are in undeveloped areas, there are some substantial residential areas to the southwest and southeast of the town which also fall into this category. Access from these areas could potentially be improved in future through the creation of more direct routes (i.e., through the delivery of new roads, paths and bridges).

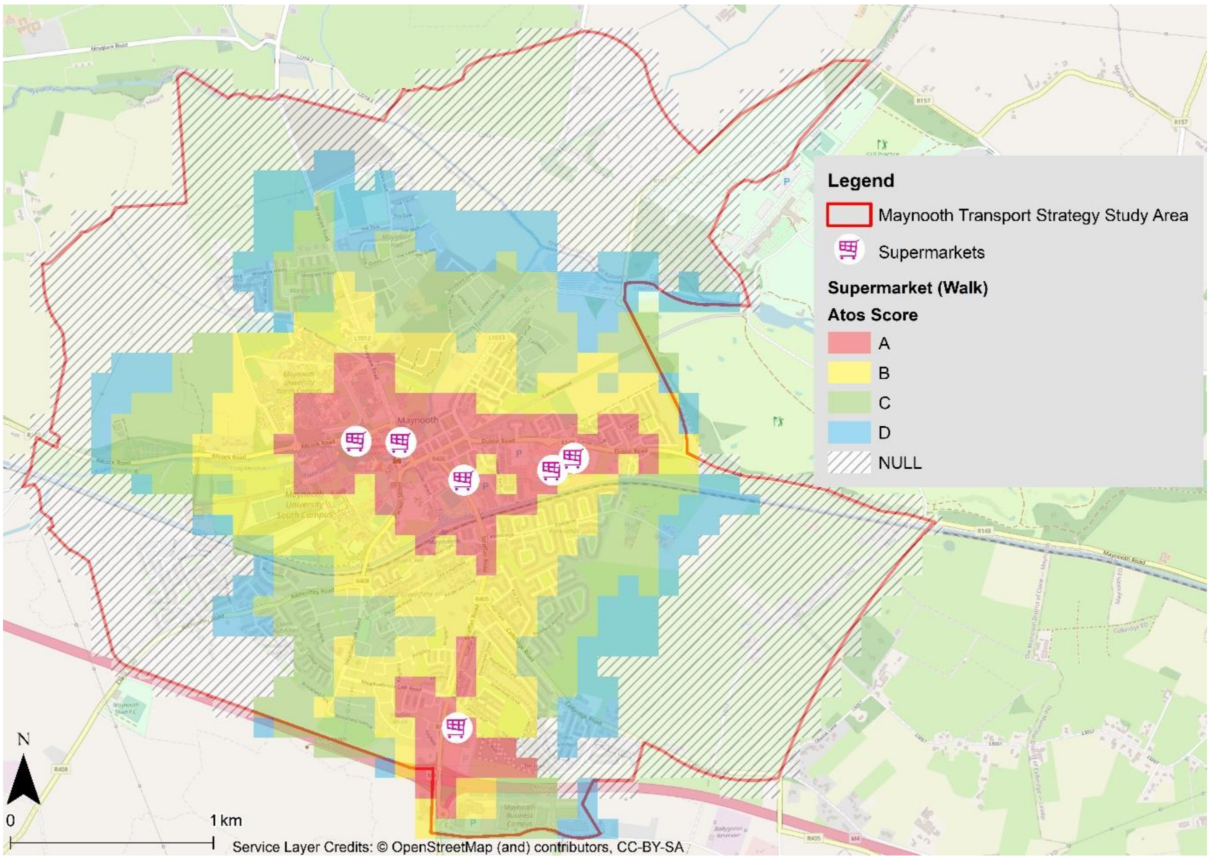


Figure 4-57 ATOS Analysis of Walking Accessibility to Supermarkets

4.5.3.6 ATOS Assessment – Parks and Open Spaces

Figure 4-58 shows the results of the ATOS analysis for walking accessibility to parks and open spaces in Maynooth. Similar to supermarkets, in this case the tool was set to search for only one park or open space. Just over 60 percent of all grid squares have access to at least one park/open space within 20 minutes of walking. Slightly less than 40 percent of grid squares are further than this from a park or open space. The majority of these are in areas without significant residential development. However, a number of existing residential areas in the north and southeast of the study area do not have access to one of the parks or open spaces shown within 20 minutes of walking, including: parts of Moyglare Abbey; parts of the Moyglare Hall estate; and parts of the Griffin Rath Hall and Griffin Rath Manor estates.

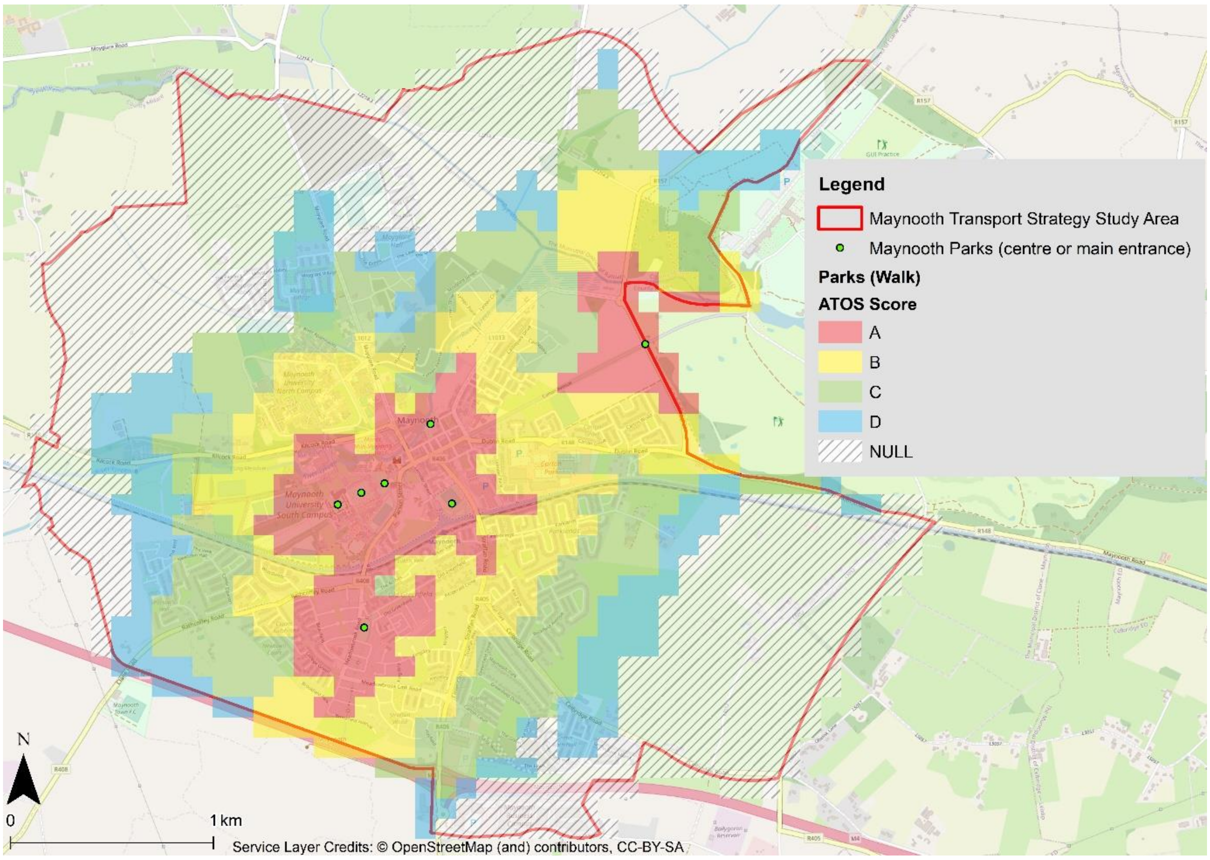


Figure 4-58 ATOS Analysis of Walking Accessibility to Parks/Open Spaces

4.6 Road Network

4.6.1 Overview of Town Road Network

Figure 4-59 shows the road network in Maynooth. To the south of the town, the M4 motorway provides access to the National Road Network via junction 7 and this provides the main route to Dublin for private motor vehicles. The M4 junction is linked to the town by the R406 (Straffan Road) which continues north until the Main Street in the town centre, there is a connection from the Straffan Road to the south-east for the R405 (Celbridge Road). To the north of the Main Street, the L1012 (Moyglare Road) connects the town to the northern areas of Maynooth and Meath. The main east-west road is the R148, which is known as the Kilcock Road in the west and the Dublin Road in the east. To the south-west, the R408 (Rathcoffey Road) connects the suburbs of Maynooth with the town centre.

The train station car park can only be accessed from the Straffan Road to the east and this will result in circular car journeys for park and ride trips from some parts of the town. There are a limited number of orbital roads, with a lot of trips having to travel via the town centre to access other parts of the town.

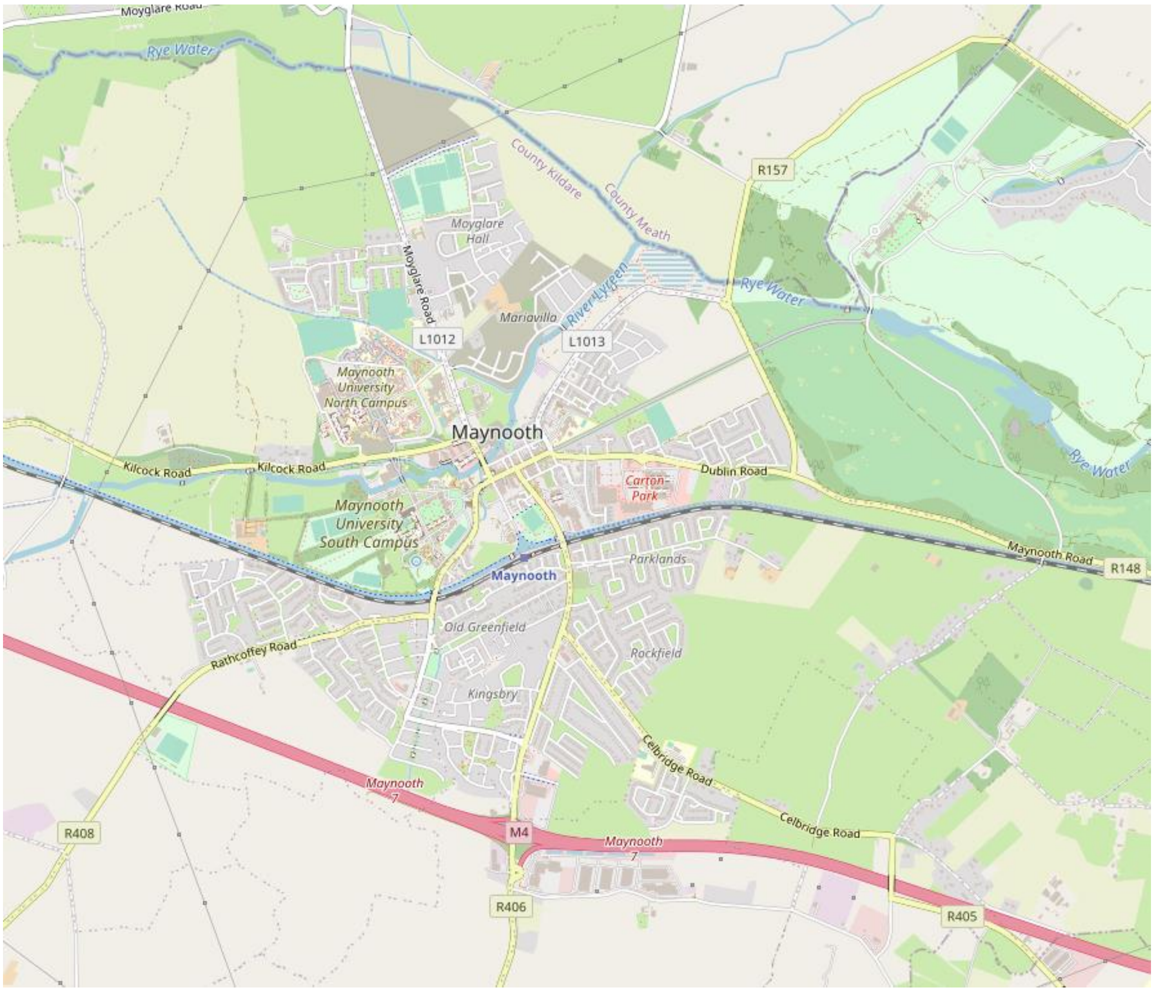


Figure 4-59 Maynooth Road Network

4.6.2 M4 Traffic Growth

The Average Daily Traffic (ADT) from 2013 to 2021 is presented in Figure 4-60, taken from the TII permanent traffic counter located on the M4 between Junction 6 Celbridge and Junction 7 Maynooth (TMU M04 015.0 E). This counter recorded steady growth in traffic on this section of the M4 between 2013 and 2019 (16.1% growth). The ADT grew from 51,091 in 2013 to 59,305 in 2019. Following this, the effect of the Covid-19 pandemic is clear with a sharp drop of Average Daily Traffic to a low of 42,333 in 2020. In 2021, traffic volumes have started to recover on the M4, recording a growth of almost 5%, to 44,049 ADT. However, average traffic volumes still remain substantially lower than the results observed in 2019 and earlier years.

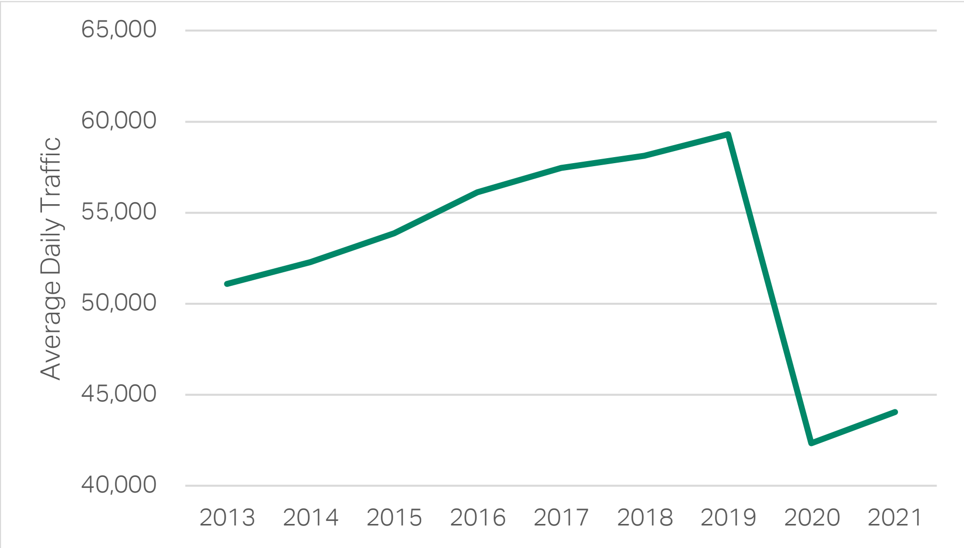


Figure 4-60 ADT 2013-2021, M4 between Junction 6 Celbridge and Junction 7 Maynooth

4.6.3 Road Collisions

Figure 4-61 shows the Road Safety Authority (RSA) database of collisions in Maynooth during 2008-2016. Collision severity is divided by the RSA into; fatal, serious and minor collisions. In respect to fatal collisions, there have been three fatal collisions which all occurred at the weekend in 2008-2009:

- **Junction of R148/L5041**: This was a head-on fatal collision in an 80kph zone in 2008.
- **R148 near R157 junction**: This was a fatal accident where a car collided with a pedestrian in a 60kph zone in 2009.
- **R148 near Carton House**: This was a head-on fatal collision in an 80kph zone during 2009.

There have been six serious collisions within the Maynooth study area during the 2008-2016 period covered by the RSA data - three in the town centre and three on the outskirts of the town. Of the town centre collisions, one occurred in 2015 on Mill Street and involved a motorcycle, one occurred on Main Street in 2013 and involved a pedestrian and a bus, and the third serious collision occurred in 2010 on Leinster Park Road, a small housing estate, and was a single vehicle collision. Of the serious collisions on the outskirts of Maynooth, one occurred on the M4 mainline near Junction 7 in 2013 and one took place on the L2214 to the north of Maynooth town.

There was also a serious collision on the R148 near to the southern entrance to Carton House which was a head on collision. Within the study area there are also two main clusters of minor accidents: the Main Street and on the Straffan Road between junction with the Celbridge Road (R405) and the Meadowbrook Link.

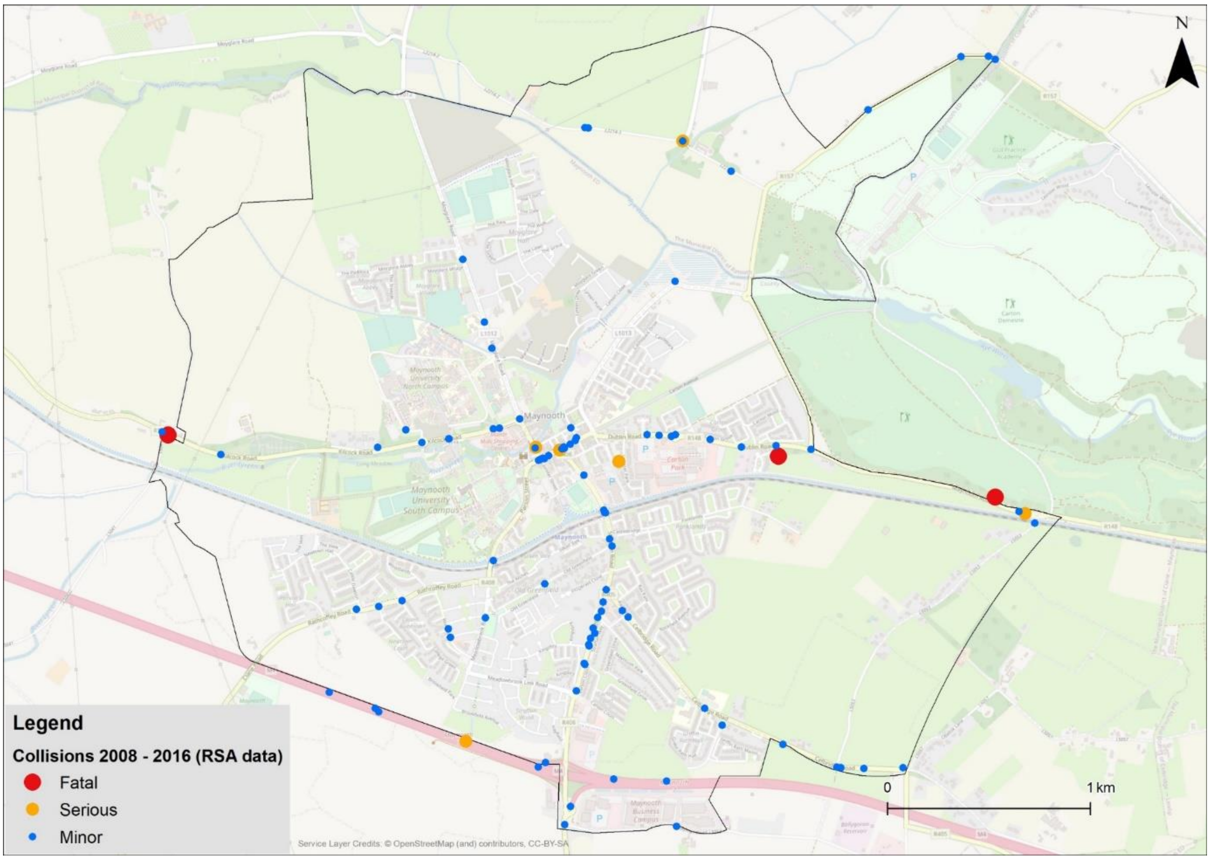


Figure 4-61 RSA Collisions 2008 – 2016 in Maynooth

5. Public and Stakeholder Consultation

Early engagement with key stakeholders and the general public prior to developing the MEABTA was considered essential in order to gain an appreciation of existing transport issues and opportunities and ensure that the proposals which will be contained within the MEABTA will meet community needs. Consultation undertaken to date has included: an online survey open to members of the public and to individuals completing it on behalf of an organisation or group; meetings with Councillors, school principals and representatives of Maynooth University (via Microsoft Teams); and the issuing of direct invitations to submit feedback by email to over 130 primary stakeholders.

5.1 Online Public Consultation Survey

5.1.1 Introduction

An online public consultation survey was launched on the 6th of October 2021 and remained open for six weeks. The purpose of the public consultation survey was to gather the views of people who live, work, shop, spend leisure time or attend education within the study area with regard to current transport issues in Maynooth and the changes they would like to see. With the exception of those who said they were responding to the survey on behalf of an organisation, the survey was conducted anonymously, and individual respondents were not asked to provide any personally identifying information. The survey was promoted by Kildare County Council through social media, local newspapers, the council’s own website and advertising at the train station and bus stops. Skip logic was designed into the survey where possible to ensure that respondents were only asked questions which would be relevant to them based on their previous responses.

Over 1,600 individual respondents commenced the survey by clicking ‘yes’ to the introductory question confirming their consent to participate. However, some of these respondents did not complete the survey or did not complete all questions relevant to them. Therefore, the number of people who responded to each question varies and has been indicated (with ‘N’) alongside all question results within the following sections.

5.1.2 Respondent Characteristics

Table 5-1 shows the place of residence of survey respondents. Just over half of respondents live in Maynooth, but this includes 8 percent of respondents who are third level students who live in Maynooth during term time or on weekdays only. Forty-six percent of respondents live elsewhere in Kildare or in another county in

Ireland. A number of respondents also highlighted that they live just outside of the MEABTA study area, or that Maynooth is their closest town.

Table 5-1 Place of residence of survey respondents

Place of residence	All respondents (N=1,599)
I am a third level student and this year I will live in Maynooth during term time or on weekdays only	8%
I live elsewhere in Kildare	20%
I live in another county in Ireland	26%
I live in Maynooth throughout the year (my main place of residence is within the study area)	44%
Other	2%

The high proportion of responses from people living outside of Maynooth reflects the fact that there is significant inbound commuting to Maynooth for work and education, as well as the fact that people living outside of the study area may also travel to the town to access essential services, social activities etc., as shown in Figure 5-1.

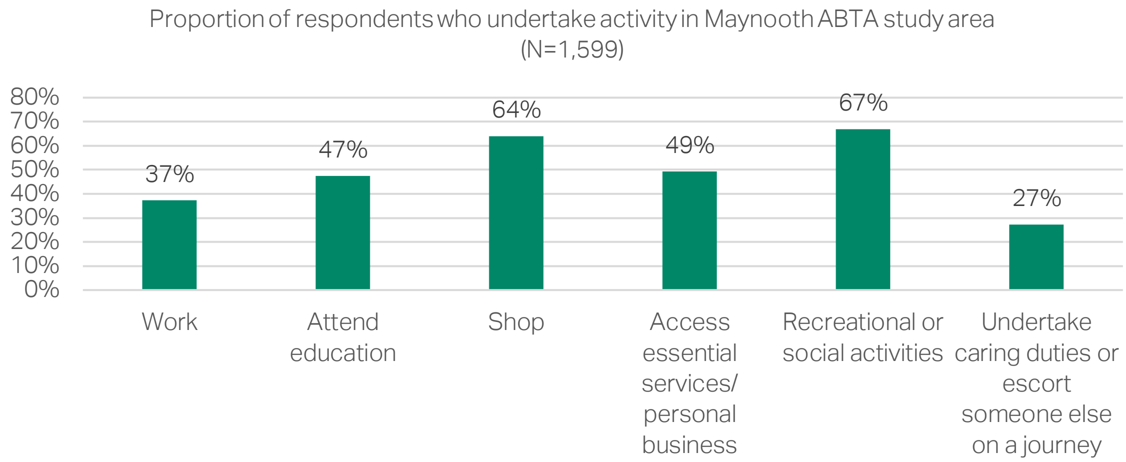


Figure 5-1 Proportion of respondents who undertake activity in Maynooth and Environs ABTA study area

Other relevant demographic information which survey respondents were asked to provide included gender (Table 5-2), age (Table 5-3), whether respondents had a disability or long term health condition which impacts their transport requirements (Table 5-4) and usual employment status (Table 5-5). Significantly more females than males responded to the survey. People under 18 and older people are underrepresented in the survey sample, with these groups each making up just one percent of the total. The high proportion of respondents in the 18-24 age group reflects the fact that the survey was completed by many students attending Maynooth University.

Table 5-2 Gender of survey respondents

Gender	All respondents (N=1,608)	Respondents who live in Maynooth throughout the year/Maynooth is main place of residence (N=700)
Female	61%	58%
Male	36%	40%
Other or prefer not to say	3%	2%

Table 5-3 Age range of survey respondents

Age Range	All respondents (N=1,608)	Respondents who live in Maynooth throughout the year/Maynooth is main place of residence (N=700)
Under 18	1%	1%
18 - 24	34%	6%
25 - 34	11%	13%
35 - 44	25%	44%
45 - 54	20%	26%
55 - 64	7%	7%
65 and over	1%	3%
Prefer not to say	1%	1%

Table 5-4 Proportion of respondents with a disability or long-term health condition impacting transport requirements

Do you have a disability or long-term health condition which impacts your transport requirements?	All respondents (N=1,608)	Respondents who live in Maynooth throughout the year/Maynooth is main place of residence (N=700)
Yes	4%	4%
No	94%	95%
Prefer not to say	2%	1%

Table 5-5 Usual employment situation of respondents

Usual situation with regard to employment *(for this question respondents were asked to select one option only)*	**All respondents (N=1,599)**	**Respondents who live in Maynooth throughout the year/Maynooth is main place of residence (N=700)**
Working full time	45%	68%
Working part time	15%	13%
Student	32%	7%
Retired	1%	2%
Job Seeking	0.4%	0.3%
Carer/ Stay at home parent	5%	8%
Unable to work due to illness or disability	1%	0.6%
Other	1%	0.4%

5.1.3 Modes Currently Used by Respondents

Respondents were asked to indicate their primary mode of travel for the majority of their trips throughout the week, but they could select more than one mode if they wished. Figure 5-2 shows the number of modes selected by respondents. Respondents living in the study area were more likely to select multiple modes than respondents living outside the study area.

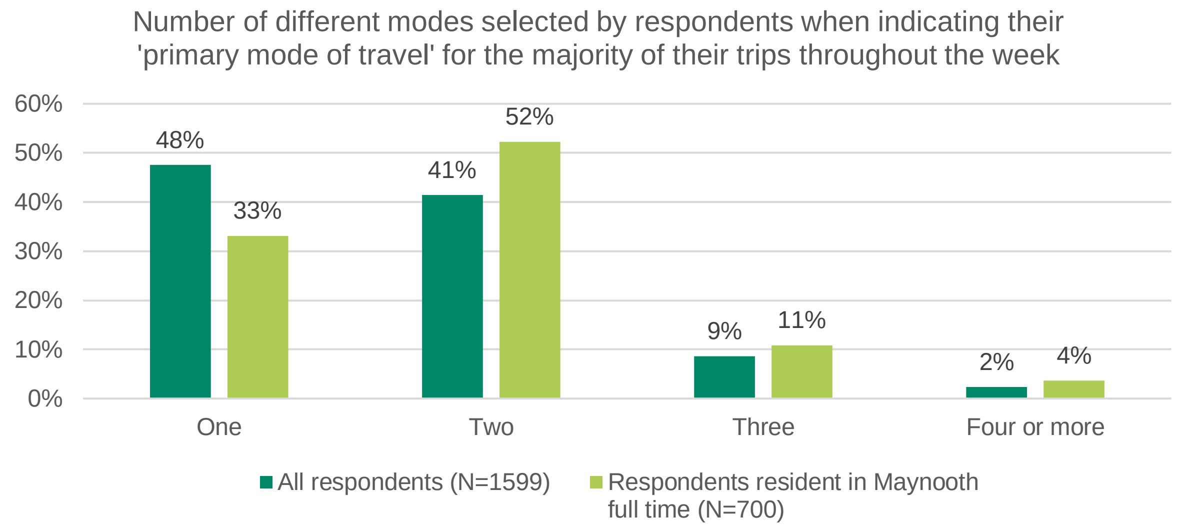


Figure 5-2 Number of modes selected by respondents when asked to indicate their 'primary mode of travel'

Figure 5-3 shows the proportion of respondents who selected each mode as their primary mode of travel. Please note that respondents could select more than one mode if they wished, which means that the percentages in this graph do not represent modal split statistics. The most commonly selected modes among the overall sample were driving, walking and bus. Respondents who were resident in Maynooth year-round were more likely to select driving a car and walking as one of their primary modes than the sample as a whole.

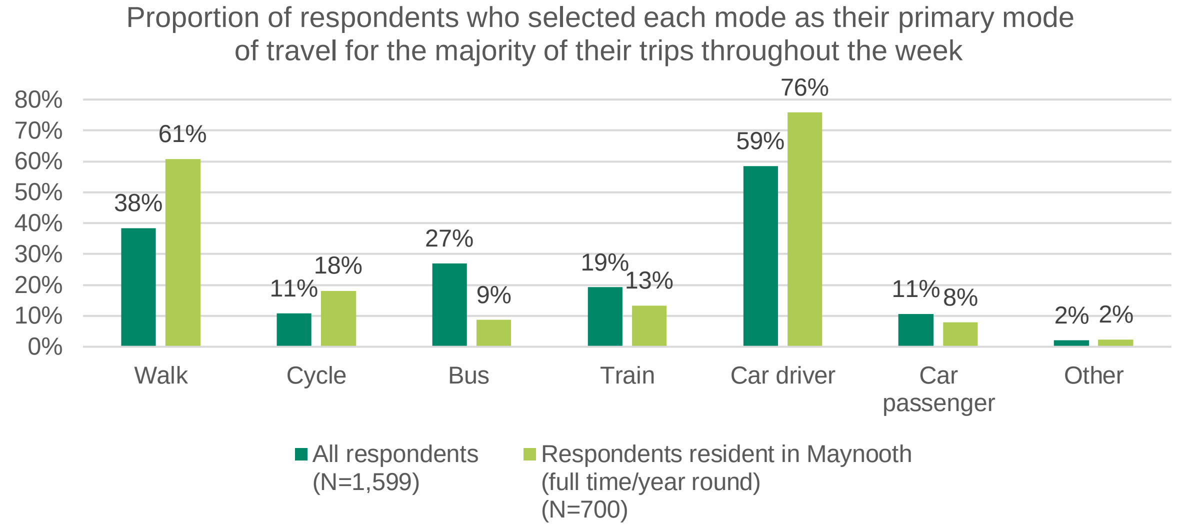


Figure 5-3 Proportion of respondents who select each mode as their primary mode of travel

Respondents who selected working full time or part time, or studying, as their usual employment situation, and who had a destination which was unchanged since prior to the start of the pandemic, were asked to indicate their current usual mode of travel to work or education and their mode prior to the pandemic. Approximately 77 percent of respondents selected the same mode in both questions, while 23 percent of respondents selected a different mode. Some of the changes made by individual respondents are 'cancelled out' when the data is aggregated – for example, one person may have changed from driving a car to working remotely, but another may have changed from another mode to driving. However, Figure 5-3 shows that the proportion of this group of respondents who were using public transport was lower at the time of the survey than before the pandemic, while the proportion driving, walking, cycling and working remotely was higher.

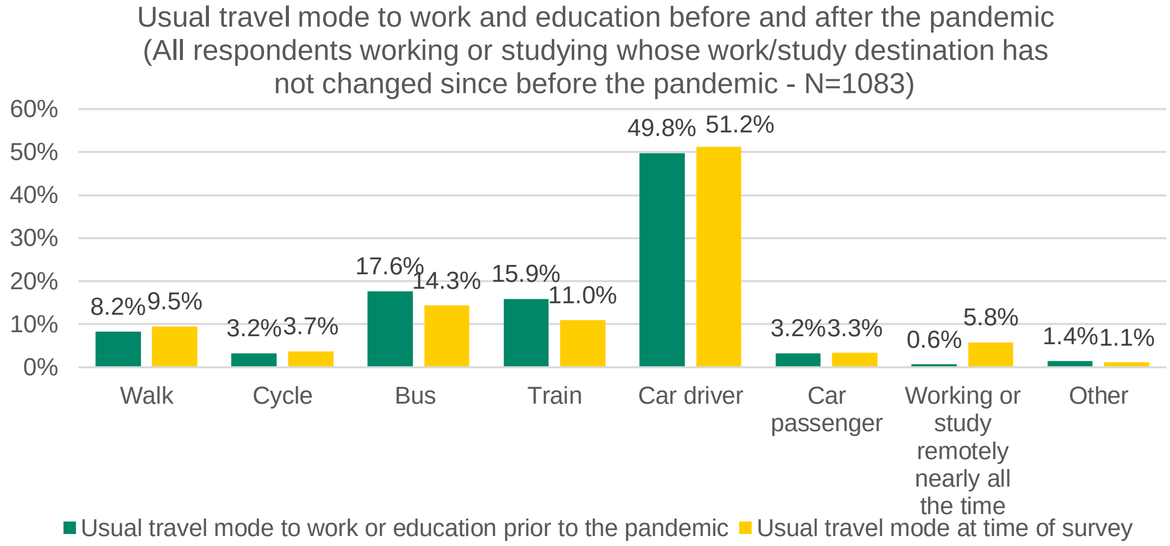


Figure 5-4 Usual travel mode to work and education before and during the pandemic

5.1.4 Remote Working

Respondents who said they work full time or part time were asked if remote working is ever a feasible option in their role (Table 5-6). Sixty percent of respondents said that it was.

Table 5-6 Feasibility of Remote Working

Is remote working ever a feasible option in your role?	Respondents who selected work full time or part time as their usual employment status (N= 967)	Respondents who selected work full time or part time as their usual employment status and live in Maynooth throughout the year/Maynooth is main place of residence (N=571)
Yes	60%	63%
No	40%	37%

The respondents who said that remoting working was a feasible option for them were then asked about how frequently they worked remotely before the pandemic and how often they think they will work remotely following the removal of Covid-19 restrictions, as shown in Figure 5-5. Among all relevant respondents, a significant majority (68 percent) expect to work remotely at least 2-3 days per week following the removal of restrictions, a significant increase from 16 percent who worked remotely this frequently before the pandemic. The increase is higher among respondents who live in Maynooth.

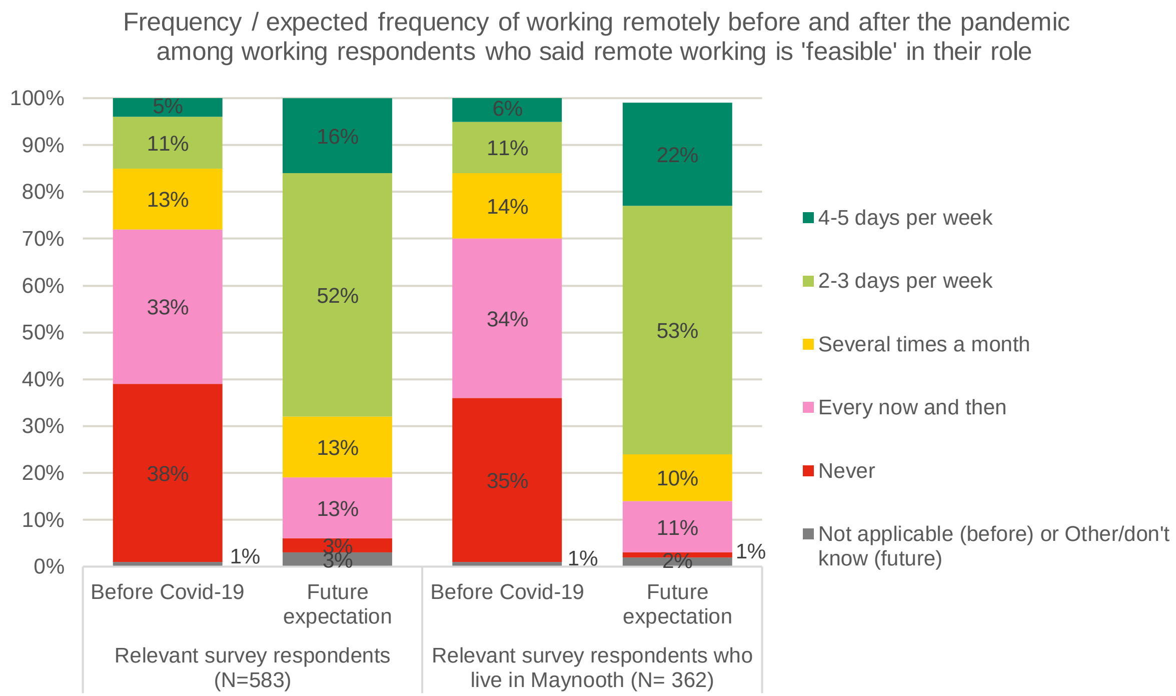


Figure 5-5 Past and future expected frequency of remote working

5.1.5 Transport in Maynooth

5.1.5.1 Rating Existing Transport Infrastructure

All respondents were asked to rate Maynooth's existing transport infrastructure for each of the main modes of travel. Results are shown in Figure 5-6 and are presented separately for the sample as a whole, female respondents and male respondents. Overall, the travel modes with the highest proportion of good and very good responses were walking (56 percent) and train (50 percent). Driving a car, cycling and bus all had a high proportion of poor and very poor responses. The results were broadly similar across male and female respondents. Female respondents are slightly more likely than male respondents to think the infrastructure in and around Maynooth for driving a car is good or acceptable and to think that infrastructure for walking is good or very good. However, female respondents are also more likely to rate infrastructure for cycling, bus and train as poor or very poor. The biggest difference between male and female respondents was in the ratings given to train infrastructure. Twenty percent of female respondents rated the train infrastructure in and around Maynooth as poor or very poor, compared to 14 percent of male respondents.

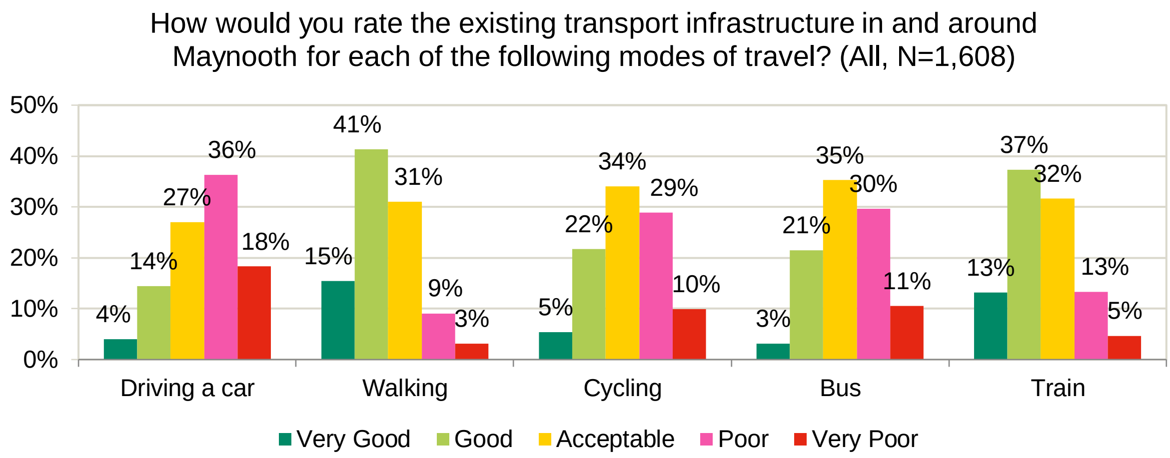


Figure 5-6 Rating of Maynooth's Existing Transport Infrastructure

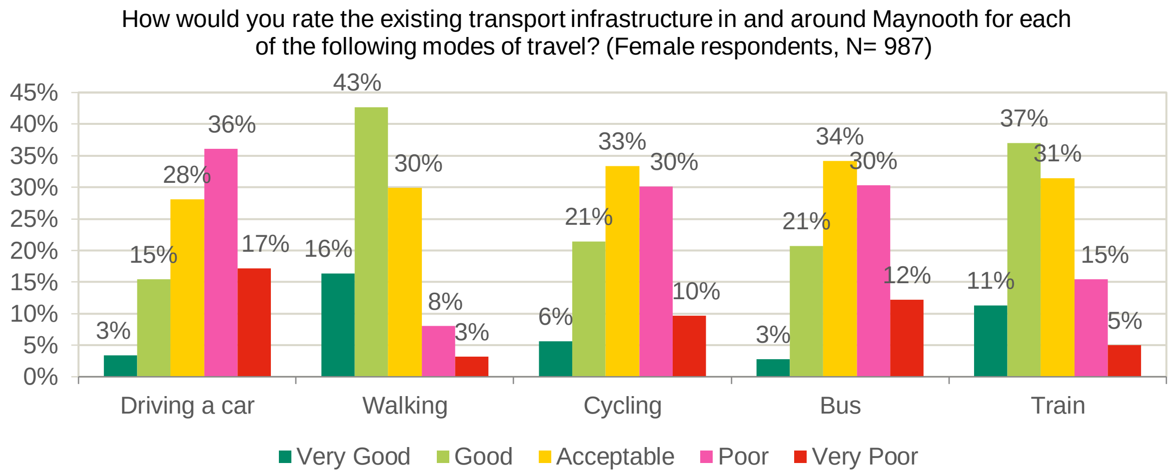


Figure 5-7 Rating of Maynooth's Existing Transport Infrastructure (Female respondents)

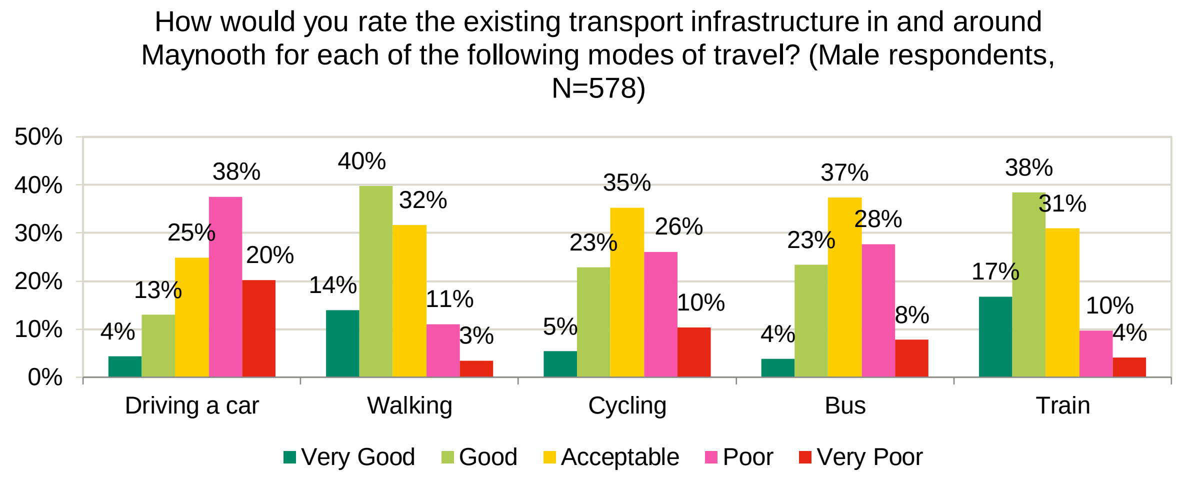


Figure 5-8 Rating of Maynooth's Existing Transport Infrastructure (Male respondents)

The ratings given by respondents to different transport modes have also been examined for the subset of respondents who use each mode as their 'primary mode of travel' (or one of their primary modes if they selected more than one) as shown in Figure 5-9. Comparing these results with the results from the overall sample show that people who said that they drive, cycle, or use a bus or train as their primary mode, rate the infrastructure for these modes as poorer than the sample as a whole. People who walk as their primary mode rate the infrastructure for walking better than the overall sample. The most significant difference in ratings between the sample as a whole and people who use a mode as their primary mode is in the ratings given to cycling infrastructure. Among the full sample, 39 percent of respondents rated existing cycling infrastructure as poor or very poor, while among people who cycle as their primary mode of travel, the proportion who rated existing infrastructure as poor or very poor was much higher (59 percent, a difference of 20 percentage points).

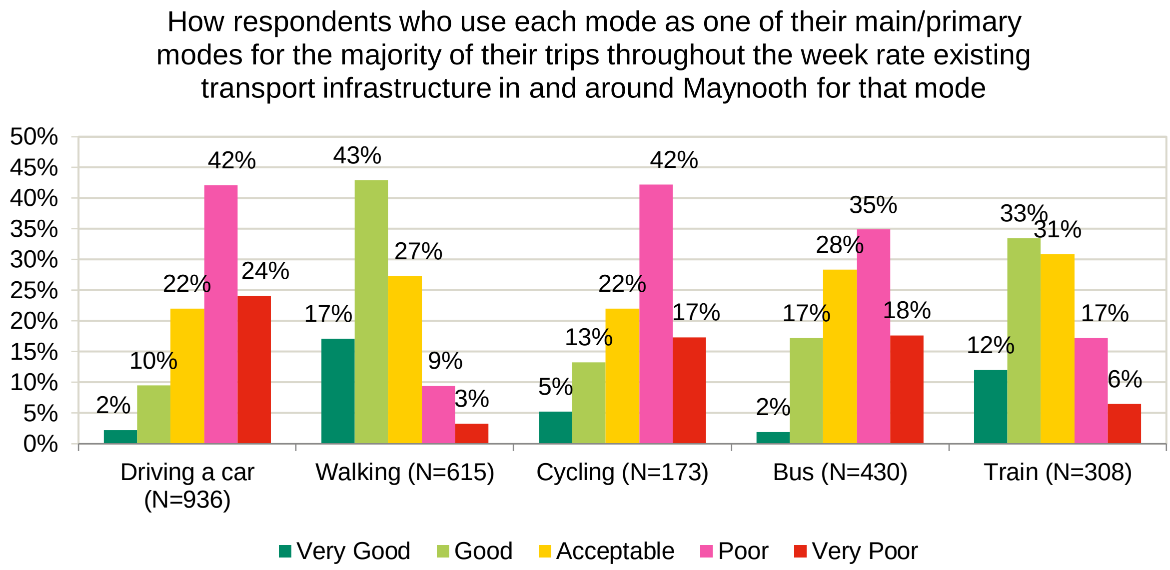


Figure 5-9 Rating of Maynooth's Existing Transport Infrastructure by Mode Users (Primary Mode)

5.1.5.2 Rating Potential Transport Improvements

Respondents were also asked to rate a wide selection of potential future changes to transport infrastructure from 'extremely important' to 'not at all important'. Due to the number of potential changes, this was split into two questions, with the second of these focused specifically on public transport related improvements, and the first focusing on other areas such as active travel, parking and general traffic management.

Figure 5-10 to Figure 5-12 show how respondents rated different options in the first question, with the results presented separately for the sample as a whole and for female and male respondents. Figure 5-13 to Figure 5-15 show how respondents rated different potential types of public transport improvements, with the results again presented separately for the sample as a whole, then female and male respondents.

Overall, many of the different potential types of improvements were rated similarly by respondents. When the proportion of 'extremely important' and 'very important' responses are combined, the top six potential improvements rated as most important among the full set of respondents were: reduced congestion in the town centre (90%) removal of non-essential through traffic from the town centre (78%); changes which make it easier to transfer from public transport services available in Maynooth to services available in the wider region (76%); increased frequency of rail services (75%) and improved walking and cycling links to Maynooth University (74%) and to schools (74%).

The combined ‘extremely important’ and ‘very important’ rating was higher among female respondents for nearly all of the potential changes listed. The only two exceptions to this were ‘removal of non-essential through traffic from the town centre’ and ‘reduced on-street car parking within the town centre’, with female respondents being less supportive of these changes than male respondents. There were five potential changes where the combined share of ‘extremely important’ and ‘very important’ responses was more than ten percentage points higher among females than among males. These were: real time car parking occupancy data; increased number of car parking spaces within the town centre; improved public lighting on walking and/or cycling links; reduced distance to bus stops; and increased number of car parking spaces at the train station.

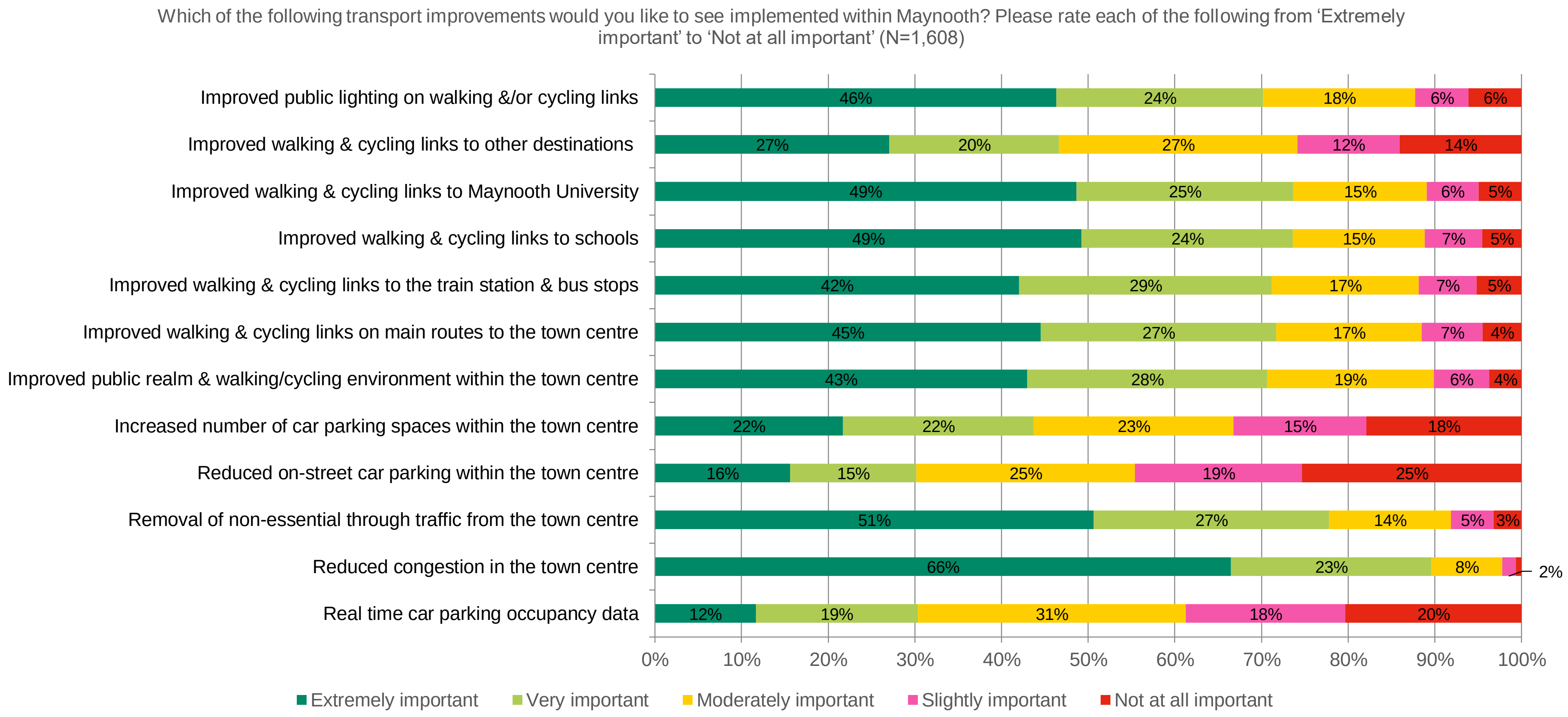

Which of the following transport improvements would you like to see implemented within Maynooth? Please rate each of the following from 'Extremely important' to 'Not at all important' (N=1,608)
Improved public lighting on walking &/or cycling links
46% 24% 18% 6% 6%
Improved walking & cycling links to other destinations
27% 20% 27% 12% 14%
Improved walking & cycling links to Maynooth University
49% 25% 15% 6% 5%
Improved walking & cycling links to schools
49% 24% 15% 7% 5%
Improved walking & cycling links to the train station & bus stops
42% 29% 17% 7% 5%
Improved walking & cycling links on main routes to the town centre
45% 27% 17% 7% 4%
Improved public realm & walking/cycling environment within the town centre
43% 28% 19% 6% 4%
Increased number of car parking spaces within the town centre
22% 22% 23% 15% 18%
Reduced on-street car parking within the town centre
16% 15% 25% 19% 25%
Removal of non-essential through traffic from the town centre
51% 27% 14% 5% 3%
Reduced congestion in the town centre
66% 23% 8% 2%
Real time car parking occupancy data
12% 19% 31% 18% 20%
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Extremely important
Very important
Moderately important
Slightly important
Not at all important

Figure 5-10 Importance of Different Potential Transport Improvements to Respondents (All respondents)

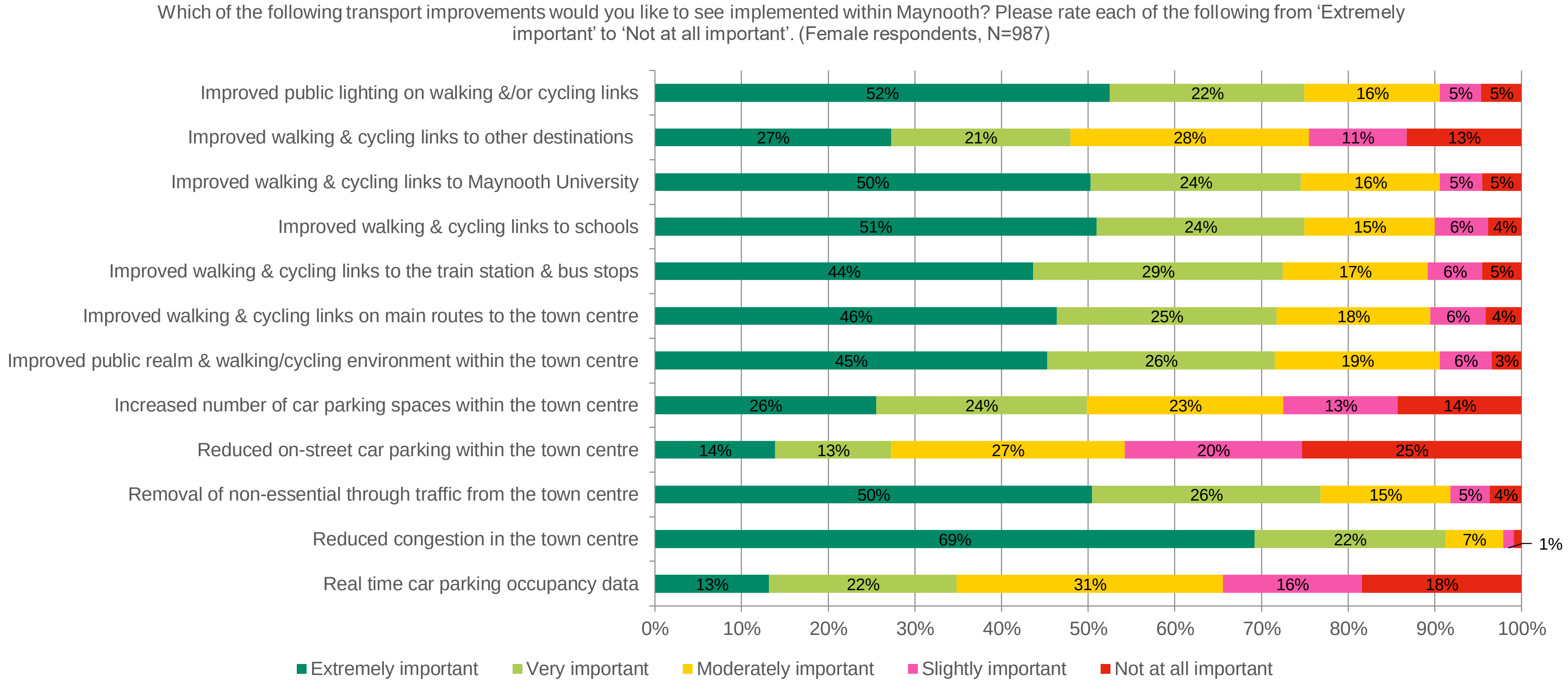


Figure 5-11 Importance of Different Potential Transport Improvements to Female Respondents

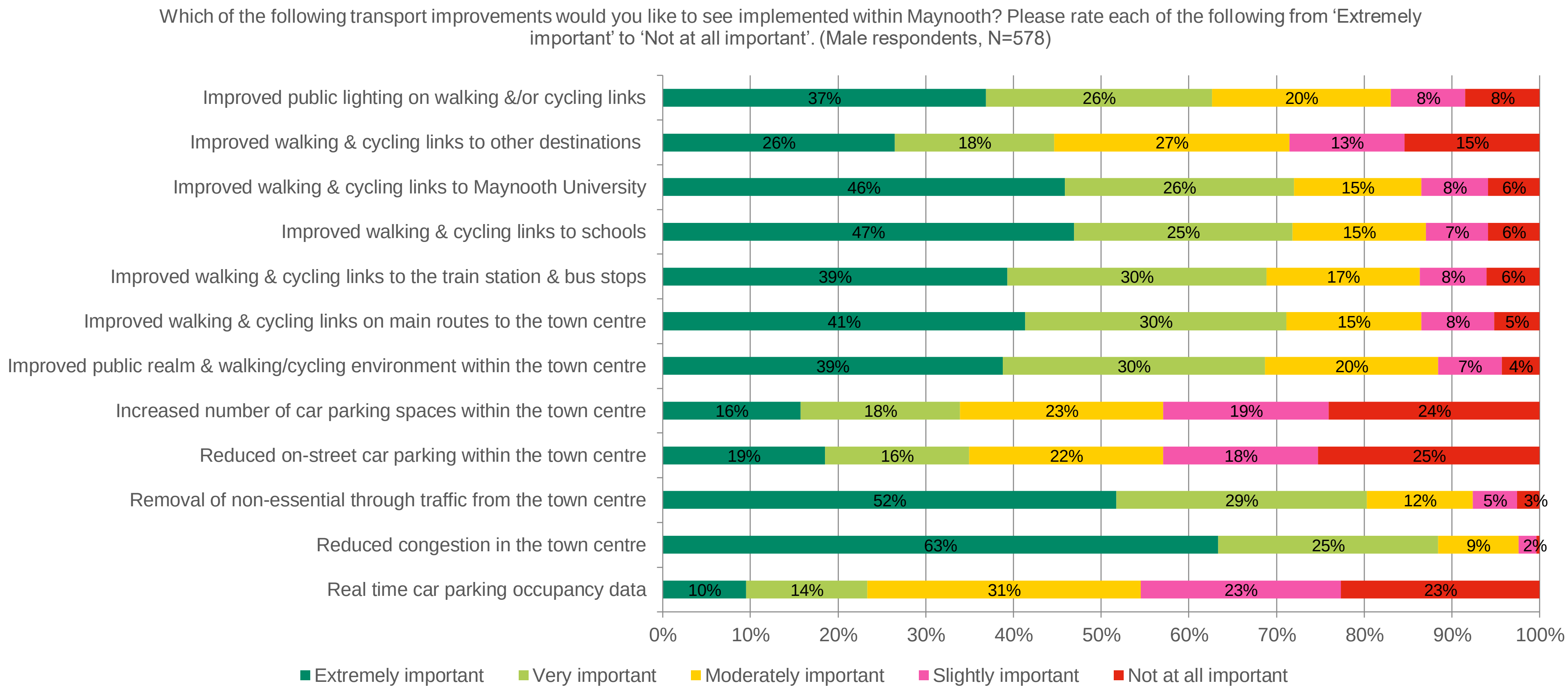


Figure 5-12 Importance of Different Potential Transport Improvements to Male Respondents

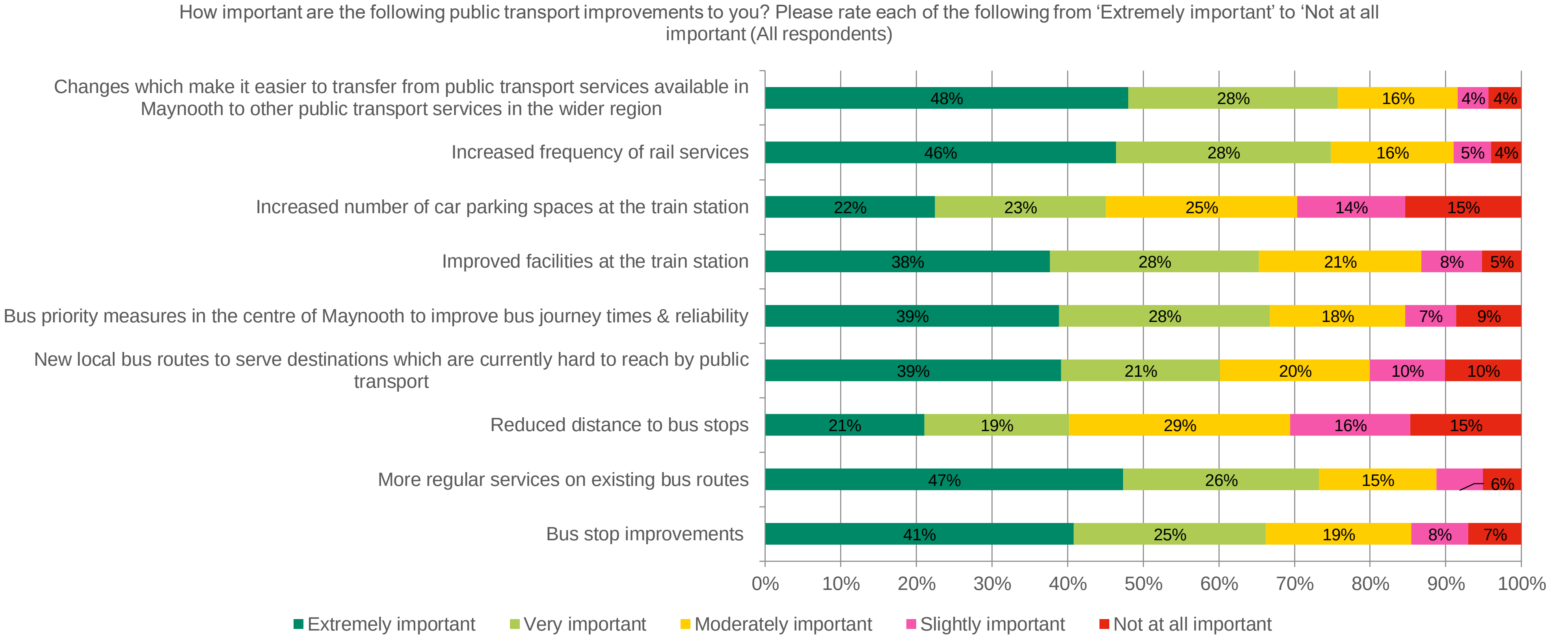


Figure 5-13 Importance of Different Potential Public Transport Improvements (All respondents)

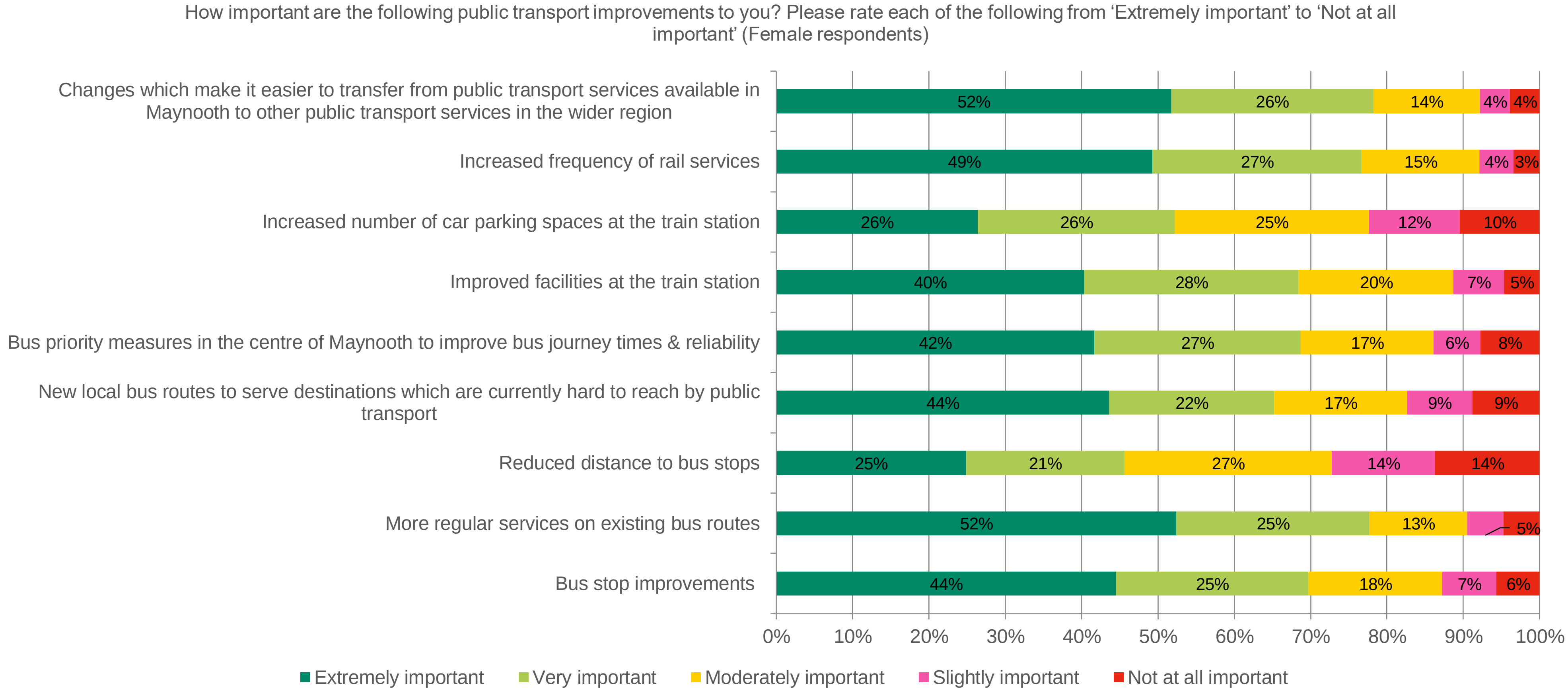


Figure 5-14 Importance of Different Potential Public Transport Improvements (Female respondents)

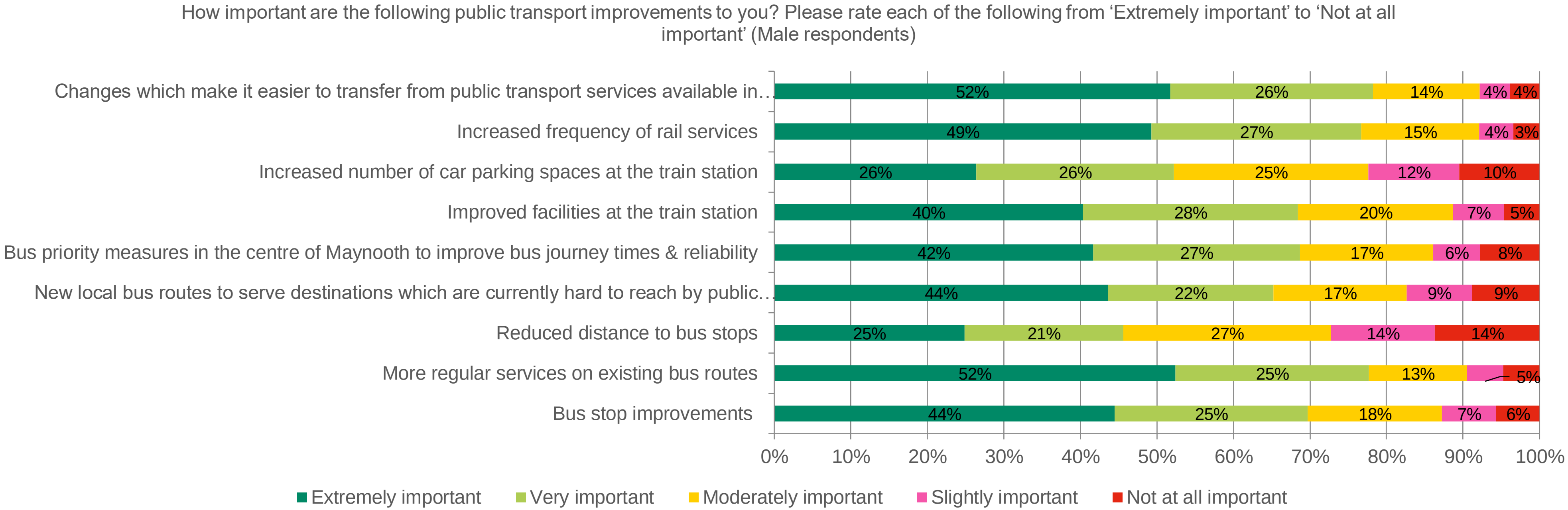


Figure 5-15 Importance of Different Potential Public Transport Improvements (Male respondents)

5.1.6 School Travel

There is potential for the MEABTA to reduce car-based trips during peak hours by making it easier for more school pupils to travel to school by active modes as well as by bus. A section of the survey focused on understanding the existing uptake of active travel modes for school trips; perceptions of barriers to active travel to school and the potential changes which would be most likely to encourage respondents to allow their children to use active travel modes. All respondents who said they were a parent or guardian of a child attending either primary or secondary school in Maynooth were asked these questions.

As shown in Figure 5-16, almost half of parents of children in both age groups said their children travel to school using active modes every day. However, more than one quarter of respondents said their primary school children rarely or never travel to school using active modes, while over one third of respondents said their secondary school children rarely or never travel to school using active modes. The results also show that many children do not travel the same way each day, as many use active modes either three or four times a week or one or two times a week. This variation is not captured through the Census, which only collects data on pupils' 'usual' travel modes to education.

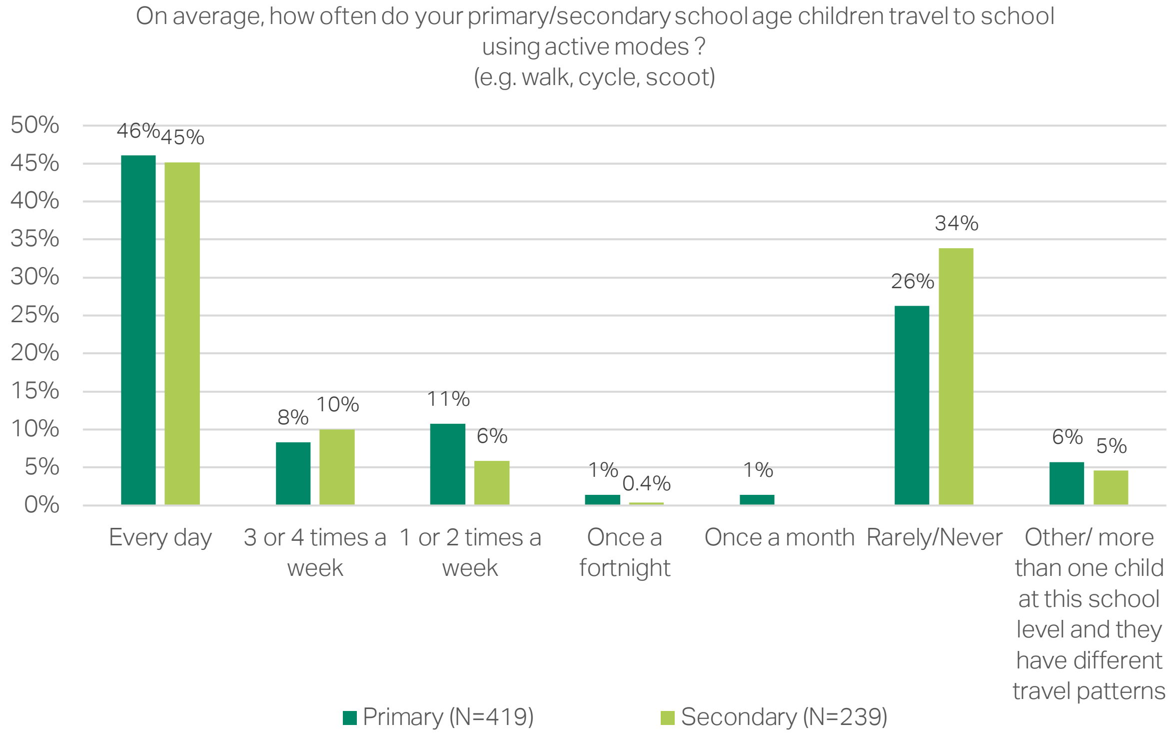


Figure 5-16 Frequency of using active travel modes for school trips

Figure 5-17 illustrates how respondents' who are parents or guardians of a child in school in Maynooth perceive different barriers to active travel to school. The barriers which most stand out include road safety/traffic risk, lack of cycling facilities between home and school and lack of walking links or crossing points.

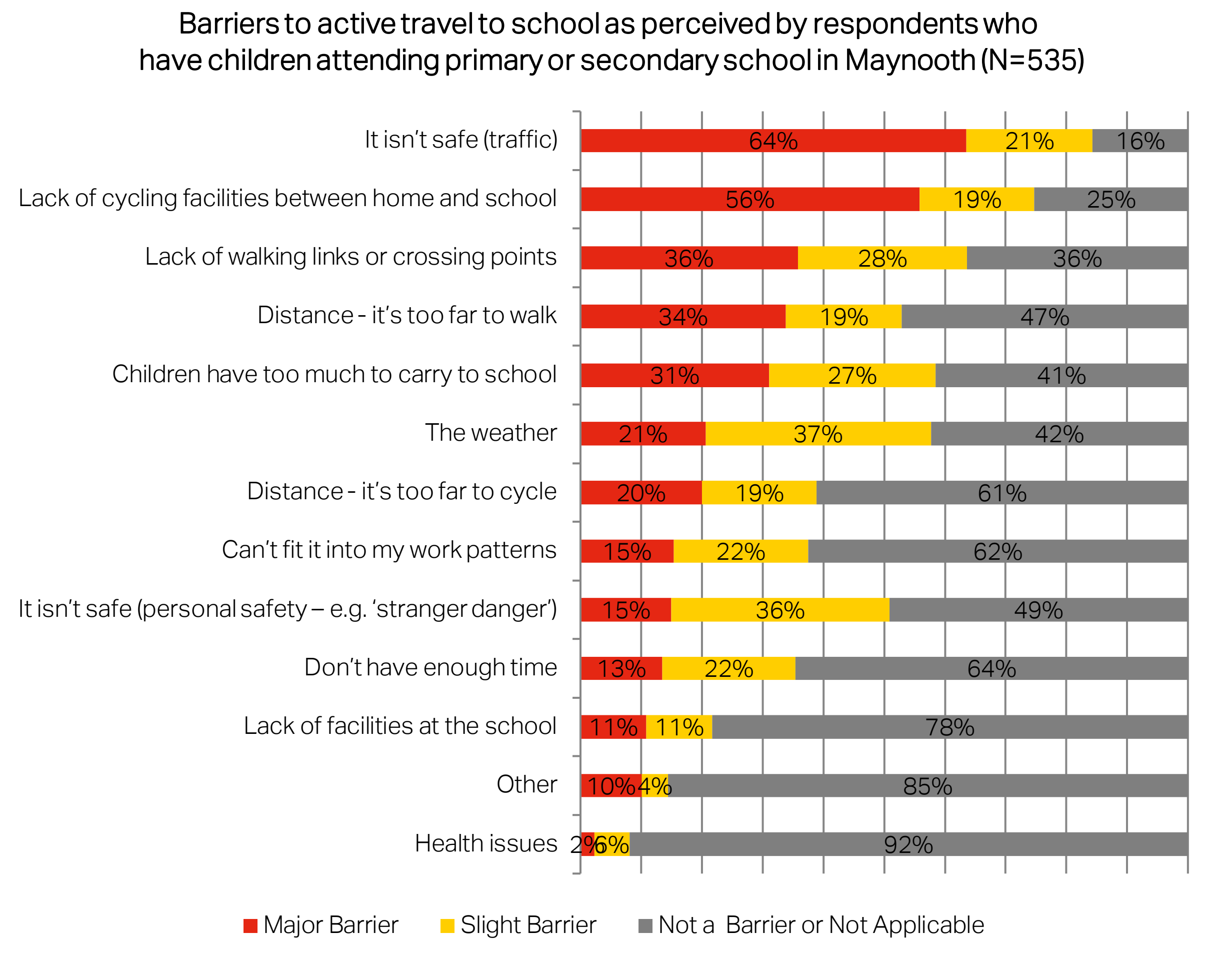


Figure 5-17 Barriers to active travel to school

Figure 5-18 shows how respondents' who are parents or guardians of a child in school in Maynooth rate potential changes aimed at encouraging more active travel to school from 'important' to 'not important'. Unsurprisingly considering the responses to the previous question, the potential changes which received the highest number of 'important' ratings included 'safer cycle routes', 'safer walking routes' and 'slower traffic speeds near school'.

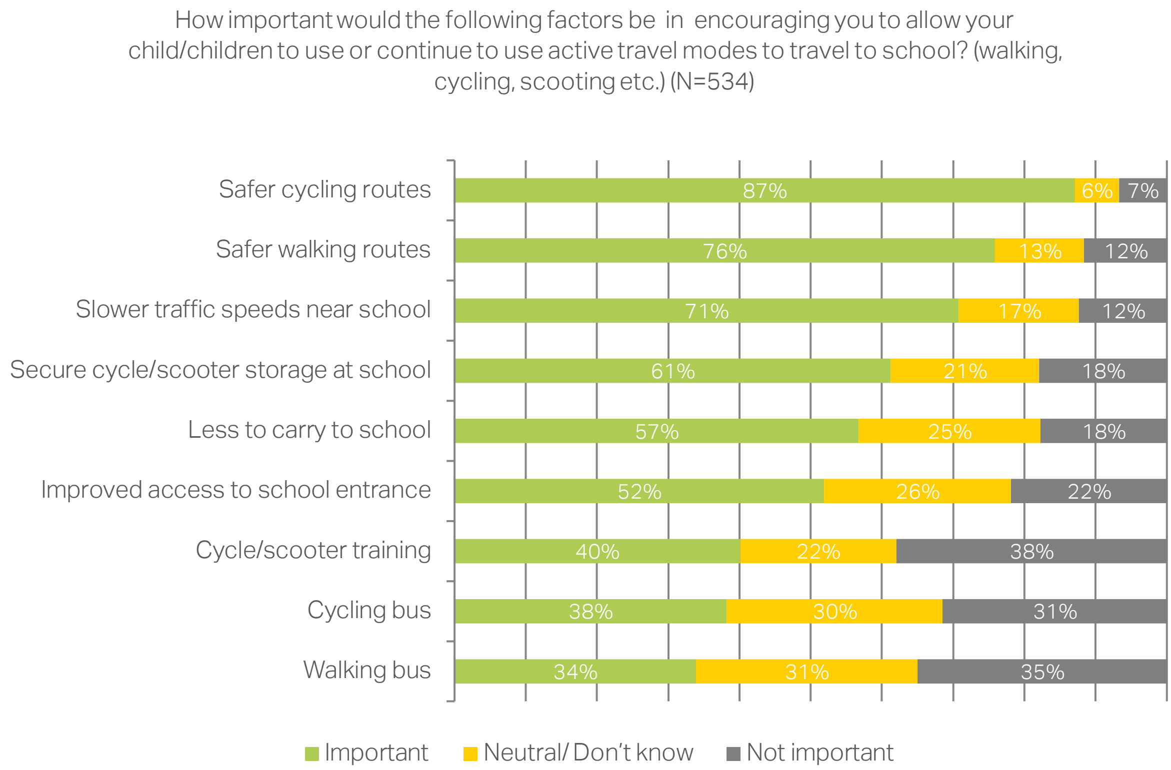


Figure 5-18 Encouraging factors for active travel to school

5.1.7 Additional Comments

There were a number of questions in the survey where respondents had the opportunity to provide an 'open' comment or further detail related to an option they selected in a multiple-choice question. An open comment box was provided with the two questions where respondents were asked which transport improvements they would like to see implemented within Maynooth and how important different potential public transport improvements were to them. A separate question at the end of the survey also invited any additional comments which respondents felt were relevant to inform the MEABTA. The latter question asked respondents to be as specific as possible in their comments. Due to the large volume of responses and the substantial overlap between responses in different 'open' comments, these questions were analysed together.

Over 1,050 individual respondents provided a comment in response to at least one of the questions, indicating the overall high level of interest amongst respondents in improving access for all transport modes within the study area. These open comments were then coded into themes as part of the analysis.

Some comments provided by respondents were quite general while other respondents provided some very specific comments in relation to existing transport issues they encounter within the study area, and/or their personal suggestions for how these issues should be addressed. The main issues raised by respondents are summarised below.

5.1.7.1 *Planning and Development*

- Many respondents were concerned about continued development and expansion of both residential areas and the university without the infrastructure to support this growth.
- It was also noted by many that due to a lack of accommodation options, more university students were having to drive to the university and this was adding to the congestion problem in the town.

5.1.7.2 *Active Modes*

- There is strong support for improving footpaths in the town and extending connections to nearby areas, primarily Celbridge, Leixlip and Kilcock. There is also strong support for improving the cycle network in the town and extending it to connect to nearby areas, primarily Celbridge, Leixlip, Kilcock, Clane, Dunboyne, Rathcoffey, Donadea and Straffan.
- Respondents highlighted many areas and specific points at which they felt that the footpath was inadequate, dangerous or at which there wasn't currently a footpath at all. Some of the areas which were noted as being inadequate and narrow were the Celbridge Road to the primary schools, the Main Street to Tesco, Cluain Aibhain entrance, Celbridge/Straffan Road at Maxol, Newtown Road, Pound Lane, sections of Parson Street and the bridge crossing at Manor Mills. Specific points noted as not having a path included Leinster Street (which it was noted is used by a high volume of pedestrians as well as by the fire brigade), the entrance of Parklands Square, Moneycooley Road, and between Brookfield Park and Meadowbrook Road.
- Some areas noted as being dangerous for walking included the back lanes off the Main Street, the section of road after the crossing from the canal at Pikes Bridge to Carton House, the crossing between the North and South Maynooth University Campus (as the pedestrian timing requires a long wait so people will run across), and the crossings required to access the Maynooth Business Park

(in particular the requirement to cross the M4 slip roads where there are no pedestrian crossing facilities. The junction of the Dunboyne Road Mariaville was also highlighted. However, it should be noted that at the time of the survey, the new traffic lights were not switched on at this junction.

- It was frequently commented that the shared path to the MEC and on Main Street was not safe or functioning for any users. Due to the numbers of people trying to use the path to MEC daily cyclists often cycle on the road as the cycle path is being used by pedestrians. Similar concerns exist regarding Main Street and on Main Street the situation is complicated further by businesses using path space to facilitate outdoor dining.

- Several respondents commented that at many of the pedestrian crossings in the town there is a long wait until pedestrians can cross which leads to many people trying to cross outside of the pedestrian times.

- Some suggestions were made for locations of new crossings particularly at the GAA pitch and the Carton Avenue end of Main Street.

- Several respondents reported that the lack of ramps for wheelchairs or buggies, particularly around Tesco, made their travel more difficult. This included the footbridge to the train station.

- It was suggested that estates be made more permeable for cyclists and pedestrians to create safer and alternative routes than on the main roads, particularly to facilitate journeys to and from the schools.

- More accesses to the canal greenway were suggested for the town, specific locations suggested were to the east of Tesco or from Castledawson/Newtown Hall area and generally accesses further outside the town.

- Many respondents indicated a desire to see the greenway widened and paved to make it a fully accessible cycle route for leisure or as a commuting route to Dublin. One respondent also noted that barriers on the greenway should be reviewed to ensure they are navigable by larger cycles, such as cargo cycles or cycles and trailers and that currently the route between Maynooth and Kilcock, and Maynooth and Leixlip is not accessible to larger/wider cycles.

- Many respondents highlighted the suitability of Maynooth for cycling, both because the town and its surrounds are relatively flat and because it is a university town.

- The main issue with the cycle network in the town was its inconsistency. Many respondents described the network as appearing and disappearing, dropping cyclists at pinch points and junctions and varying between being on the road or on the footpath.

- A frequent comment about the cycling network was that people felt unsafe using it, with many respondents saying that a lack of safety was one of the main reasons they didn't cycle more. Areas frequently highlighted as being unsafe for cyclists were Parson St, Newtown Road, Straffan Road, Mill St, Celbridge Road, Dunboyne Road and Doctors Lane. Some of the specific points were opposite Manor Mills Shopping Centre on the Moyglare Road cycle way (it is a two-way path until this point and becomes a single file path), the junction of Main St and Straffan Road and the junction of Moyglare Road and Parson St where cyclists turning right have to navigate two lanes of traffic.

- Many respondents requested more cycle parking across the town and in specific locations such as at the large shopping centres (Glenroyal, Carton Retail Park and Manor Mills), the library, at bus stops, the GAA and soccer pitches and on Main Street. It was also highlighted that these facilities should be able to accommodate different types of cycles, such as cargo cycles.

- Some respondents report high levels of illegal parking in the cycle lanes and the lack of enforcement on this issue. Some specific locations mentioned were north of the church on the Moyglare Road at mass times and the GAA club at busy times.

- Some desire lines highlighted in the responses that respondents felt were not adequately served by the existing cycle network included the train station to the University, major housing estates to the schools, housing estates to the smaller shopping locations such as the Greenfield Shopping Centre and the Beaufield Shopping Centre and from the town to the Maynooth Business Campus, Maynooth FC and the Intel campus.

- One respondent noted that tree and bush pruning would be beneficial to improve safety and another to allow more use of some paths as they are sometimes obstructed by overgrowth.

- Some respondents raised the issue of catering for personal e-mobility or e-scooters in the town, they felt that these shouldn't be used on the footpaths but that on the road was also not safe.

- Several respondents requested a scheme similar to Dublin Bikes for the town or a scheme that enables the use of e-scooters.

- The provision of education for all road users about cyclist safety on the road was suggested by some respondents.
- One respondent suggested that a boardwalk should be provided along the Joan Slade River to accommodate pedestrian traffic.
- The creation of additional entrances to the university was suggested to improve access from the train station.

5.1.7.3 School Drop Off Issues and School Travel

- School run related traffic congestion in the town was mentioned by many respondents, and a feeling of increased car usage since the new school campus was created on the Moyglare Road (MEC) was described.

- A lack of safe drop off areas was highlighted by many respondents in relation to all schools. At the town centre schools people dropping children to the schools often use the shopping centre parking and the removal of the approx. 10 spaces on the Dublin Road has made dropping children to school more difficult. One respondent said that there was not enough disabled parking available at schools and that the existing disabled parking was often occupied.

- The drop-off situation at the MEC was described by many respondents as unsafe. Many of those dropping children to school use the GAA pitch parking but this is unmarked, with uneven surfacing and has bad sightlines for vehicles exiting. This option also requires crossing the shared pedestrian and cycle path.

- Also with regard to the MEC, respondents noted that some children are dropped to school by people parking on the roundabout at the Moyglare Hall Estate Road and in the various estates along the Moyglare Hall Road.

- One respondent suggested that drop-off/pickup should occur within the campus grounds using the campuses internal road system to avoid the situations described above.

- Many respondents reported that they would not let their child walk/cycle to school due to a lack of safe facilities. The Dunboyne Road does not have a cycle path, the shared path to the MEC is regularly congested and the mixing of cyclists and pedestrians is perceived as not safe, particularly for national school age children. The Celbridge Road does not have cycle lanes and the footpaths were described by several respondents as too narrow and dangerous as they serve two schools.

- With respect to using active modes to get to school it was also highlighted that due to Covid a lot of students do not have has access to lockers at school and therefore have to carry heavy school bags which makes walking or cycling any distance difficult. The unsuitability of required school shoes and uniforms for active modes was also identified as a barrier to children using active modes.

- Many respondents requested more school buses, particularly for students attending the MEC. It was suggested that buses should collect students from the large estates around the town, with other routes serving the wider locality. It was also suggested that bus priority measures would be required to support this.

- Other suggestions made by several respondents included more covered cycling parking and waiting areas at schools, active mode routes to the schools that go through estates instead of on the main roads and the possibility of staggering school start times to reduce the congestion connected to children being dropped to school or collected.

5.1.7.4 Bus

- The reliability and capacity of the existing bus services is considered to be a problem, with multiple respondents stating that they or members of their family often cannot get a place on a bus because it is full and that buses are often late (lateness is often ascribed to the congestion experienced in the town centre).

- The frequency of the services is also highlighted as an issue by many respondents, particularly university students. Many of the services only have a few options throughout the day meaning that the students must wait long periods before or after their classes and their ability to participate in extracurricular activities is hampered (evening times specifically)

- The cost of the bus routes to the local towns (e.g., Naas, Newbridge, Navan), particularly the private university services, are considered to be prohibitive by some as it can mean it is cheaper to drive and some respondents would like to see more integration supported by LEAP card features which are available in Dublin, such as fare capping and transfer discount.

- There is some demand for a town bus service which connects to the train station, estates and other destinations in the town such as shopping areas.

- There is demand for more bus services to nearby towns, many feel that the public transport available is very Dublin city centre centric and often requires going into the city centre to come back out again. Frequently mentioned locations as desired destinations include Celbridge, Kilcock, Enfield, Naas, Newbridge, Leixlip, Clane, Straffan, Navan, Ashbourne, Kildare Town and Dunshaughlin. For some of these towns the bus that does operate only operates during university term time.

- As outlined in the previous section, there is a demand for more school buses. The cost of existing private school buses was also highlighted as an issue, with one respondent paying €60 a week for three children to get to MEC.

- Some respondents expressed worry about a reduction in services to Maynooth with the BusConnects timetable changes.
- There is demand for an extension of bus services to the north side of the town.
- Many respondents suggested that creating bus lanes and giving bus priority through Maynooth Town would greatly improve the bus service and prevent them getting stuck in the congestion – particularly to service the schools, the university and enable a quicker journey to Dublin.
- It was also pointed out by respondents that the bus stops provided on Main Street are not adequate for the buses to fully pull in. On Main Street the buses often do not/cannot fully pull in off the road and create more congestion as passengers get on and off the bus. The waiting passengers also create accessibility issues for people with disabilities as well as people pushing buggies and cyclists.
- The Glenroyal Hotel bus stop was mentioned as not being used fully by the buses, with some buses stopping in the cycle lane instead of pulling into the stop.
- Many respondents requested that more shelter and seating be provided at all bus stops – stops near the university, along with the Glenroyal Hotel stop were frequently mentioned.
- Real time information is not available for most buses currently servicing Maynooth and respondents indicated that access to real time information would be of help to their travel.
- Several respondents requested that cycle parking be provided at bus stops to support multi modal travel.
- The bus stop after Carton House was highlighted by one respondent as being difficult to access – "you have to walk on the hard shoulders of the main Maynooth to Leixlip road & cross over the very busy main road where often there are cars parked on the hard shoulder on the canal side."
- One respondent who is a wheelchair user requested that bus drivers be give more training on how to lower the bus properly so that can get on and off safely.

5.1.7.5 Train

- There is demand for more sheltered waiting areas and seating at the train station, as well as better information to be provided on whether a service arriving at the platform is direct or a stops-at-all-stops service.
- Many respondents said that the station needed lifts as the footbridge was not accessible to wheelchair users, buggies, and is difficult for older people to use. It was also suggested that the station should be accessible from both sides of the tracks and not just the station side.
- The footbridge to access the station over the canal was noted as being slippy and dangerous when wet and not practical for those with bikes, buggies, using a wheelchair or limited mobility to use.
- Some respondents requested facilities such as a café, wifi and toilets be provided at the station.
- Overcrowding on train carriages was an issue for some respondents, particularly in the morning peak.
- Many respondents reported that the train service was often late and that service to Dublin was too slow.
- Some respondents felt that the train was expensive, particularly for school children over 16.
- There was strong support for the DART extension to Maynooth. Some respondents suggested that the extension should also include Kilcock and that the leap card should be extended to cover Enfield.
- Many respondents requested a connection to the Hazelhatch station which could then provide access to the Heuston lines and destinations in the south of the country without having to enter Dublin.
- Many respondents pointed out that the train times did not match with the university class times and either left students late to class or waiting for significant lengths of time before or after class. It was also noted that this was recently made worse by the introduction of the Pelletstown stop.
- There were some responses which were worried about security on the train, at the station and the surrounds and wanted to see more security measures implemented.

- Several respondents requested that the run times of the trains be extended to accommodate a night life in Maynooth, non-standard work hours and access to Dublin for entertainment.
- There is some demand for more car parking at the station as it was noted as regularly being full in the mornings.
- More set-down/pick-up parking was also requested, as well as the ability to pay with methods other than coins.
- There is a need for a more cycle parking at the train station, particularly parking which can cater for different sized cycles, and also more security measures.

5.1.7.6 *Public Realm and Town Centre Traffic Management*

- Significant congestion as a problem in Maynooth was one of the main themes of survey responses. It was described as having a negative impact of the quality of life for residents – in terms of air quality and noise pollution due to idling vehicles, and enjoyment of public spaces. Respondents reported that it was worse during school and university term time and that the situation had deteriorated in recent years.
- The most frequently mentioned areas for regular congestion included Parson Street, Straffan Road, Moyglare Road, Rathcoffey Road and the Dublin Road, although congestion was most often referred to as a town wide problem.
- Congestion was noted as a reason why some respondents were not using active modes more regularly due to safety concerns and many other respondents said they actively avoided the town due to the levels of congestion. On the other hand, some respondents said that congestion was a reason they walk regularly, because walking is often faster than taking the car due to the congestion.
- There is support for measures to increase the space available for active modes (wider footpaths, cycle lanes) and public transport (bus lanes)
- Several respondents proposed pedestrianizing the Main Street area or creating a one-way system using the back lanes in the town centre and as a way to make Parson Street safer and less of a bottleneck. However other respondents highlighted that they would like to see the two-way traffic system on Parson Street retained.

- There is some support for diverting heavy vehicles such as HGVs and buses away from the town centre. Some respondents highlighted the need for enforcement of the existing ban, while others said a ban should be introduced.

- There was some support for removing all on-street parking from Main Street, except disabled parking and loading bays. Parson Street was also mentioned as a location where the on-street parking could be removed. However, one respondent highlighted the need to retain parking provision for the town houses on Parson Street.

- It was also suggested that on-street parking in the town centre and on the back lanes of Main Street be restricted for use by residents only and visitors could use the multiple car parks around the Main Street.

- There were several mentions of businesses on Main Street taking over sections of the footpath for outdoor dining and creating sections of path which are too narrow and create pedestrian 'bottlenecks.

- It was highlighted that parking in the lanes off Main St sometimes results in cars parked directly in front of someone's front door, which can present a health and safety hazard.

5.1.7.7 Parking / Park and Ride

- There was strong support for the creation of a Park and Ride facility on the outskirts of the town which people could then use cycles/scooters/bus to access the town, University and train station, especially as the DART is extended to Maynooth.

- Parking at the GAA pitch was highlighted as an issue leading to illegal parking on the paths around the pitches.

- There were conflicting calls for more and less parking on the Maynooth University campus as some can't get parking despite paying for yearly permits and others see the existing parking provision and any expansion as supporting increased car usage.

- Several respondents felt that more parking was required for the town but that it should not be in the town centre. However, there was support from others for more parking in the town centre.

- Some respondent felt that parking in the town was too expensive.

- Several respondents highlight the difficulty that residents in the town centre can have in getting a parking space despite paying for a parking permit and felt that residents should be prioritised when it comes to parking in the town centre as compared to visitors.

5.1.7.8 Road Safety

- A significant number of respondents suggest speed reduction measures are required on main roads such as ramps or lowering the speed limit– the most frequently mentioned roads were Moyglare Road, Parson Street, Straffan Road, Rathcoffey Road, Celbridge Road, Newtown Road and Dublin Road.
- Sightlines are a problem exiting the GAA pitch, particularly as it is used as a school drop off location.
- Many respondents report that there is a problem with vehicles breaking red lights in the town at several locations across the study area but particularly on Main Street.
- A problem with motorists sitting in the yellow boxes at junctions preventing other motorists from joining or crossing the traffic was highlighted.
- Many respondents highlighted that due to the congestion in the town small roads in the outskirts of the town and the lanes in the town centre are used as rat-runs to avoid the town centre and Main Street, making these roads dangerous due to the higher volumes and speeds of vehicles. One particular road which was mentioned is the link road between the R157 and the Moyglare Road.
- Several respondents noted that HGV's use small back roads to avoid the town centre and those coming through the town are dangerous and contribute to the congestion in the town.
- Several respondents pointed out that the traffic lights at Lyreen Ave and Moyglare Road had not been turned on yet (at the time of the survey) and this made the junction difficult to navigate, which was particularly concerning given that it is used by both construction HGVs and large numbers of school children.
- A lack of signage around the new school campus notifying motorists that they are approaching a school entrance and to reduce their speed was highlighted.

5.1.7.9 Road Network

- There is significant demand for the ring road to be completed around Maynooth to reduce congestion in the town centre and provide another route for north south movements through the town, particularly to the university and the new schools campus.

- A new interchange on the M4 to divert Maynooth University traffic away from Maynooth town Centre was also a suggestion made by many respondents.

- A significant number of respondents raised issues related to the number of traffic light junctions in the town, how these are synchronised and the timings of the lights. The main areas mentioned were along Straffan Road (particularly the junction with Meadowbrook Link Road), Parson Street, Main Street and junctions along the Moyglare Road.

- Several respondents questioned why Lyreen Avenue hadn't yet been opened for through traffic to reduce congestion in the town centre.

- It was highlighted that exiting estates onto Moyglare Road, particularly at peak times, is difficult due to the volume of vehicles. This leads to dangerous manoeuvres like edging into the traffic. Yellow boxes were suggested as a possible solution.

- The reinstatement of the left turning filter lane at Straffan Road onto the Celbridge road was mentioned by several respondents.

5.1.7.10 Public Lighting

- There is demand for improved lighting throughout the study area to facilitate walking and running in the town for transport but also for recreation. Respondents also mention improving lighting to further enable cycling between Maynooth and nearby towns such as Celbridge, Kilcock and Leixlip.

- Some specific locations where respondents feel lighting upgrades are required include: several locations along the Royal Canal (in the town and towards the nearby towns), Carton Avenue, routes to the train station (from the university and town centre mainly), the Moyglare Road, Celbridge Road and in areas on the outskirts of the town.

5.1.7.11 Noise

- It was mentioned that the noise from the M4 between Maynooth and Celbridge has impacted and is currently impacting the quality of life for residents along this stretch of the motorway due to a lack of mitigation measures.

- Resurfacing of the M4 last year between the Maynooth interchange and Kilcock greatly reduced noise issues on that section of the M4, but the upgrade was not extended to the Maynooth/Celbridge section.

5.2 Input from Stakeholders

The following sections summarise feedback received from Councillors and from key stakeholders and other organisations on the transport issues which they wished to see considered as part of the MEABTA.

5.2.1 Meeting with Councillors

Councillors representing the Clane-Maynooth Municipal District were invited to an online consultation workshop in August 2021. The meeting was attended by nine councillors from the Municipal District. The main points raised by the councillors during the meeting are summarised below.

- The MEABTA should consider the current population of Maynooth, including the student population as well as the significant anticipated population growth, and should not overly rely on information from the 2016 Census.
- The implications of increased working from home should be considered (it was suggested that around 15-20 percent of people may be working from home).
- The need for collaboration and consultation was emphasised, including with other departments and teams within KCC, with the Climate Action Regional Office (CARO); with community groups and with Maynooth University.
- Transport demand arising from the expansion of Maynooth Business Campus needs to be considered.
- There is a need for more integration of land use and transport planning and for additional housing around transport hubs.
- Infrastructure should be delivered before new housing rather than ‘constantly playing catch up’.
- New houses being planned in Maynooth have driveways and therefore there is a need to anticipate that most households will have one car.
- Support was expressed by most participants for the delivery of proposed/planned ring roads to reduce traffic in the town centre. The potential for an additional motorway junction to the west of Maynooth to reduce traffic in the town centre was also noted.
- An opposing view to the above was also expressed - that ‘new roads are not a solution’ to the transport issues in Maynooth due to the need to significantly

reduce greenhouse gas emissions from transport, which it was argued will involve some hard choices.

- Regarding emissions, it was suggested that the MEABTA will need to take account of: Maynooth's status as a 'decarbonisation zone'; targets set out in legislation to achieve a 50 percent reduction in emissions nationally by 2030; ongoing work being undertaken by the Regional Assembly to quantify greenhouse gas emissions; and the changing policy environment in the GDA and Dublin as reflected in the new GDA Transport Strategy and the 'Five Cities Demand Management Study'. It was suggested that there is a need to set targets for emissions reductions within the MEABTA.

- There is potential to extend the DART+ project to Kilcock. In the absence of this, there will be an influx of commuters driving to Maynooth to access DART+ services.

- The proposed bridge over the Royal Canal and rail line which forms part of the DART+ project (to provide access to the new DART+ Depot west of Maynooth) should be moved to the east of the existing Jackson's Bridge so that it could form part of a future Western Orbital Route.

- There is a need for safe routes for walking and cycling between different areas of the town, particularly to facilitate active travel to schools and to improve connectivity in a north-south direction.

- There is a need for safe cycling links between Maynooth and surrounding towns such as Celbridge, Straffan and Clane.

- There is a need to reduce speeding by motorists to improve safety for children using active modes.

- As there is a tendency for residents' associations to oppose permeability improvements due to fear of anti-social behaviour issues, it was suggested that the delivery of some links on a time restricted basis (e.g., 8am to 8pm) should be explored.

- There is a need to reduce the high proportion of Maynooth University students who travel to the university by car and contribute significantly to congestion during term time. Suggestions included making it more difficult for students to drive, the introduction of a Park and Ride facility and improving access routes for buses from rural areas to access the university.

5.2.2 Meeting with School Principals

The principals of all primary and secondary schools in Maynooth were invited to an online consultation workshop held in October 2021. The meeting was attended by four school principals including the principal of Maynooth Boys National School (located on the Moyglare Road in the town centre) as well as the principals' of Gaelscoil Ruairí, Maynooth Community College and Maynooth Post Primary School, all of which are located on the new education campus off the Moyglare Road to the north of the town. The main points raised during the meeting are summarised below.

- Traffic going to and from the University impacts upon access to all of the schools. More third level students now have parking permits and drive to the university than before, in part as a result of the student accommodation crisis. Car journey times from the new school campus to the Kilcock Road significantly increased after the start of the university term.
- There are currently around 1,000 pupils attending Maynooth Post Primary School and 700 attending Maynooth Community College. There are only 60 pupils currently attending Gaelscoil Ruairí, but this will grow by approximately 30 pupils per year initially and later by 60 pupils per year until the maximum capacity of 16 classes is reached.
- There were very large numbers of pupils walking and cycling daily to the new schools' campus up to the date of the meeting in October but there was some concern more pupils might travel by car when the weather worsened.
- More bike shelters will be needed at the new schools' campus to keep up with the very large numbers cycling to school, particularly if the proposed 'bike to school scheme' currently under consideration is implemented (it was estimated that at the time of the meeting approximately 350-500 secondary school pupils per day were cycling to the northern campus).
- 'Park and stride' is also promoted as a means of accessing the new schools' campus. Parents are asked not to drop their children to the campus entrance but instead to park at the old secondary school campus (adjacent to Maynooth Boys National School) or within the GAA grounds.
- A range of different safety concerns were expressed surrounding the new shared path on Moyglare Road. There are conflicts between users of different modes (walking, cycling and scooting), and the facility is shared by older and younger pupils, some of whom are travelling in different directions. There are also safety concerns at junctions. In particular, the pedestrian crossing at Moyglare Hall is located very close to the junction which means that crossing pedestrians and

cyclists are at risk from drivers who break the lights and come around the corner when the pedestrian lights have gone green. It was also felt that there are conflicts between cyclists and pedestrians at crossings and that people should be asked to dismount from bikes and scooters.

- It was suggested that signage is needed on Moyglare Road to warn drivers that there are schools ahead.
- Some secondary school pupils are using the Royal Canal Greenway to cycle to the new schools' campus from Kilcock.
- Weather and the weight of school bags at secondary school are additional barriers to students traveling by active modes and currently lockers are not available due to Covid-19.
- It was suggested that the planned Maynooth Outer Orbital Route (MOOR) to the north of the schools' campus would help alleviate traffic congestion in the vicinity.
- The residents of the Moyglare Hall estate have raised concerns that the estate is being used as a rat run by parents driving children to the new schools' campus, and there are also problems with some parents parking at the roundabout between Moyglare Hall and the main vehicular entrance to the school.
- Parents of pupils attending all of the schools on the new schools' campus currently use the car park at the GAA Club Training Grounds as a drop off facility. As a result, it is very busy and can be dangerous for children to navigate. Additionally, it is difficult for drivers to leave the carpark due to congestion on the road outside. An alternative drop off area for Gaelscoil Ruairi will be constructed within the grounds of the school as part of the school building project.
- It was suggested that Dublin Bus routes should be extended to the Moyglare Road to provide access to the schools.
- As a result of the building project ongoing on the Maynooth Boys National School campus, parents have been asked not to drop children to school by car. Many drive to the carpark of the nearby shop and walk from there to the school. However, when the building project is complete, it is likely that more parents will want to access the school by car.
- Bike racks at Maynooth Boys National School are full which is a barrier to increasing cycling in the short term, but more racks will be provided in future as part of the new building development.

- Safety is considered to be the biggest barrier to children walking or cycling to Maynooth Boys National School, particularly those who have to come through the town centre.

- Pupils need to cross a lot of roads on their journey to school. It was suggested it may be useful if the MEABTA could identify ‘ideal’ routes from residential areas to schools which minimise the number of road crossings.

- It was suggested that more bollards are required to separate road cycle lanes from vehicular traffic lanes.

- A special needs school called Stepping Stones, is scheduled to move to the Maynooth Boys National School grounds by December 2021. Most pupils attending this school will travel by bus. There will be increased bus traffic to the Kilcock Road/Moyglare Road junction and a reduction in drop-off space for Maynooth Boys National School.

- There is a need to improve access to the School Transport Scheme for pupils who are not attending their nearest school because their nearest school is full – currently the application process for these pupils is difficult. It was also suggested that provision of school bus services for pupils not currently eligible for the School Transport Scheme could also contribute to reducing congestion.

- The provision of a traffic warden for all schools in Maynooth would be beneficial, even on a temporary basis, in order to embed improved safety habits.

- It was suggested that in the longer term, there will be a need for new schools in the south of Maynooth to cater for increased population growth.

- More generally, attendees felt that the traffic problems in Maynooth are very frustrating for people, particularly those who have to use a car every day. Better public transport, such as improved train frequencies west of Maynooth could reduce the number of people driving into Maynooth every day.

5.2.3 Meeting with Maynooth University

- Maynooth University attracts thousands of trips on a daily basis and therefore was identified as a key stakeholder for the MEABTA. An online workshop was organised to gather the views of senior representatives of the University on issues which should be considered. The University was represented at the workshop by the General Services Manager, the Director of Campus and Commercial Services and the Admissions Officer. The main points raised during the workshop are summarised below.

- Maynooth University currently has around 15,000 students and has grown significantly in recent years, as four or five years ago, there were only around 10,000 students.

- There will be a new strategic and campus development plan for the University next year. It is likely that the number of students will increase to 20,000 by 2030. A commuting plan to accommodate this additional growth hasn't been considered yet.

- Significant work has been undertaken over the past number of years to introduce new commuter bus services. There are now around 12 commuter routes encompassing locations such as Dundalk, Navan, Meath, Tullamore, Carlow and Portlaoise and there are approximately 1,000 students using these services. Many of the services are commercial services which are self-funding, but the University was instrumental in identifying the need for the routes and getting commercial operators on board. Many of the daily services have mid-day services in addition to morning and evening. Some of the commuter services from further afield are weekend only (e.g., Waterford, Thurles).

- The University normally carries out a transport survey in conjunction with the NTA every two years. The most recent survey was in 2018 due to Covid-19. This found that 67 percent of respondents were traveling to the University using public transport or active modes, which represented a significant improvement compared to the initial travel survey in 2009.

- Buses are regularly delayed in traffic within Maynooth. Improved bus priority in the town would improve their reliability. However, the ideal situation from the perspective of bus access for the regional commuter buses would be if the need for buses to go through the town to access the University could be eliminated, through delivery of a new link from the motorway to the west of Maynooth.

- There is a plan for a new bus terminus on the campus with six bus stops and ten layover spaces. It will be adjacent to the new student centre and restaurant. There will also be additional parking.

- The University would like the Dublin Bus services to Maynooth to terminate on the campus. However, buses lose time in the town centre.

- Although the process of introducing legislation for e-scooters is still ongoing at national level, there is a need to consider a plan for them into the future and there may be potential for a town wide e-scooter rental service.

- There is a need for an accessible footbridge across the canal to the train station.

- It would be preferable if the train which currently arrives in Maynooth close to 9am could arrive at 8.45 to accommodate students attending 9am lectures.
- The bus connectivity from Celbridge to Maynooth is poor as buses tend to be late arriving in Celbridge after getting stuck in traffic closer to Dublin. There are significant numbers of Maynooth University students living in Celbridge.
- There is a subsidised cycle repair service on campus which is popular. There is also a Go-car base. There was previously a car sharing scheme which could no longer be promoted during the pandemic, but it is hoped to revive this initiative in the future.
- There are plans to provide more covered and locked bike parking on campus but to date bike theft on campus has not been a major issues and existing cycle parking is undersubscribed.
- There are currently over 1,150 long term residential accommodation beds on campus as well as additional short-term accommodation. There are fewer rooms available on the ‘rent a room’ scheme this year as a result of Covid-19. More students are now staying in Leixlip or Kilcock instead of Maynooth. However, unlike what some other universities around Ireland have experienced as a result of the student accommodation shortage this year, there was no significant increase in the deferral rate.
- Currently lectures involving more than 250 students are held remotely but in the long term, there is no intention to continue any significant level of online learning, the intention is that students would be on campus for 100 percent of classes following the opening of the new Technology, Society and Innovation building next year.

5.2.4 Written Responses from Stakeholders

More than one hundred primary stakeholders with a possible interest in the MEABTA were identified prior to the consultation period. These included: public representatives; schools; staff based in other departments of Kildare County Council; bus operators; Irish Rail; state agencies and government departments; utility companies; large employers and retail groups; sports clubs; and other local community organisations and service providers. All identified primary stakeholders were contacted by email or phone and invited to submit feedback by email to help inform the Area Based Transport Assessment. In addition, a number of organisations also completed the online public consultation survey. All comments received from organisations through either of these channels are summarised in this section.

TII

- The M4 is identified as part of the core Trans-European Transport Networks (TEN-T). The TEN-T regulations define the objective of increasing the benefits for road users by ensuring safe, secure, and high-quality standards for road users and freight transport to achieve integrated and intermodal long-distance travel routes across Europe. The M4 Maynooth to Leixlip Scheme included in the National Development Plan has been identified as a scheme to be brought through pre-appraisal and early planning.

- TII wishes to ensure in so far as practicable, the preservation of the efficiency, capacity, and safety of national roads in this area as the M4 falls under the National Strategic Outcome 2 of the National Planning Framework and is also an investment priority of the National Development Plan 2018-2017.

- TII advise that the NTA, TII and relevant local authorities plan to develop and construct a road link between the N3 and N4 to act as an alternative to the M50 in cases when there is an incident on the M50.

- TII also note that in emergency cases traffic from the M50 may be diverted through Maynooth.

- The study should inform the future Local Area Plan and be prepared based on an evidence-based area transport assessment, in accordance with the requirements of the Department of Environment, Community and Local Government’s (DoECLG’s) Spatial Planning and National Roads Guidelines.

- TII recommends that the study should be undertaken in accordance with the Area Based Transport Assessment (ABTA) Guidance.

Iarnród Éireann (IÉ)

- It is Iarnród Éireann’s core objective to provide safe, accessible, and integrated rail services for Ireland, that contribute to sustainable environmental, economic, and social development in an efficient manner.

- Maynooth has seen significant population growth between 2011 and 2016 and approximately 66% of residents use the private car to get to work. However, the modal share of rail in Maynooth is three times higher than the Kildare County average.

- Daily rail passenger usage at Maynooth Rail Station, as measured by the IÉ Rail Census, has increased by 25% since 2015.

- Iarnród Éireann is planning for a major expansion of rail as set out in our transformative Iarnród Éireann Strategy 2027, within this is the DART+ program, currently at Preliminary Business Case, which is outlined below:
- provides a major upgrade to the future public transport network in two ways; firstly, through infrastructure improvements and secondly; through additional rolling stock.
- The DART will travel directly to Maynooth, aiming to provide a sustainable, electrified, reliable and more frequent rail service, while increasing capacity and frequency of the line.
- By 2027, it is the ambition of IÉ to increase Intercity services on the Dublin-Sligo line to two-hourly services all day with some improvement in journey times also planned, also enhancing connectivity to the areas immediately west of Maynooth at Kilcock and Enfield, and onwards to Mullingar, Edgeworthstown, and Longford.
- Approval of the business case for 41 intermediate intercity railcars (ICRs) was obtained in 2019, the additional fleet will allow for improvements in capacity and frequency on suburban services in the Greater Dublin Area as well as on Intercity services.
- IÉ is progressing with its Accessibility Programme. The Area Based Transport Assessment should support improvements to accessibility for transport users in Maynooth.
- IÉ is developing a Customer Information Services (CIS) Strategy, a key requirement of this strategy is the ability to provide reliable real time passenger information that is accessible to all, co-ordinated across the network in stations and on trains, and that is consistent across all media.
- IÉ's Sustainable Interchange Programme enables more sustainable end-to-end journeys to be made by train by including facilities at stations which make it easier to change between rail and other modes, such as cycle parking or electric vehicle parking. This programme also has the potential to promote mobility-as-a-service.
- It is noted that any future measure or proposal impacting the CIE group or on the operation of the railway must be fully discussed and agreed with the CIE Property division in advance.

Irish Water

- With regard to Sustainable Urban Drainage, IW would like to see a reduction in stormwater runoff from roads and paved areas, no surface water discharge to existing foul/combined sewer networks and Blue / Green Infrastructure and SUDs to be promoted wherever possible.

- IW would like to be consulted on the impact of projects being carried out by Kildare County Council on existing IW assets. Early notification is requested to enable IW to plan works and minimise disruption to the public.

Road Safety Authority

- The RSA do not have the technical expertise to comment on specific transportation proposals but would be anxious that road safety underlie any proposals put forward within the plan.
- The new Road Safety Strategy will be circulated to county councils and the development of this strategy was aided by consultations with Local Authorities and the CCMA.

Kildare County Council Departments

- The Water and Environment Department noted that linkage with the proposed Maynooth Decarbonising Zone would be important for the Area Based Transport Assessment.
- The Heritage Officer noted that biodiversity can suffer with the introduction of cycleways or greenways and requested that consideration is given to retaining hedgerows when designing cycleways, such as by placing cycleways inside of hedgerows, thereby providing separation from motor vehicles and retaining biodiversity.
- The Parks Section of Kildare County Council advised that it is intended to develop a masterplan for Carton Avenue and adjoining lands in Council ownership. A key issue for this is permeability through Carton Avenue for walking & cycling and how it might fit in with the proposed masterplan and the MEABTA, as new openings to Carton Avenue and facilitating cycling will be contentious issues. Related to this, the Parks Section advised that as part of the recently granted Cairn Home Properties Ltd - Strategic Housing application, a new pedestrian link to Carton Avenue was included. A second proposed shared pedestrian & cycle link running adjacent the R157 Dunboyne Road was not permitted by An Bord Pleanála.

Irish Wheelchair Association

- The vision of the IWA is for an Ireland where people with disabilities enjoy equal rights, choices, and opportunities in how they live their lives, and where our country is a model worldwide for a truly inclusive society.
- Recommendations outlined by Irish Wheelchair Association Best Practice Access Guidelines (4th Edition) provide that the design of busy urban and suburban environments must take account of adequate safety measures,

particularly including physical divisions, to ensure their safe use for all road users, and prioritise pedestrians, particularly vulnerable pedestrians.

- IWA highlights island bus stops as hazardous due to design that often prioritises cyclists and does not provide design features to make it usable and safe for vulnerable users.

- IWA noted that shared spaces for pedestrians and cyclists makes the pedestrian vulnerable and the use of these designs is isolating for people with disabilities and that shared space planning concept does not work for people with disabilities.

- IWA highlights that any removal of parking and the lack of places to exit and enter a car safely for a passenger will mean large parts of Maynooth will be much more difficult to access. Accessible parking bays should be in prime locations on the route to provide access to local amenities, following Section 4.1.2 IWA Best Practice Access Guidelines for accessible parking design criteria.

JJ Kavanaghs

- JJ Kavanagh and Sons operates 4 bus and coach services either to or via Maynooth.

- These services cater for students arriving before 9am. They use the road R148, coming from Kilcock direction so they very rarely meet the morning traffic.
  N06 – Athy - Maynooth University
  N08 - Portlaoise - Maynooth University
  N12 - Kilkenny - Maynooth University

- The R139 Naas - Blanchardstown service, runs 18 times a day with the first services departing from Naas and from Blanchardstown at 07.00 hrs and the last ones at 22.35 hrs.

- JJ Kavanagh note the following locations where their buses regularly get delayed in the town:

  - 5 - 15 minutes on Parson Street, at the junction with Mill Street,

  - On the Dublin Road, opposite Uniform Warehouse Store,

  - 15 - 30 minutes particularly in the afternoons and all day on Saturday and Sunday between the roundabout at Cartoon Retail Park and the junction with Main Street and Straffan Road, and

- Additional 5 - 10 minutes delay on Parson Street, where the road narrows, cars parked on one side of the road, and the oncoming traffic.

Maynooth Cycling Campaign

- The Maynooth Cycling Campaign comment that bus priority is not feasible with the current level of private traffic in Maynooth.
- They note that trains at peak time are currently overcrowded and that security of bikes parked at the railway station is poor. They add that the frequency of buses and trains deter their use.
- Maynooth Cycling campaign mention that the existing provision of a shared pedestrian and cycling path on the Moyglare road and on Main St is not adequate or safe. On Moyglare road children are cycling on the road as the path is full of pedestrians and a similar situation occurring on Main St, which has been exacerbated by the Covid-19 pandemic and the use of street space by businesses.
- The campaign wants to see a reallocation of road space away from cars and from the storage of cars in the town centre generally but with provision for disabled people to access the town and for deliveries. The campaign believes higher quality facilities are required to attract people from their cars.
- Finally, they mention that timings at traffic lights currently give more priority to motorised traffic over pedestrians or cyclists despite the hierarchy outlined in DMURS

Kildare North branch of the Social Democrats

- Kildare County has experienced significant population growth over 20 years to 2016 (64.8%) and in 10 years to 2016 (19.4%), the fourth highest in the state. Within Kildare, Maynooth Town is the fifth largest settlement, and the district is the second largest.
- Issues raised include:
    - Levels of congestion in the town centre that render it unusable between 8am and 8pm, leading to people shopping elsewhere
    - Existing public transport operating at capacity putting more pressure on the road network

  - The fluctuating nature of requirements of the transport infrastructure due to the university in the town
  - Lack of enforcement of parking laws to stop illegal parking in cycle lanes
- Solutions proposed are:
  - Imperative to remove through traffic from Main Street though a ring road in combination with other measures
  - Development of a park and ride facility at the perimeter of the town
  - A new M4 entrance/exit between Maynooth and Kilcock to serve the north of the town
  - To help alleviate traffic associated with the school drop off and collection, the introduction of a wraparound school bus service serving all schools is proposed
  - Safe, segregated pedestrian and cycle infrastructure within the core of the town needs to be prioritised, considering schools, linkages to the Royal Canal Greenway and local businesses
  - Extension of the DART+ program to Kilcock due to existing parking restrictions in Maynooth and the assumed continuation of this due to increased use of rail once DART+ is implemented

Kildare Branch of the Green Party and Local Electoral Area Representative

- Consideration should be given to the provision of a bus terminus for the town as the existing facility opposite the Glenroyal Hotel can have 5-6 buses pulled in at a time which leads to very low functioning of the facility and unsafe conditions.
- A park and ride facility is needed for the town. The proposed DART+ depot between Kilcock and Maynooth is a proposed location, with feeder bus routes and roads connecting to main roads. With the increased numbers using rail after the implementation of DART+ this type of facility will be necessary. The Park and ride facility should consider mode transfers between active modes, buses, and rail. A connection to the greenway would benefit commuters from Kilcock.
- Problems at the Maynooth Education Campus for buses are noted due to a tight turn from Kilcloon causing congestion.

- A plan for a western relief road is needed, connecting to the proposed Maynooth west exit on the M4 to help relieve congestion. Also, the eastern and northern relief roads should be of high priority to progress towards a one-way system in the town centre and eventually a pedestrianised town centre.
- Completion of the developer led sections of road from LIDL to the Celbridge road is also a priority that needs to be addressed with the developers.
- Poor air quality is also noted as an issue due to vehicles and use of fossil fuels. Improvements to traffic and electrification of the trains will help to alleviate this problem.

St. Patricks College Maynooth

- St. Patricks College Maynooth (SPCM) encouraged the consideration of the future development of the town in the MEABTA, particularly development to the north and west of the town as outlined in the Regional Spatial & Economic Strategy (RSES).
- The need for full integration between land use planning and transport planning is stressed by SPCM to ensure that there is cooperation between plans for future development of Maynooth and plans for the required enabling infrastructure.

Suggestions submitted by St. Patricks College Maynooth include:

- Maximising active travel (walking and cycling) connectivity and permeability, along with improvement to existing infrastructure such as improved lighting and surface materials. It is also noted that all new active travel routes should be designed to accommodate micro-mobility modes.
- Importance of timely completion of Outer Orbital Route, both to facilitate future expansion including to the west & north, but also to alleviate existing traffic congestion in town centre.
- Maximising the benefits of planned bus enhancements, including BusConnects, to ensure seamless expansion of bus services including a localised shuttle service for the town to serve growth to the north and west of Maynooth from the outset to be expanded as the town develops further. More innovative options such as Travel-on-Demand, Demand Response Transport and Mobility as a subscription should be considered.
- Making the most of the existing opportunities arising from the planned new station to the west of Maynooth.

- A new Park & Ride facility in west Maynooth as part of the DART+ West proposals. The addition of this facility on the outskirts of the town could potentially open up the existing station parking for development as it sits in a prime location.
- Aligning the DART+ West proposals with the strategic ambition of the Western Orbital Route.
- Creating a new interchange on the M4 motorway to link with the Western Orbital Route.
- Placing a Smart Mobility Strategy at the heart of the Area Based Transport Assessment.
- Seizing the opportunity to develop Maynooth in a ‘nature positive’ way, leading for Ireland and becoming a best practice example in the European Union.
- Exploring the potential for funding to support the provision of sustainable travel solutions across Maynooth.

Gaelscoil Ruairí

Submissions received from both the Bord of Management and the Parents Council have been combined here.

- Gaelscoil Ruairí has approximately 60 pupils and this is our third year in existence and has been located on the Maynooth Education Campus since last year. A survey of the parents showed that 60% of students travelled to school via active modes.
- New bus routes to serve the Maynooth Education Campus would be beneficial.
- There is an urgent need for traffic calming measures on the Moyglare Road and for signage to alert drivers to the presence of a large educational campus.
- The pedestrian crossing at Gaelscoil Ruairí is noted as a dangerous crossing due to cars coming around the preceding corner quickly, vehicles breaking the crossing lights and buses turning into the campus coming close to pedestrians waiting due to the tight turn. Parents have requested a traffic warden at this location.
- The shared pedestrian footpath and cycling lane can be very congested at peak times and can be dangerous for young children walking or cycling to school. The

smaller children can be hard to see at crossings amongst the secondary school children and cyclists not dismounting at these crossings is an issue.

- The GAA pitch car park, which is used as a drop off point is extremely busy in the mornings and There is extremely poor visibility for all (both pedestrians and motorists) when entering and leaving the GAA pitch.
- The traffic to the school is expected to increase with the easing of Covid restrictions and the phased return to work.

Sky Castle

- Details of the development proposals for the site to the north of Maynooth were provided.

Carton Residential Development Ltd

- A local bus link between Maynooth and Dunboyne, along with a new bus stop at the Dunboyne entrance to Carton Demesne should be considered.
- Upgrading the existing bus shelter stop near Dublin Gate, Carton Demesne to a covered shelter should be considered and the provision of a pedestrian crossing from Carton Avenue to the Maynooth Gate entrance of Carton Demesne.
- A review of the speed limits on the Kellystown Rd should be undertaken, provision of speed calming measures along main stretch Kellystown Road and at 90-degree bend at Kellystown Lodge, Carton Demesne and a review and upgrade of the road signage along this road should be considered.
- Ongoing damage to the main R157 road along Moygaddy/ Carton Demesne and Demesne Wall due to no verge, traffic volumes, lack of drains in places. An upgrade of this section is proposed.

Rail Park Residents Association

- Upgrades to the bus infrastructure should be considered to make them more user friendly (covered, seats) and addressing congestion at the bus stop across from the Glenroyal Hotel due to insufficient space to pull in.
- Increased cycle parking availability would be beneficial.
- Traffic through the town is noted as an issue and traffic diversion from the town centre is proposed.

- Traffic speeds on main roads and in estates is an issue, particularly as estates are being used as 'rat runs'. The 30kmh speed limits are ignored (Traffic counts carried out by KCC has confirmed this).

Maynooth Community Council

Maynooth Community Council is a voluntary, non-political organisation which works to organise and improve Maynooth for the people who live in, work in, and visit the town.

- Public transport improvements suggested included the provision of buses for both the north and south side of the town and building a park and ride service on the outskirts of the town.

- Measures suggested to support active travel include introducing a bike rental scheme for the town, building a new pedestrian bridge to support the flow of active mode users on Mill Street, removing the on-street parking to give greater width and / or a footbridge over the Joan Slade River to address a 'pinch point' on Parson St and opening access behind Manor Mills for pedestrians and cyclists.

- Suggestions made for the road network included completion of all sections of the proposed Maynooth ring road and a second exit on the M4 to service the University.

Kilcloon Environmental Action Association

The Kilcloon Environmental Action Association (KEAA) was established in reaction to Meath County Council's decisions over the last number of years to zone approximately 350 acres of rural Meath as development land.

- A new train station with park and ride facilities to the west of Maynooth is proposed for access to NUIM and to relieve congestion for the Kilcock station.

- A reduction in parking at the Maynooth train station to be replaced with cycle parking for commuters is suggested.

- To help relieve congestion in the town centre it is suggested that the eastern and western sections of the Maynooth ring road be completed, with direct access from the M4 to the NUIM campus.

- The creation of cycle routes away from main traffic routes should be setup to enable direct access to schools, university, shopping areas and the train station, particularly for primary and secondary school students.
- Examples for the secondary school is to link a cycle route through the Moyglare Hall estate to the Lyreen estate; dedicating the back/Pound lanes to local traffic and cycles only; and a cycle bridge across the canal and railway away from the Straffan Road.
- Inconsistencies in the map extents in the Phase 1 Consultation materials were noted. It was highlighted that a portion of County Meath is included in the map on page 4, the reason for this is not presented and the residents of this area have not been contacted.

6. Surveys

6.1 Covid-19 Disruption

Due to the disruption to normal travel behaviour caused by the Covid-19 pandemic, it was decided that new traffic and parking surveys should not be conducted. Parking occupancy surveys were completed in Maynooth in 2016, as part of the Traffic Management Plan, and parking occupancy and duration data collected at this time for some of the main off-street carparks is presented in the following section. Surveys of walking and cycling infrastructure, parking signage, parking costs and public transport infrastructure were completed using a combination of online information sources and site visits.

6.2 Parking Surveys

6.2.1 Main Car Parking Areas and Costs

Figure 6-1 shows the Maynooth paid parking bye laws which were introduced in 2013 and commenced in May 2016. There is some on-street parking available on most streets within the town centre. On Main Street, on-street parking is limited to a maximum stay of one hour during business hours. On other streets the maximum stay is two hours. On most streets, on-street parking costs €1 per hour, but on six streets, the cost is €3 per hour. They are Convent Lane, Cross Lane, Double Lane, Buckley's Lane, Back Lane and Parson Street. On site visits, it was observed that nine spaces on the north side of Dublin Road are currently blocked off by bollards, which it is assumed were installed during the pandemic to support social distancing and active travel. The number of public spaces available on Leinster Street has also reduced as part of improvements implemented on this street.

There is a very large quantity of off-street car parking in Maynooth, although most of the larger car parks are commercial car parks and reserved for the use of customers. The only off-street car park owned by KCC is the Doctors Lane carpark. This is accessed by car from Straffan Road, using the same access as the Glenroyal Shopping Centre/SuperValu car park. The main off-street parking locations around the town are shown in Figure 6-2. Figure 6-3 shows the Maynooth University car parks in more detail. The University also uses the two GAA club car parks on Moyglare Road as 'overspill' car parks and these are shown in Figure 6-4. Table 6-1 shows the costs or other restrictions associated with the main off-street car parks, as well as the approximate number of spaces in each where this information was available.

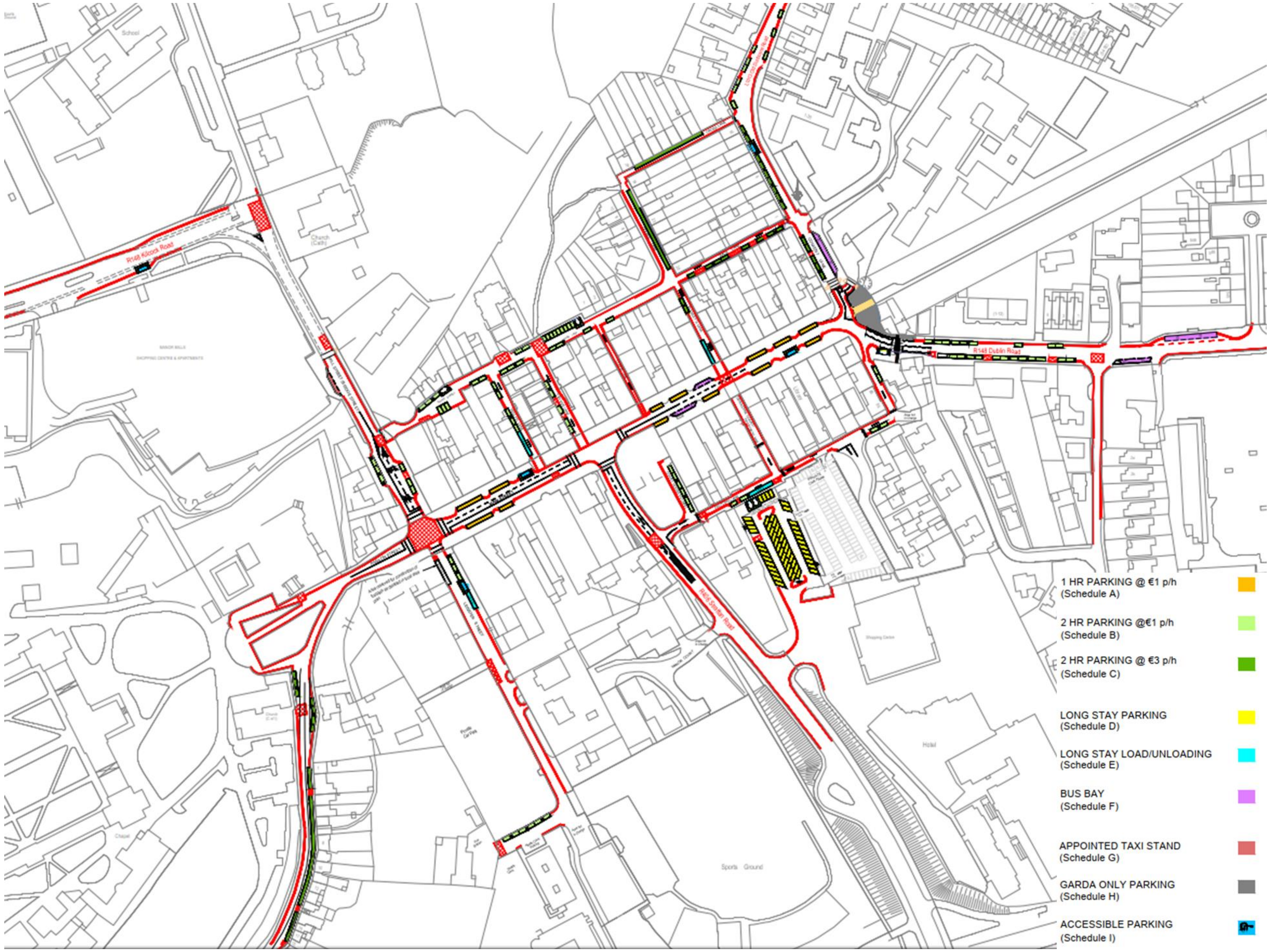


Figure 6-1 Maynooth Pay Parking Bye Laws 2013 (Commenced May 2016)

Figure 6-2 Maynooth Main Off-Street Car Park Locations

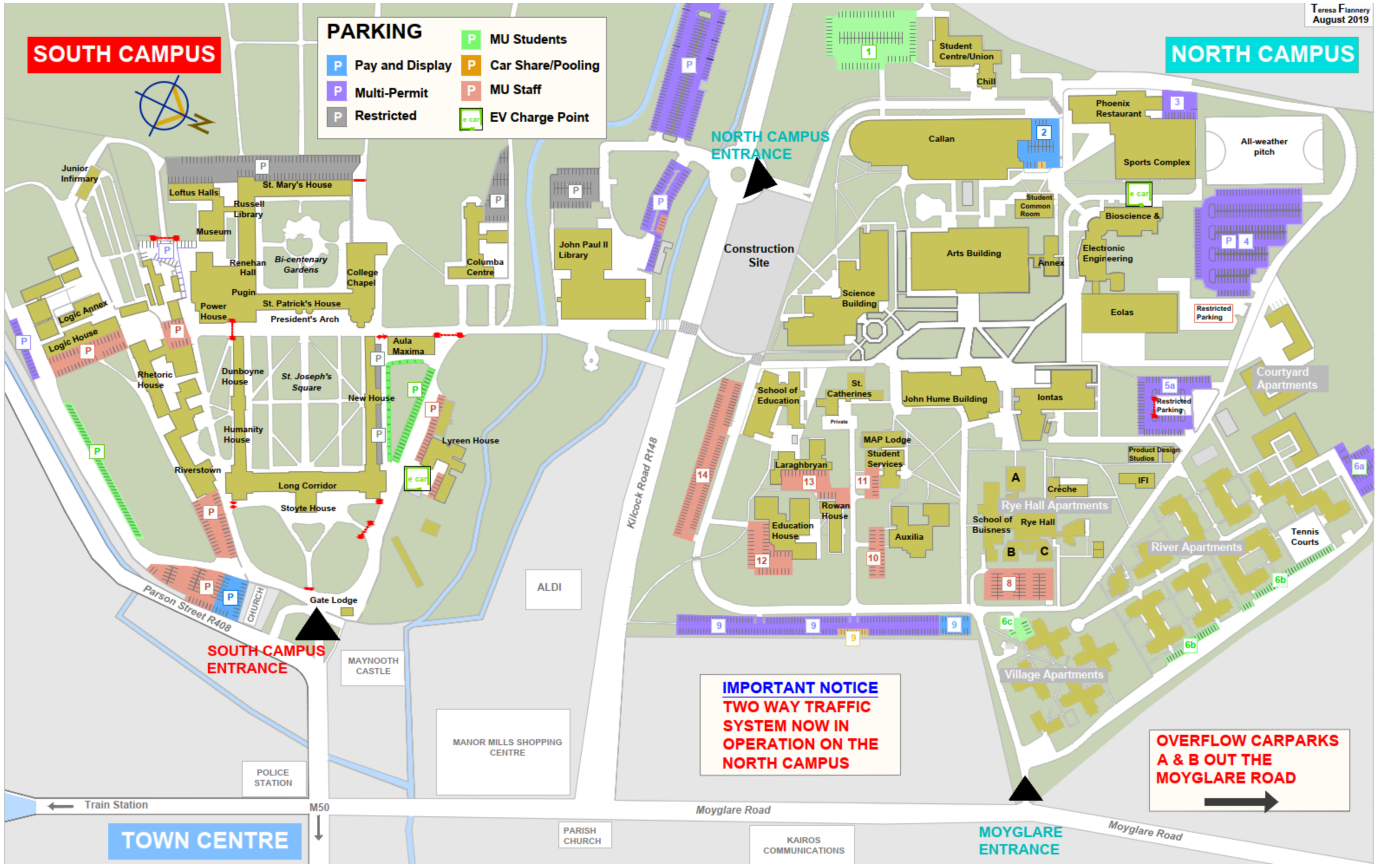


Figure 6-3 Maynooth University Main Car Parks

Figure 6-4 Maynooth University Overflow Parking (Maynooth GAA)

Table 6-1 Maynooth Off-Street Parking Costs

Car Park / Parking Area	**Cost / Restriction**	**Approx. No. Spaces**
Train Station	€3.50 per day, €9.00 for seven days, €30 per month, €360 per year [Above rates are APCOA Connect, machine charges are higher]	194
Glenroyal Hotel	Free for customers, strictly for customers of hotel and leisure club	187
SuperValu/Glenroyal Shopping Centre (A/B)	Free for customers only, max two hours	139 (37+102)

Car Park / Parking Area	Cost / Restriction	Approx. No. Spaces
Manor Mills Shopping Centre	Free for customers only, max stay three hours	500
Leinster Road Car Park (Leinster Street A)	€1.50 per hour, €7.00 per day, €25.00 per week	54
The Mall Car Park (Leinster Street B)	€1.50 per hour, €7.00 per day, €25.00 per week	65[12]
Doctors Lane (KCC)	€1.20 per hour, €6.50 per day, free Sundays	57
Doctors Lane (Private)	€1.20 per hour, €5.00 per day, €20.00 per week, €70.00 per month	Not surfaced and lined, estimated 80+
Carton Retail Park/Tesco	Free for customers, max stay	1,400+
NUIM (numerous)	Staff and student permits - €40 per academic year/€20 per semester Pay & Display €1 for first hour, €1.50 for next hour, max €10/day, max stay one day	Over 1,600 spaces in 2016, up to date information not available

6.2.2 2016 Off-Street Parking Occupancy Surveys

Parking occupancy surveys were undertaken to inform the development of the Maynooth TMP on the 17th of May 2016, which was a Tuesday. The results of these surveys in respect to occupancy and duration of stay (in one-hour bands) for the most relevant off-street car parks are presented here. Occupancy at the train station was very high with a long duration of stay. The typical duration of stay at the Glenroyal Hotel and Glenroyal Shopping Centre/SuperValu car parks was much

[12] This carpark had a capacity of 130 recorded in the 2016 Parking Surveys, but the southern half of the former area is not currently accessible, while the northern half has been formalised as a carpark with new surface and space markings.

lower, with most customers staying less than one hour. Occupancy of the car park at the front of SuperValu was high for much of the day, but there was significant capacity remaining in the car park at the rear of the shopping centre throughout most of the day. Occupancy of the KCC car park on Doctors Lane was very high all day and most drivers stayed less than two hours. The two car parks off Leinster Street were underutilised compared to other car parks, with a large amount of spare capacity available throughout the day. A large proportion of drivers stayed in these car parks for less than one hour.

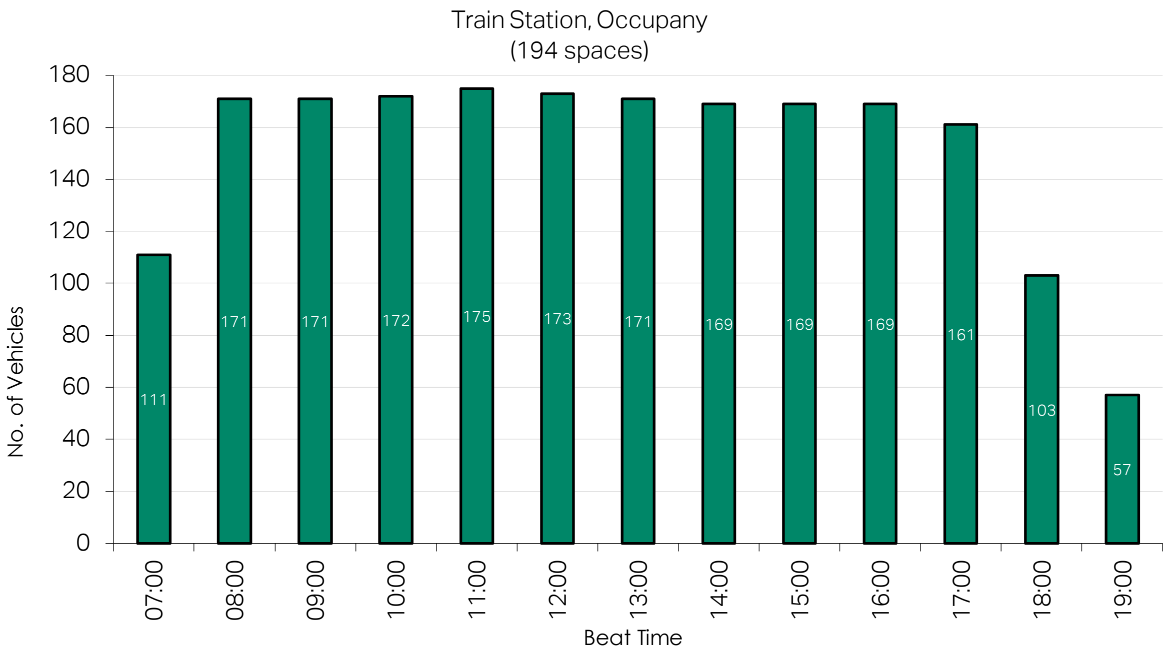


Figure 6-5 Train Station, 2016 Parking Survey, Occupancy

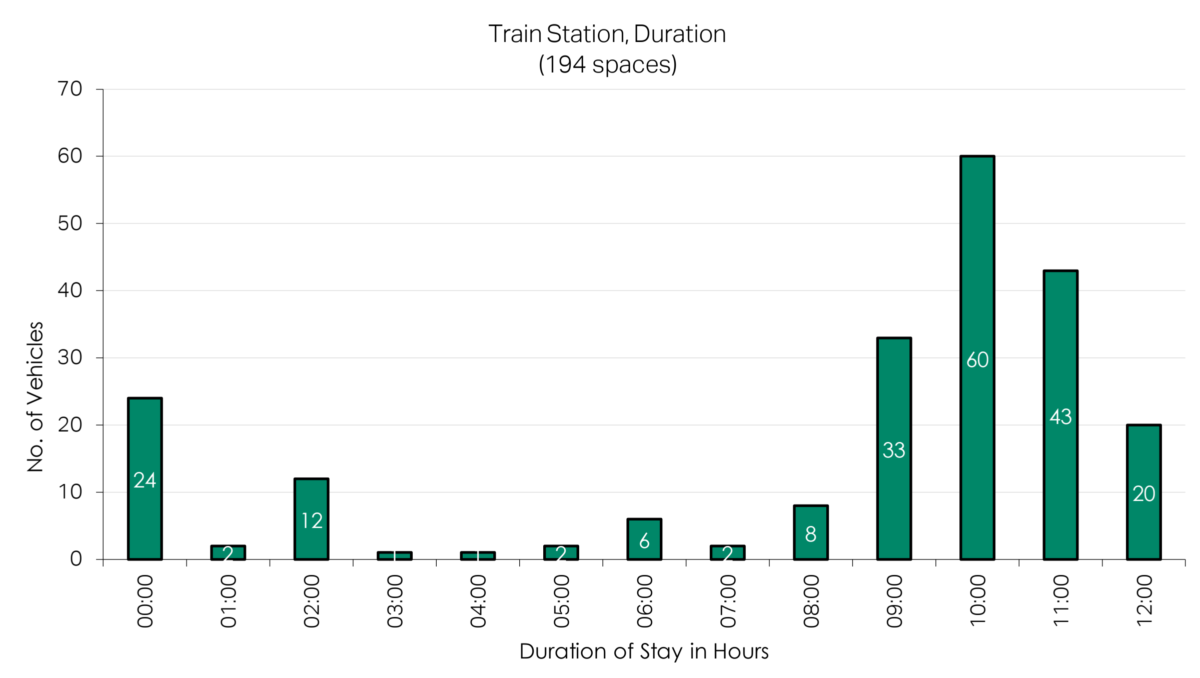


Figure 6-6 Train Station, 2016 Parking Survey, Duration

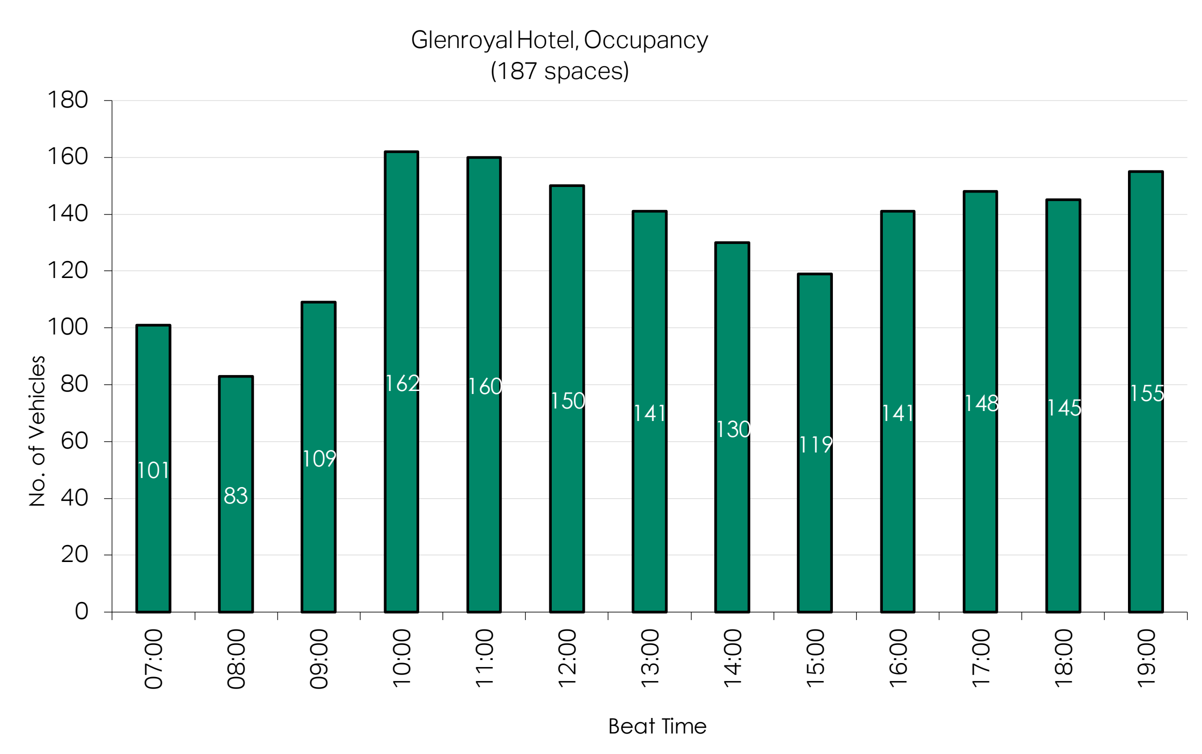


Figure 6-7 Glenroyal Hotel, 2016 Parking Survey, Occupancy

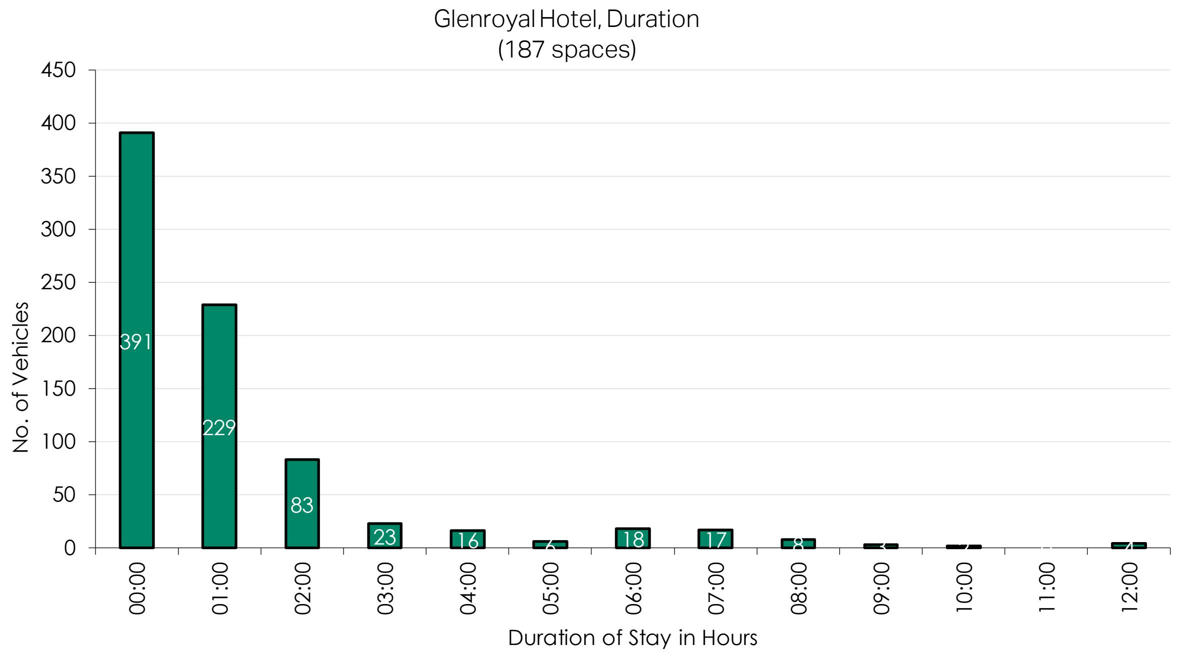


Figure 6-8 Glenroyal Hotel, 2016 Parking Survey, Duration

Figure 6-9 SuperValu (front), 2016 Parking Survey, Occupancy

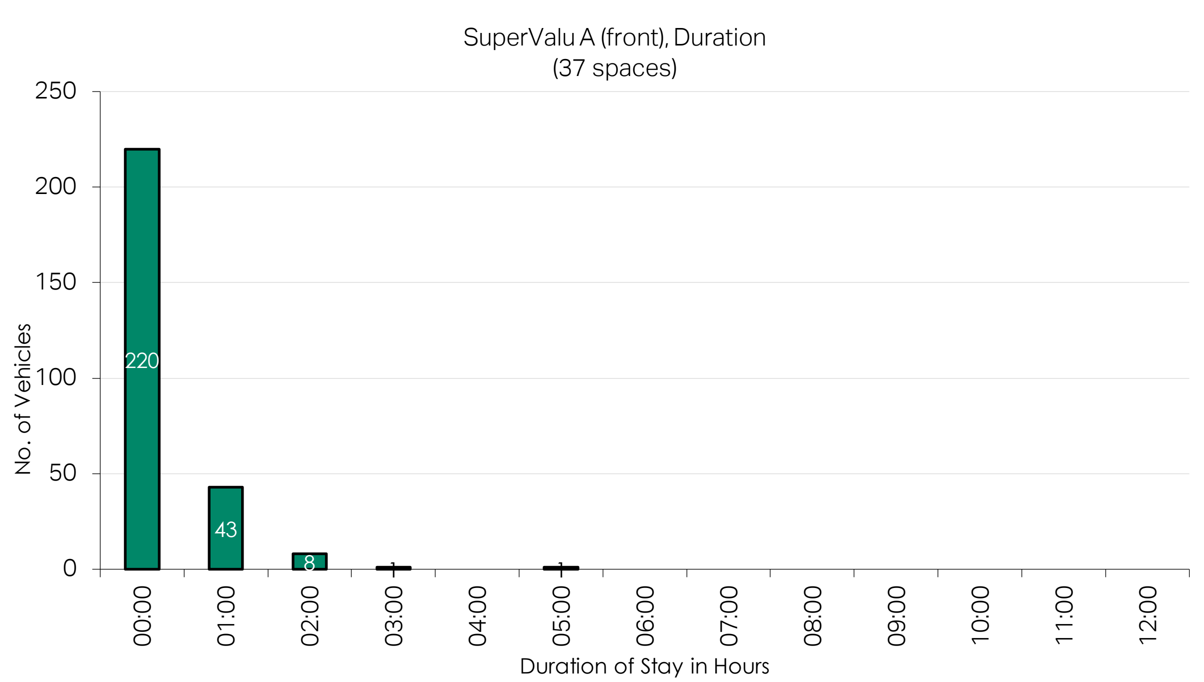


Figure 6-10 SuperValu (front), 2016 Parking Survey, Duration

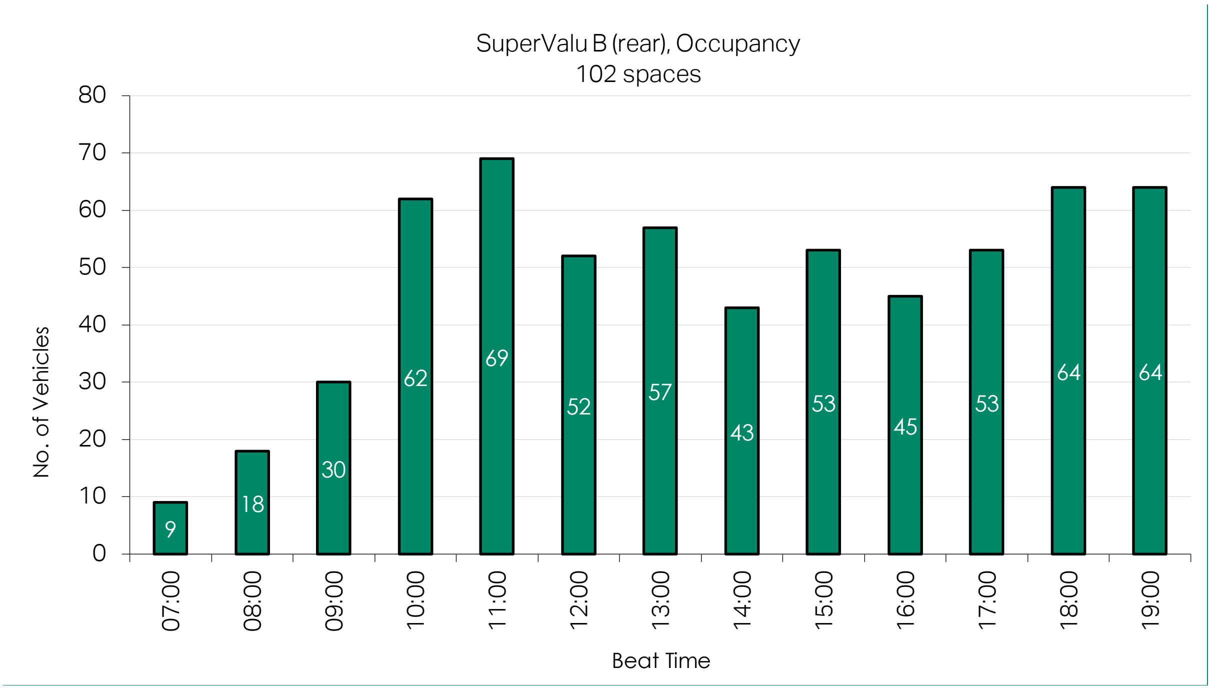


Figure 6-11 SuperValu (rear), 2016 Parking Survey, Occupancy

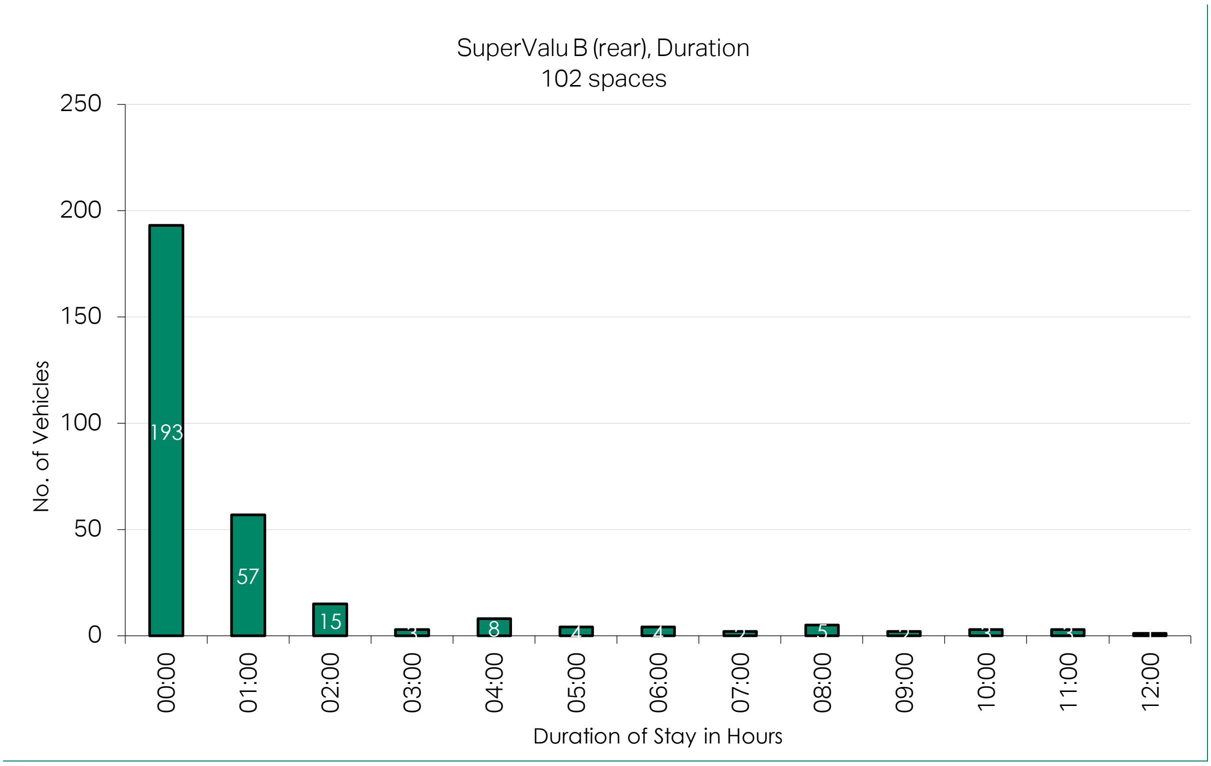


Figure 6-12 SuperValu (rear), 2016 Parking Survey, Duration

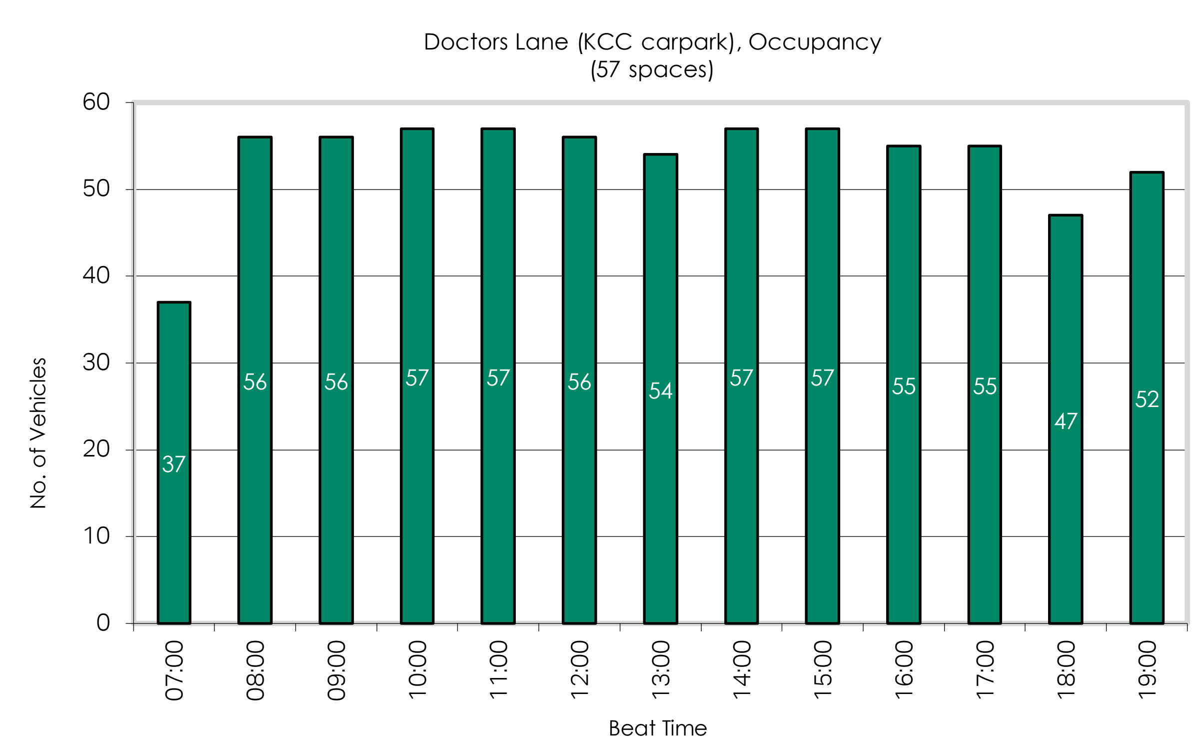


Figure 6-13 Doctors Lane (KCC Carpark), 2016 Parking Surveys, Occupancy

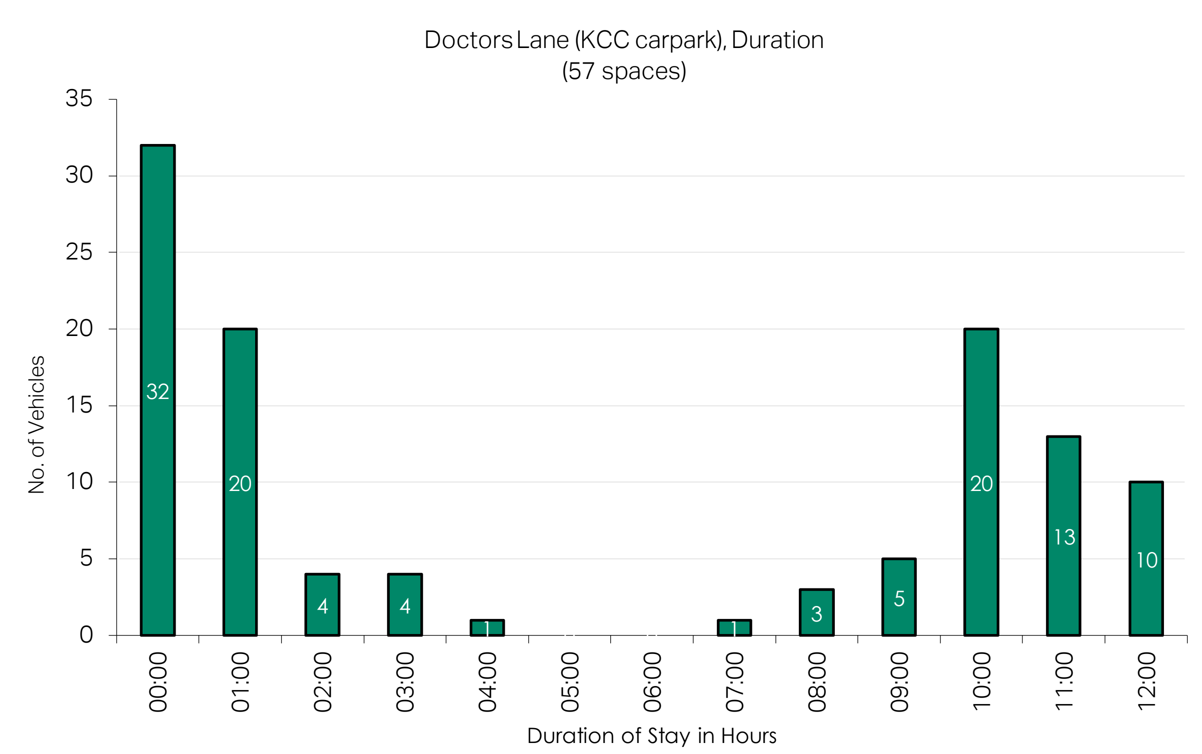


Figure 6-14 Doctors Lane (KCC Carpark), 2016 Parking Surveys, Duration

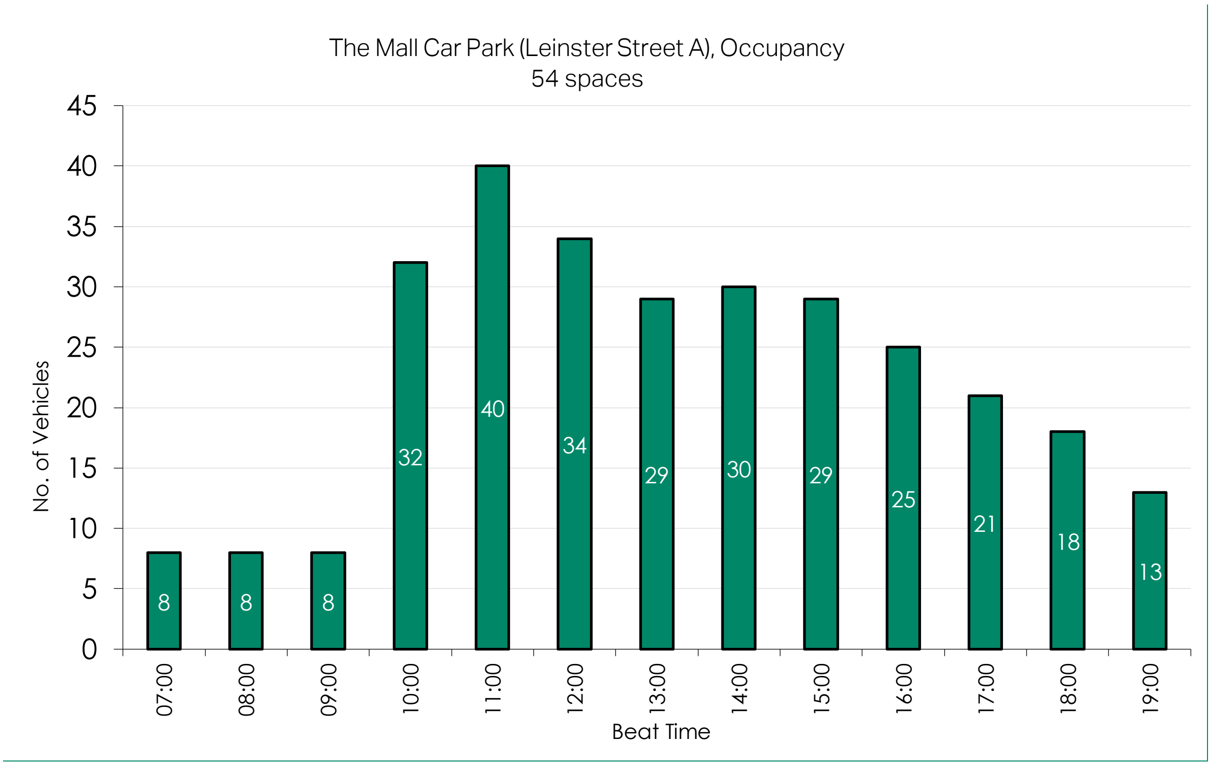


Figure 6-15 The Mall Car Park, 2016 Parking Surveys, Occupancy

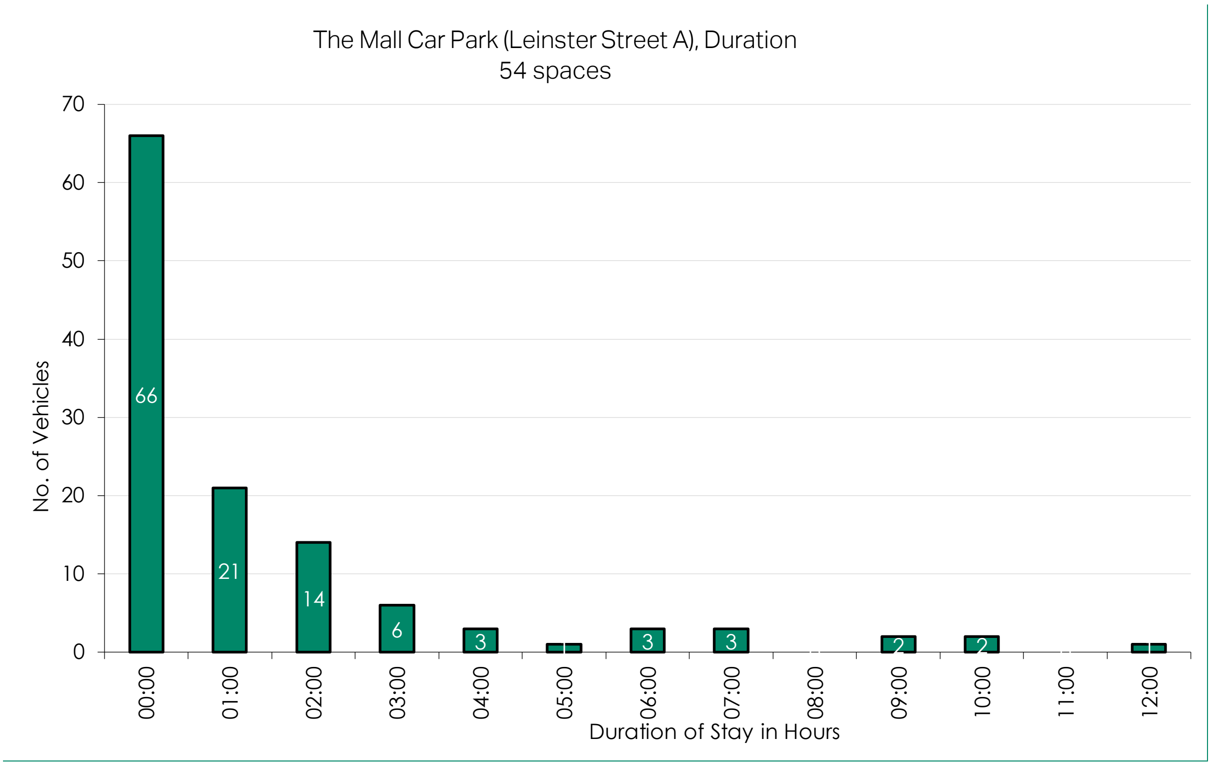


Figure 6-16 The Mall Car Park, 2016 Occupancy Surveys, Duration

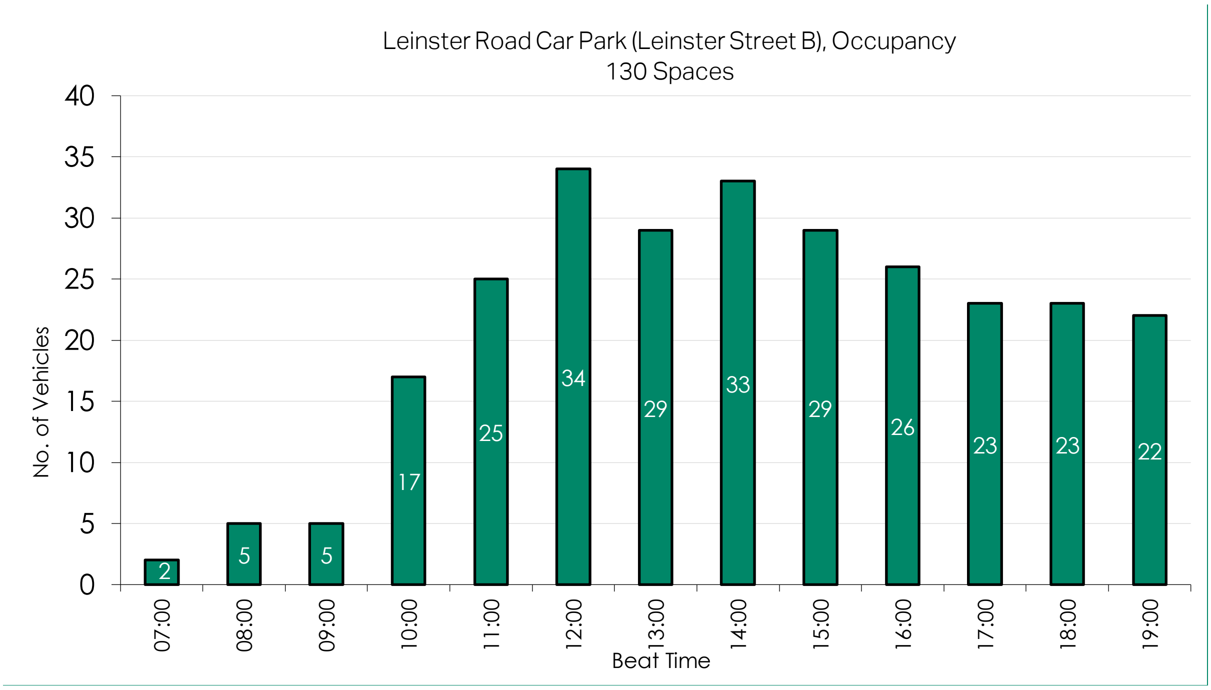


Figure 6-17, Leinster Road Car Park, 2016 Parking Surveys, Occupancy

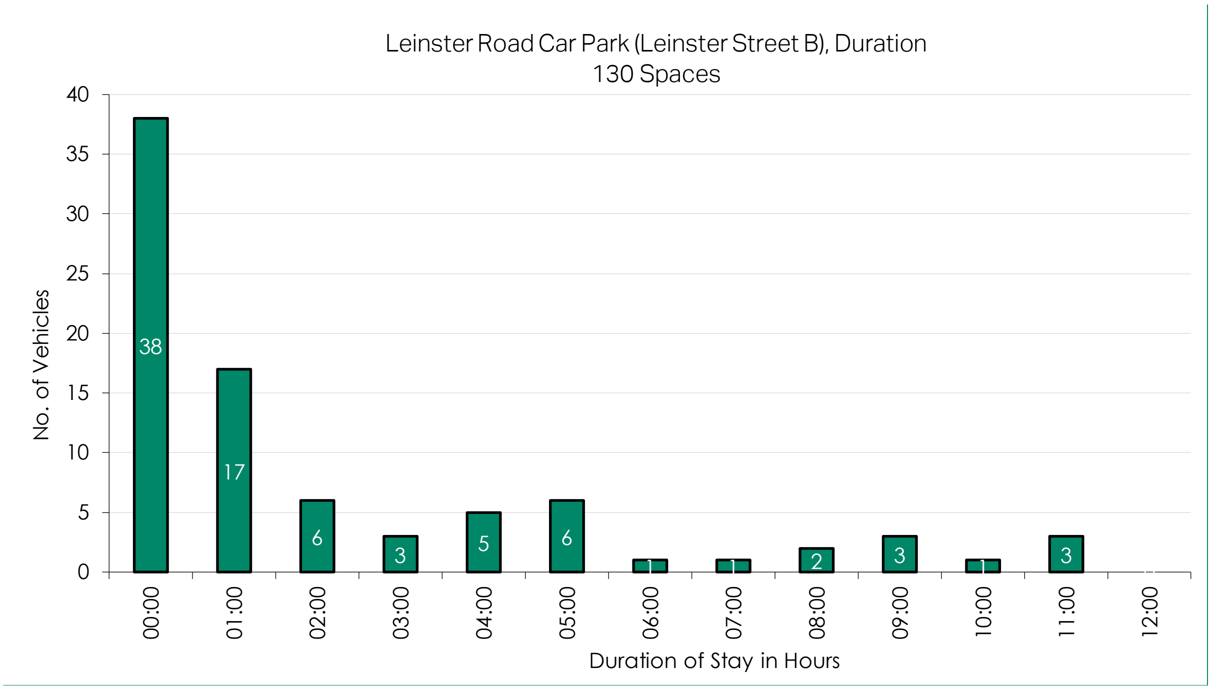


Figure 6-18 Leinster Road Car Park, 2016 Parking Surveys, Duration

6.2.3 Parking Signage Survey

The parking signage survey considered signage on the main approach roads and within the town centre. As shown in Figure 6-21, there are identical large signs on all major approach roads to the town highlighting that a ‘pay and display’ regime is in operation. However, there are no signs to direct drivers to off-street car parks. This may be partly due to the fact that only one of the off-street car parks, (Doctors Lane, accessed from Straffan Road) is within the control of Kildare County Council. This car park shares an access road from Straffan Road with the larger Glenroyal Hotel / Glenroyal Shopping Centre car park.

The very large number of on-street car parking spaces designated within the town centre have resulted in a requirement for a significant quantity of accompanying signage to indicate where parking is possible, or not, and what maximum stay is in operation. This is a contributor to street clutter which negatively impacts the public realm and makes walking more difficult as shown in Figure 6-19 and Figure 6-20.

Figure 6-19 Mill Street

Figure 6-20 Dunboyne Road

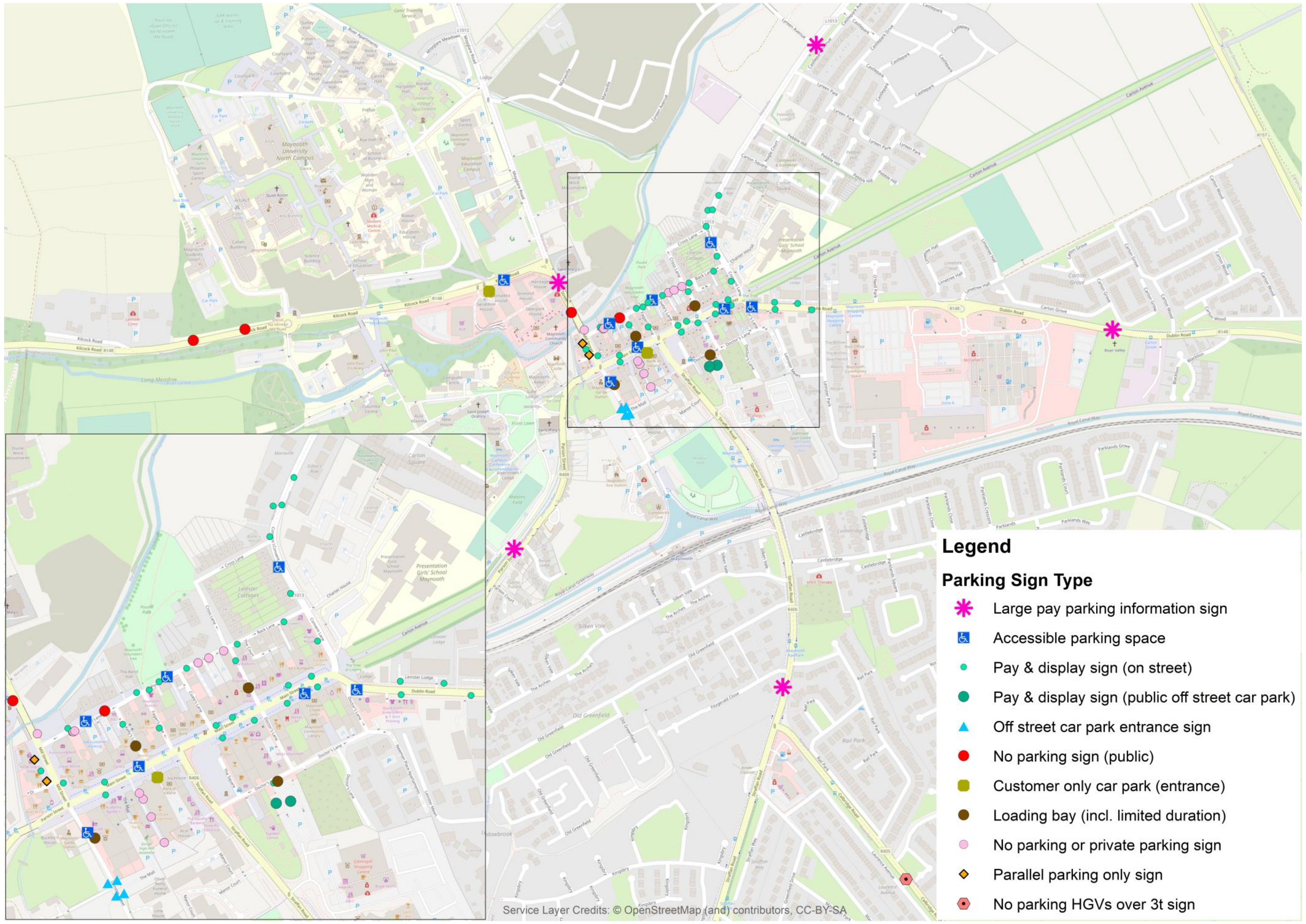


Figure 6-21 Maynooth Parking Signage

6.2.4 Parking Enforcement/Offences

The parking section of KCC were consulted in relation to parking non-compliance in Maynooth. There are considered to be no individual specific hot spots within the town with regard to parking non-compliance. However, a total of 2,406 parking offences were recorded by the enforcement section in Maynooth between the 1st of January 2021 and the 4th of October 2021. The majority of these offences, 71%, related to non-display of current motor tax or parking without a valid parking permit or pay & display ticket (1,710 offences). The remainder, 29% (696 offences), involved various forms of prohibited or restricted parking which could represent an obstruction or danger to other road users, such as parking within 5 metres of a junction or parking on a footway or double yellow line. A full breakdown of the recorded parking offences in Maynooth is provided in Table 6-2.

Table 6-2 Maynooth – Total Parking Offences from 01/01/2021 to 04/10/2021

Parking Offence	Number of parking offence	% of all offences committed
Not Parking within limits of a parking bay	67	2.78
Parking a vehicle within 5 metres of a road junction	1	0.04
Parking a vehicle in a prohibited place	27	1.12
Parking a vehicle obstructing other traffic	27	1.12
Parking a vehicle on a cycle track	37	1.54
Parking a vehicle on a double yellow line	84	3.49
Parking a vehicle on a footway	105	4.36
Parking a vehicle on a grass margin	1	0.04
Parking a vehicle on a single yellow line during a prohibited time	9	0.37
Parking or stopping a vehicle on a clearway	3	0.12

Parking Offence	Number of parking offence	% of all offences committed
Parking a goods vehicle in a loading bay for over 30 mins	18	0.75
Parking a non-goods vehicle in a goods vehicle loading bay	15	0.62
Parking a vehicle in a taxi stand	150	6.23
Parking or stopping a vehicle in a disabled person's parking bay	43	1.79
Parking a vehicle within a stopping place or stand or bus stop	109	4.53
Non display of current road tax	1058	43.97
Pay & Display / Permit parking area offence	652	27.10
Total	2406	100.00

6.3 Active Mode Survey

The walking catchment areas for the main services and destinations in Maynooth have been outlined in the permeability assessment in Section 4.5.2. This section presents additional information on the quality of walking and cycling infrastructure, as well as a review of existing pedestrian demand.

6.3.1 Pedestrian Footpath Infrastructure

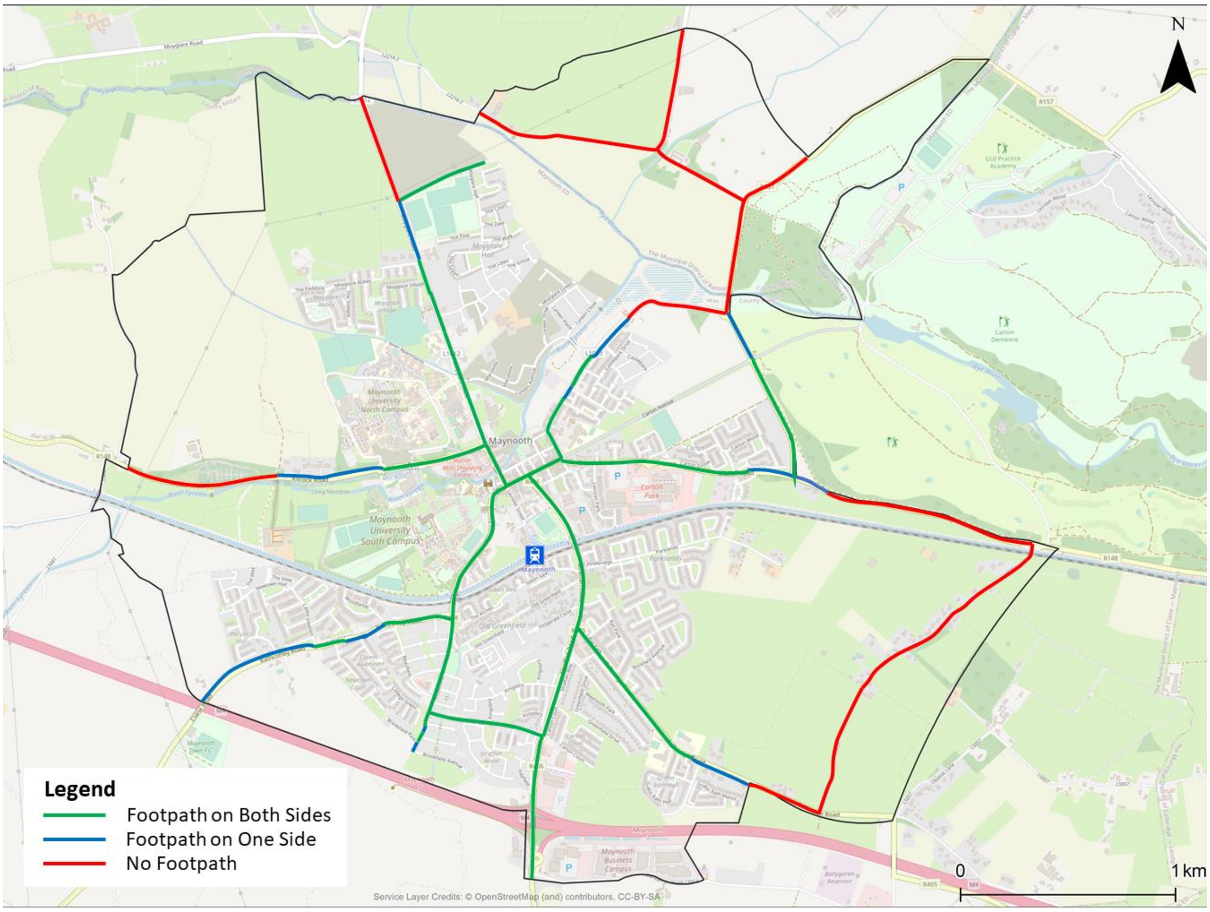


Figure 6-22 illustrates the findings of the survey of footpaths on the main approach roads and in the town centre. As shown, most roads assessed have a footpath on either one side or both sides of the road. The roads which lack footpaths are generally located on the outskirts of the town and would generally be catering for lower volumes of pedestrians. However, it will be important to consider whether a footpath should be added at these locations to facilitate future development areas or key desire lines.

There are a significant number of roads within the study area which have an existing footpath on only one side of the road. In many cases, this is adequate based on existing development patterns and desire lines, but there may be some instances where an additional path, or an additional crossing would allow for easier access. For example, the Rathcoffey Road does not have a continuous footpath available on either side of the road despite being the only access road for the surrounding estates to access Maynooth town centre. A comprehensive survey of path widths is outside the scope of this study. However, it should also be noted that many paths within the study area appear to be narrower than desirable based on current design standards and/or are in poor condition.

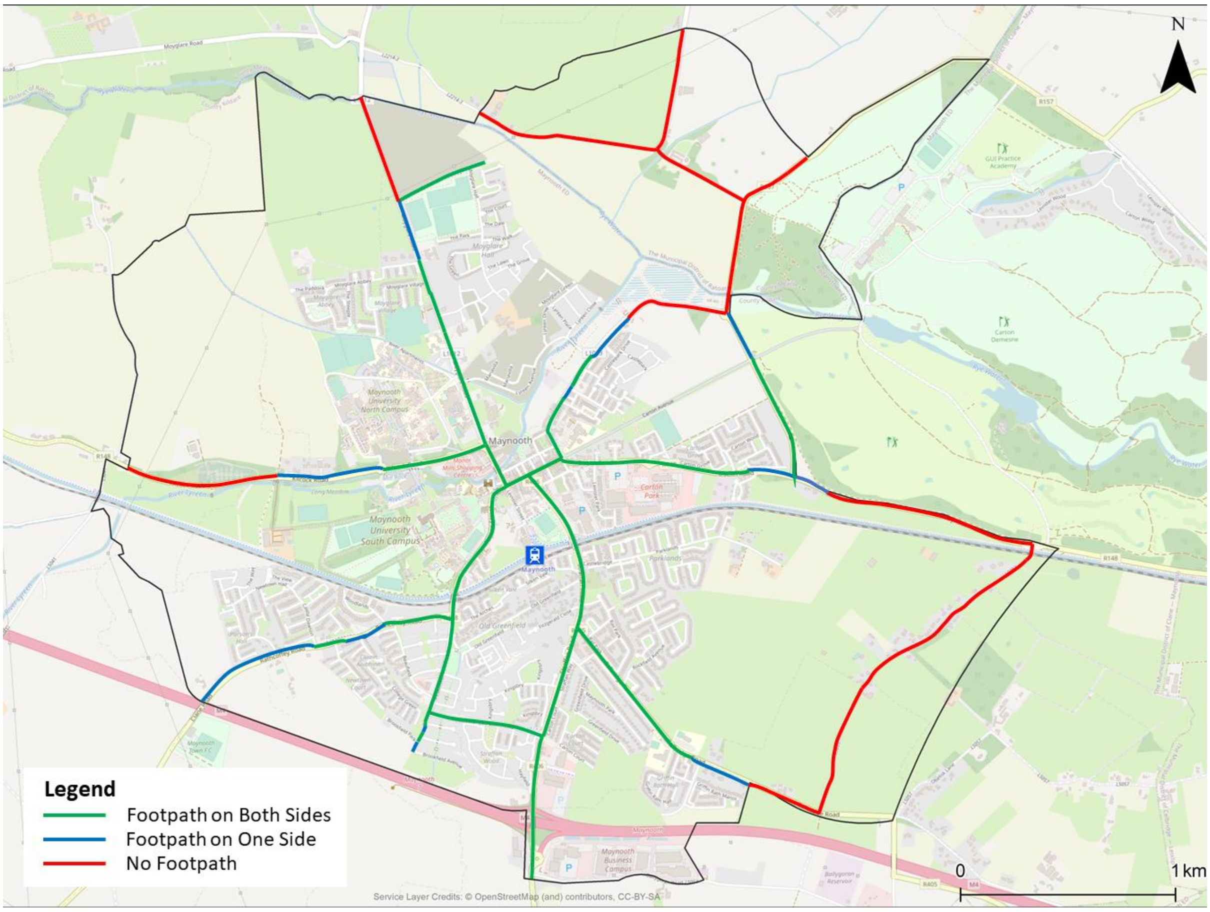


Figure 6-22 Footpath Survey

6.3.2 Pedestrian Crossing Facilities

A survey of pedestrian crossing facilities was completed on the main roads to and around the town and within the town centre. The survey encompassed formal crossing facilities – i.e., toucan crossings, signalised pedestrian crossings and zebra crossings. The survey was updated in January 2022, as some new crossing facilities identified in the earlier survey were not yet operational at the time.

Figure 6-23 shows the crossing facilities identified within the study area. Toucan crossings, shown in purple, are intended for use by both pedestrians and cyclists. As shown, most formal crossing facilities within the study area are signalised crossings. The only zebra crossings identified were two near the Main Street/Dublin Road junction and three at the roundabout between the new Maynooth Education Campus and Moyglare Hall.

There are a number of roads and junctions within the study area where there are no formal pedestrian crossing facilities and some places where there are facilities on one or two arms of a junction, but not all potential pedestrian desire lines. Some of the areas which stand out as lacking in pedestrian or pedestrian and cyclist crossing facilities are the area around Carton Retail Park, the M4/Straffan Road junction and the junction of Meadowbrook Road/Parson Street and Newtown Road.

On Celbridge Road, close to the two primary schools (shown in yellow on the map), a toucan crossing has been installed but was not operational during the most recent site visit. However, there are also zebra crossing beacons at the same location which were operational.

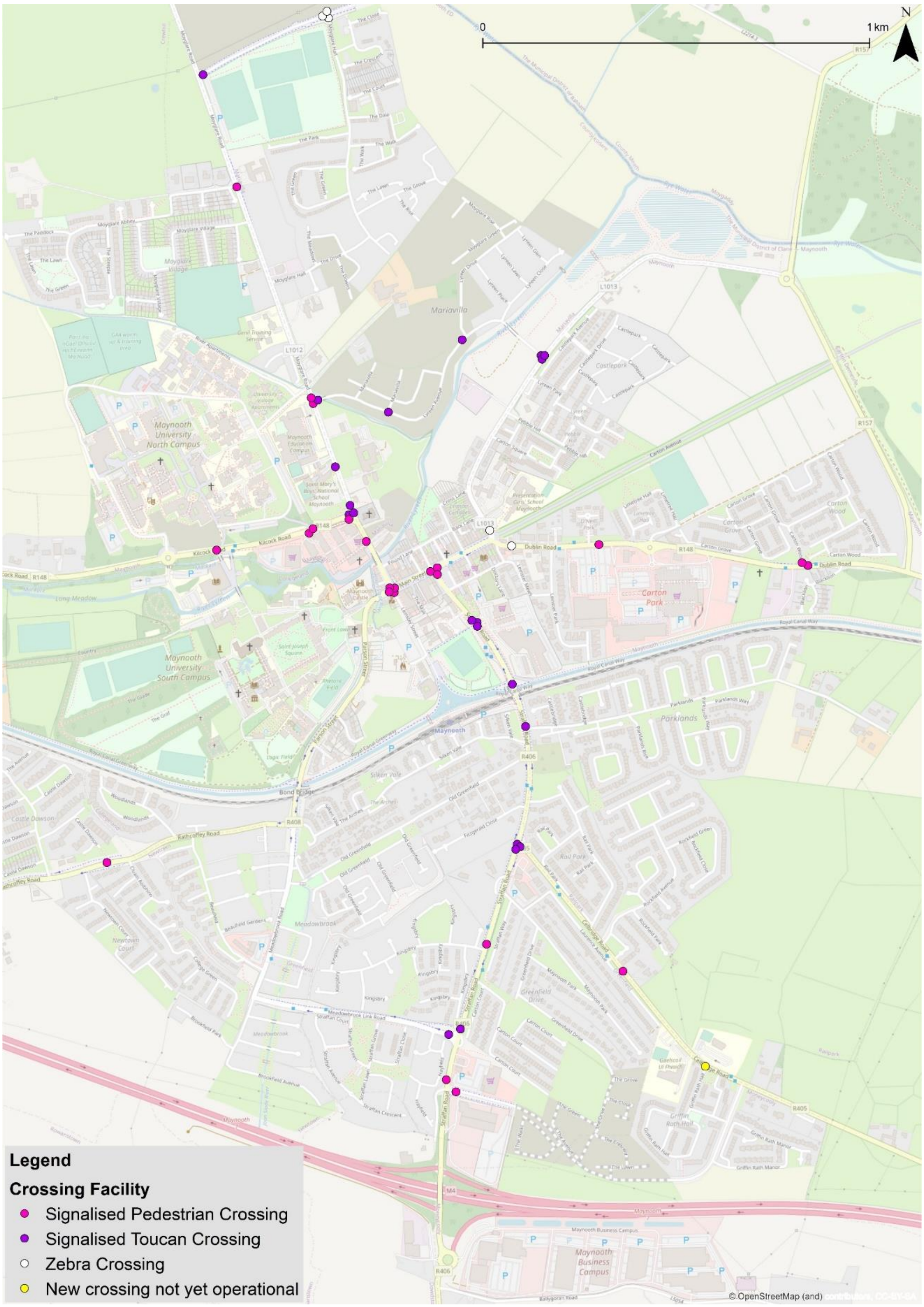


Figure 6-23 Crossing Facilities

6.3.3 Existing Cycling Infrastructure

Figure 6-24 shows that there is a substantial amount of existing cycling infrastructure in Maynooth. However, the quality of this existing infrastructure varies significantly.

The Royal Canal Greenway connects Maynooth to Kilcock and beyond. However, only a short section of this route close to Maynooth currently has a paved surface and public lighting, with the remainder having an unbound surface which is more difficult to cycle and generally not preferred by cyclists. The Royal Canal towpath connects to Leixlip and beyond in the opposite direction and is used by some cyclists, but this cannot be considered existing cycling infrastructure as it is not yet upgraded to a Greenway standard, it is narrow and has a very uneven surface.

There is a shared walking and cycling facility on Moyglare Road between Kilcock Road and the new schools to the north. As outlined in the previous chapter, many negative comments were received about this facility as part of the public consultation, as it is not ideal for such a busy facility to be shared between people walking and cycling. On Main Street, there is a much older shared walking and cycling facility, encompassing a cycle lane painted onto the existing footpath. During site visits it was observed that this cycle facility could only be used safely at walking speed.

Cycle facilities on the northern part of Straffan Road were upgraded in the last number of years to modern design standards and are now substantially segregated from vehicular traffic and from pedestrians. However, south of the junction with Celbridge Road, a large proportion of this link on both sides consists of a shared pedestrian/cycling path.

On the Dublin Road, there is a segregated cycle track on the north side of the road between O'Neil's Park and the R157 junction. However, this is only suitable for eastbound cyclists and there is no cycle facility in the opposite direction.

The recently opened Lyreen Avenue has mainly segregated cycle tracks on both sides of the road and all crossings in this area are Toucan crossings. However, there are extensive areas of 'shared use' surface on either side of all crossings, as well as on and around the bridge over the Lyreen River.

There are segregated cycle tracks on Mullen Park Road. At the western end, these consist of older facilities which have not yet been upgraded. The section to the east which is being delivered in conjunction with residential development is substantially complete on the north side of the road but with work still required at junctions/side roads as there are high kerbs at these locations currently.

There are unsegregated painted cycle lanes on the western part of the Kilcock Road and close to the junction with the Moyglare Road. While the cycle lanes in the immediate proximity of the junction are reasonably wide, west of this the cycle lanes on both sides are narrow and have ‘advisory’ status (meaning that vehicular traffic can enter the space).

There is also an advisory cycle lane on Straffan Road, from close to the junction with Mullen Park Road / Lidl to the northern side of the Meadowbrook Road junction. There is a long left turn lane for vehicular traffic at this location and this means that cyclists going straight need to cycle in between two lanes of traffic and are also at risk from vehicles crossing the cycle lane to access the left turn lane.

There is a short section of cycle track on Parson Street, but this starts and ends abruptly at both ends. There are very old sections of cycle track at Griffin Rath Manor and Newtown Road which require substantial upgrade/redesign. There is a cycle track on most of Meadowbrook Link Road which also starts and ends abruptly at either end as well as at side roads.

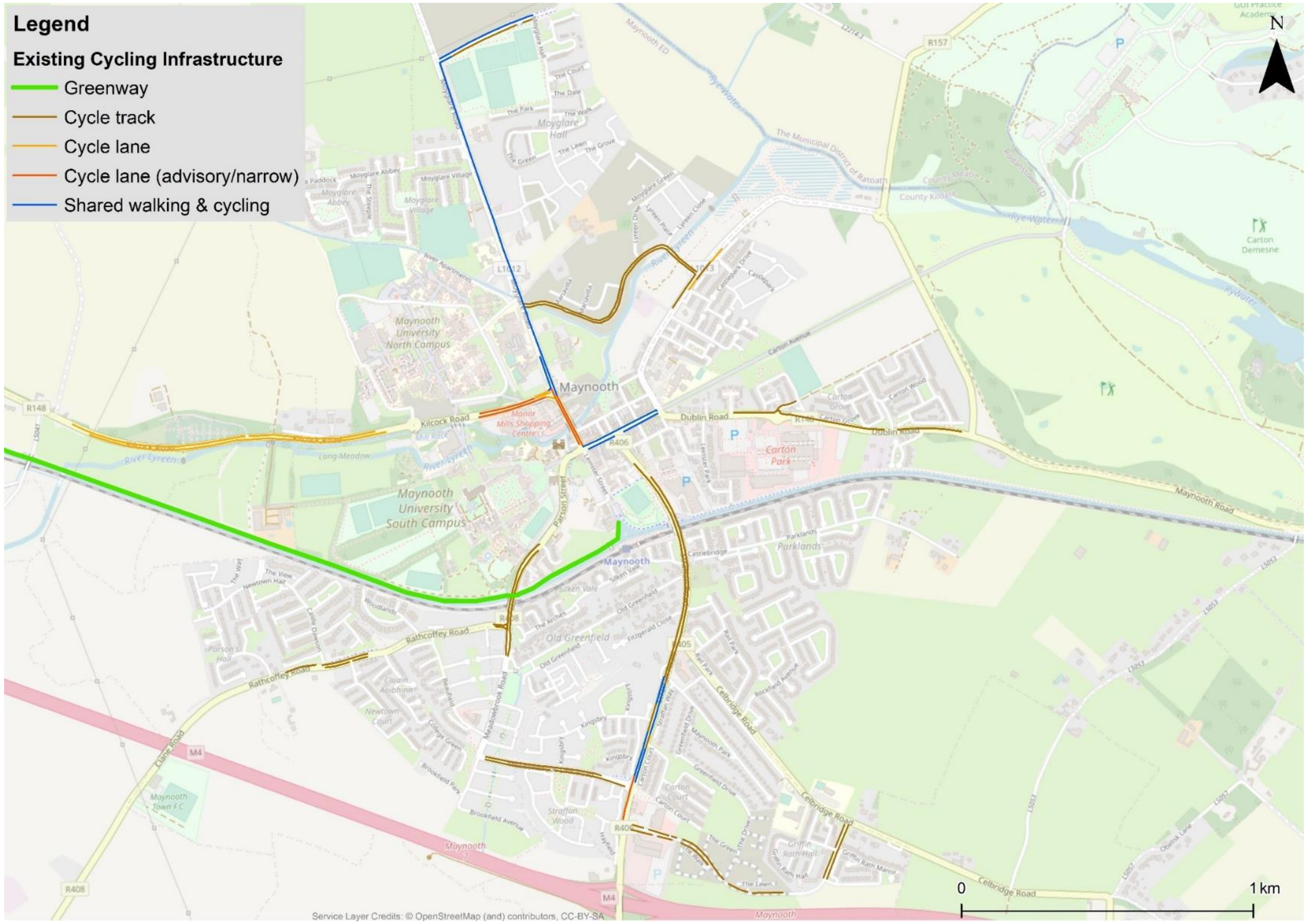


Figure 6-24 Existing Cycling Infrastructure

6.3.4 Cycle Parking Facilities

An absence of convenient and adequately secure cycle parking at all types of destinations presents a significant barrier to cycling. Different types of cycle parking solutions are typically required at different locations and in some cases, a variety of different cycle parking solutions are required at the same location to accommodate different cycle parking duration or types of users. However, the most basic requirements of all cycle parking facilities are that they should be capable of supporting the frame of the cycle and preventing it from falling over; protecting the cycle against theft and allowing the cyclist sufficient room to position and lock the cycle. In addition, consideration should be given to protection against weather, lighting, ease of access and additional requirements at public transport.

A cycle parking survey was undertaken as part of the site visit completed in October 2021 to assess current provision of cycle parking within Maynooth. The survey encompassed most of the key destinations within the town with the main exception being the university and private workplaces. A summary of existing cycle parking provision identified by the survey is outlined in Table 6-3. Overall, this shows a need to significantly enhance public cycle parking provision throughout the study area.

Table 6-3 Existing Cycle Parking

Destination Type	Destination	Cycle Parking
Public Transport	Train station	Set of stands which are partially sheltered (the shelter has a roof but no sides as shown in Figure 6-25). The stands are lower than usual and spaced quite closely together. During the site visit it was observed some cyclists opted to use railings instead. There are also secure lockers operated by BikeLocker.ie but these must be reserved and paid for by individuals on an ongoing/long term basis. Pricing or details of current availability not found on website.
	Bus stops	Four stands (not sheltered) near two bus stops opposite Glenroyal Hotel. Main Street bus stops each have two adjacent stands (not sheltered) No cycle parking at other bus stops
Schools	Maynooth Post Primary School/ Maynooth Community College /	Good quality cycle parking shelters but schools reported these were already at or close to capacity in September 2021, so more cycle parking is likely to be required soon
	Gaelscoil Ruairí	Poor quality 'wheel grip' stands, no shelter
	Gaelscoil Uí Fhiaich	Poor quality 'wheel grip' stands, some shelter
	Maynooth Educate Together	One new shelter with good quality cycle parking stands, also poor quality 'wheel grip' stands adjacent to this which are unsheltered
	Presentation Girls N.S.	No cycle parking visible from main entrance
	Maynooth Boys N.S.	Only poor quality 'wheel grip' stands visible from entrance, but more cycle parking will be provided as part of ongoing building project
Retail	Main Street	Individual stands are well distributed all along Main Street. However, some are located too close to the road carriageway/parking and a few are bent out of shape.
	Carton Retail Park	Poor quality 'wheel grip' stands There are also a small number of secure bike lockers operated by CycLok, but these cost €1/hour or €3 for 12 hours to use.
	Glenroyal Shopping Centre/ SuperValu	No cycle parking visible
	Manor Mills	Poor quality very small 'wheel grip' stands as shown in Figure 6-26
	Lidl, Straffan Road	No cycle parking visible

Desination Type	Destination	Cycle Parking
Retail	Greenfield Shopping Centre, Straffan Road	No cycle parking visible
	Aldi, Kilcock Road	Good quality cycle stands available, but they are positioned too close together for both sides to be used
Community Facilities/Leisure Destinations	Harbour Field	Good quality cycle stands on both sides of Harbour Field (Straffan Road and Leinster Street/Canal Basin), but none are sheltered
	Glenroyal Hotel	Poor quality 'wheel grip' stands

Figure 6-25 Cycle Parking at Train Station

Figure 6-26 Cycle Parking at Manor Mills Shopping Centre

6.3.5 Walking Demand Assessment

This section identifies the key trip producers and attracters for walking trip desire lines, as well as the demand for walking trips for travel to work and education by residents of the study area within the 2016 Census data. The number of people walking to bus and rail from different areas across the town are also assessed.

6.3.5.1 Key Trip Attractors and Producers in Maynooth

To assess the walking demand in Maynooth, the main origins and destinations were identified. The origins are primarily residential dwellings, which were identified using GeoDirectory. The origins include residential buildings and also buildings marked as ‘both’, which are combined residential and commercial buildings. The destinations identified include the following locations in Maynooth:

- Primary Schools;
- Secondary Schools;
- Third Level Institutions
- Supermarkets
- The Town Centre;
- Train Station;
- Bus Stops; and
- Maynooth Business Campus

Figure 6-27 shows these key origins and destinations within the study are

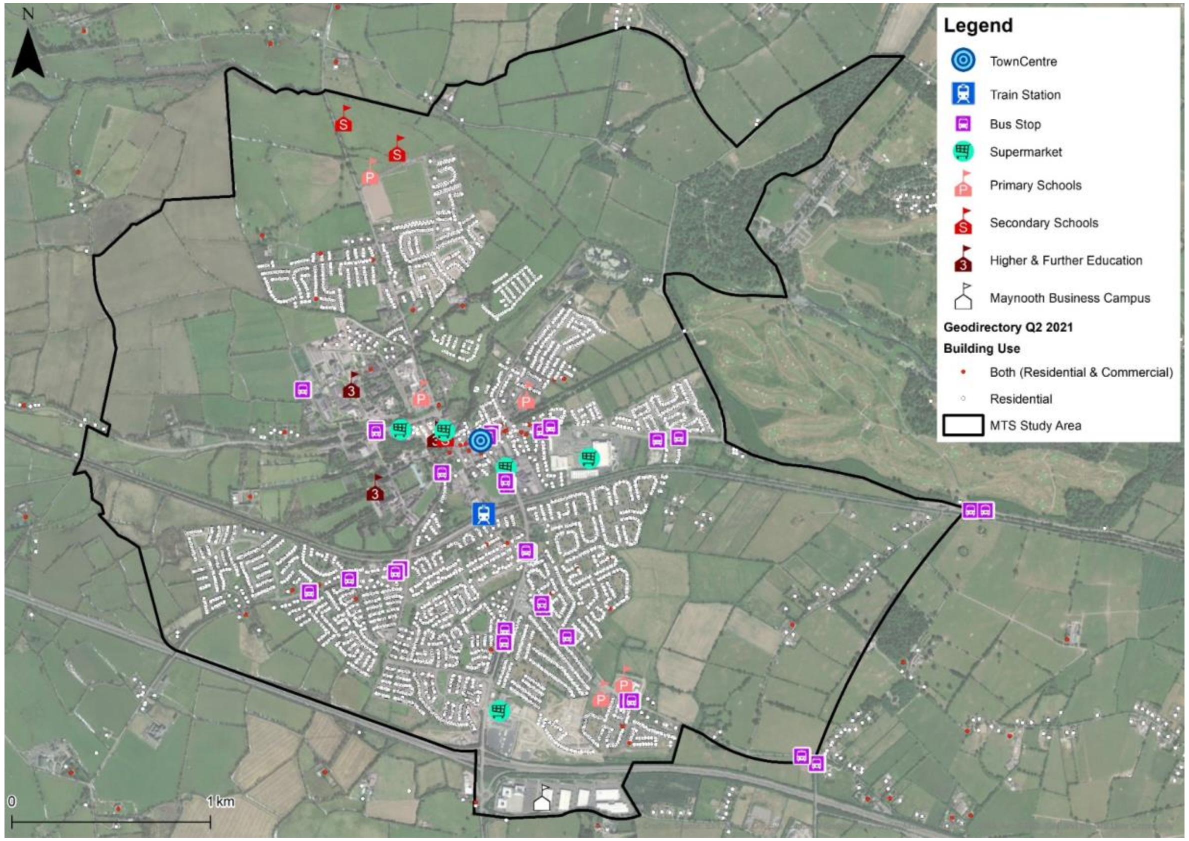


Figure 6-27 Overview of Main Origins and Destinations within Maynooth

6.3.5.2 Walking to Education

Figure 6-28 shows the number of people who usually walked to education in Maynooth at the time of the 2016 Census. The number of people walking from the small areas within the study area ranges from none to a maximum number of 265. There are two small areas in the southwest of the town where there were an extremely low number of pupils or students walking to school or third level education, which is likely to relate to the distance of these areas from relevant education destinations and a lack of crossing points of the Royal Canal and train line which are close to the northern boundary of these areas.

As noted elsewhere in this report, the new school campus in the north of Maynooth was not open at the time of the 2016 Census. Therefore, it is likely that a lower proportion of pupils living in areas south of the town centre are now walking to school than previously.

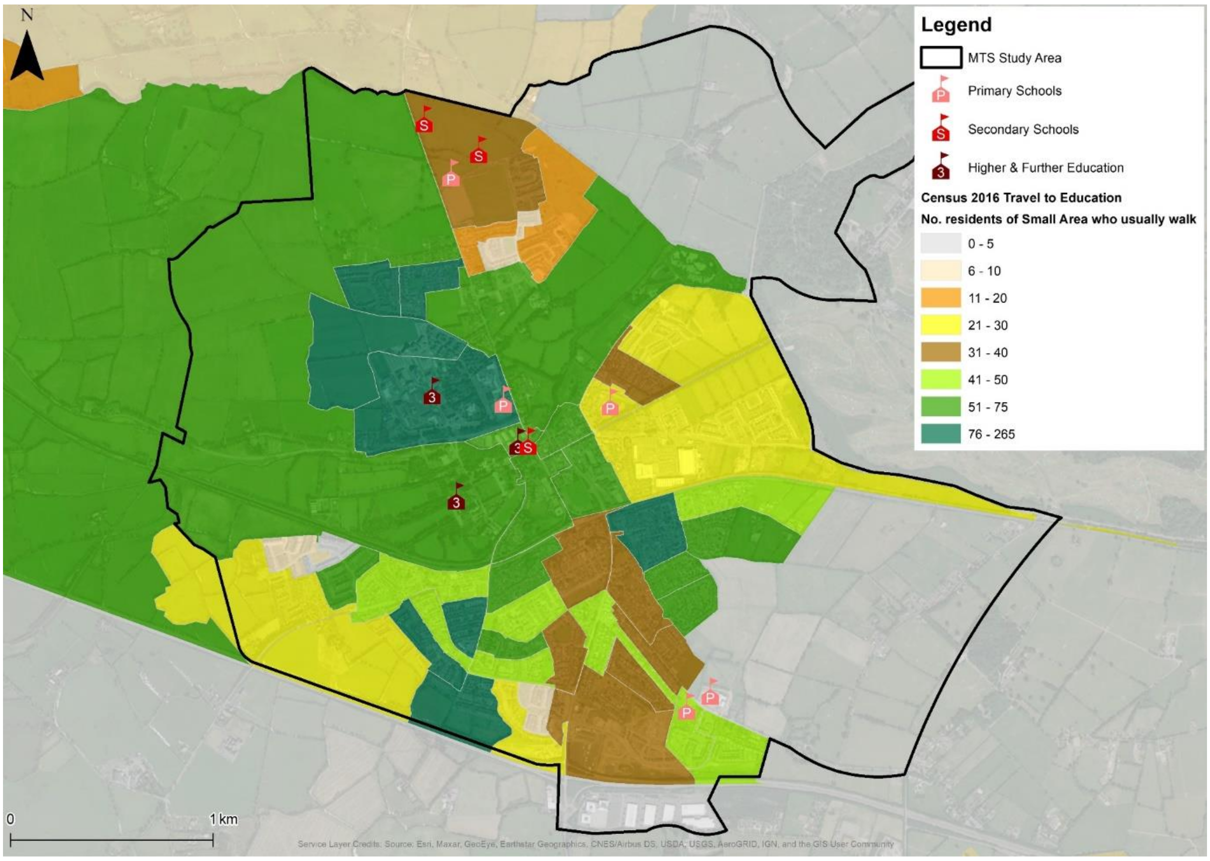


Figure 6-28 2016 Number of People Walking to Education from CSO Small Area

6.3.5.3 Walking to Work

Figure 6-29 shows the number of people in each CSO Small Area who usually walked to work at the time of the 2016 Census. The two small areas where the largest number of people walked to work are both located within the town centre, with the majority of their area being north of Main Street. There is a large residential area in the southwest of the study area, south of the Royal Canal and train line, where very few people walked to work. If walking distance to the university campus and/or the town centre could be reduced from this area through permeability improvements and the creation of additional crossing points over the Royal Canal, there may be potential to increase the number of people walking to work from this area.

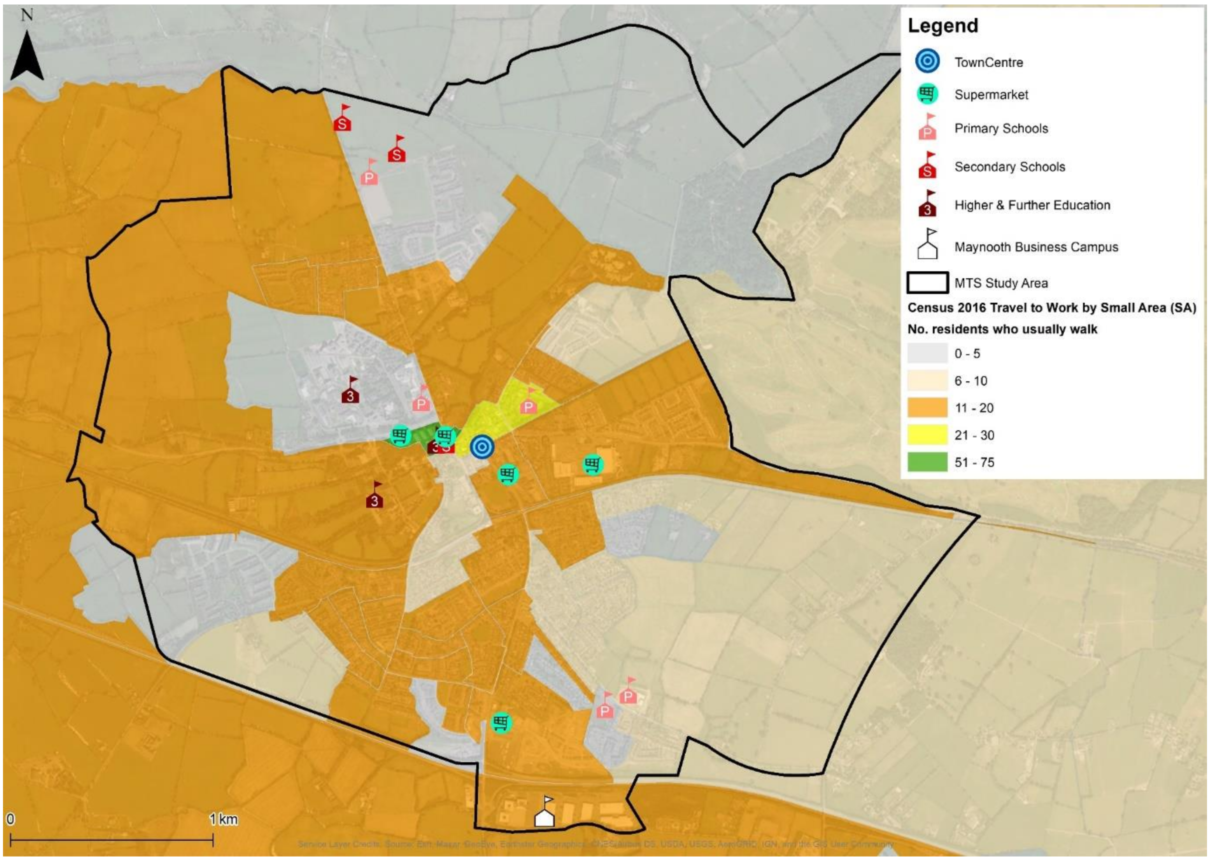


Figure 6-29 2016 Number of People Walking to Work from CSO Small Area

6.3.5.4 Walking to Public Transport

Figure 6-30 shows the number of people who usually travelled to work by train from each CSO Small Area at the time of the 2016 Census. This shows that a large volume of people walk to the train station from across all residential areas of the town, but particularly from the housing estates to the south of the train station. This map shows the importance of improving walking links to the train station and enhancing permeability through urban areas to ensure that people have the shortest possible trip distances on foot, which will make walking to rail more appealing.

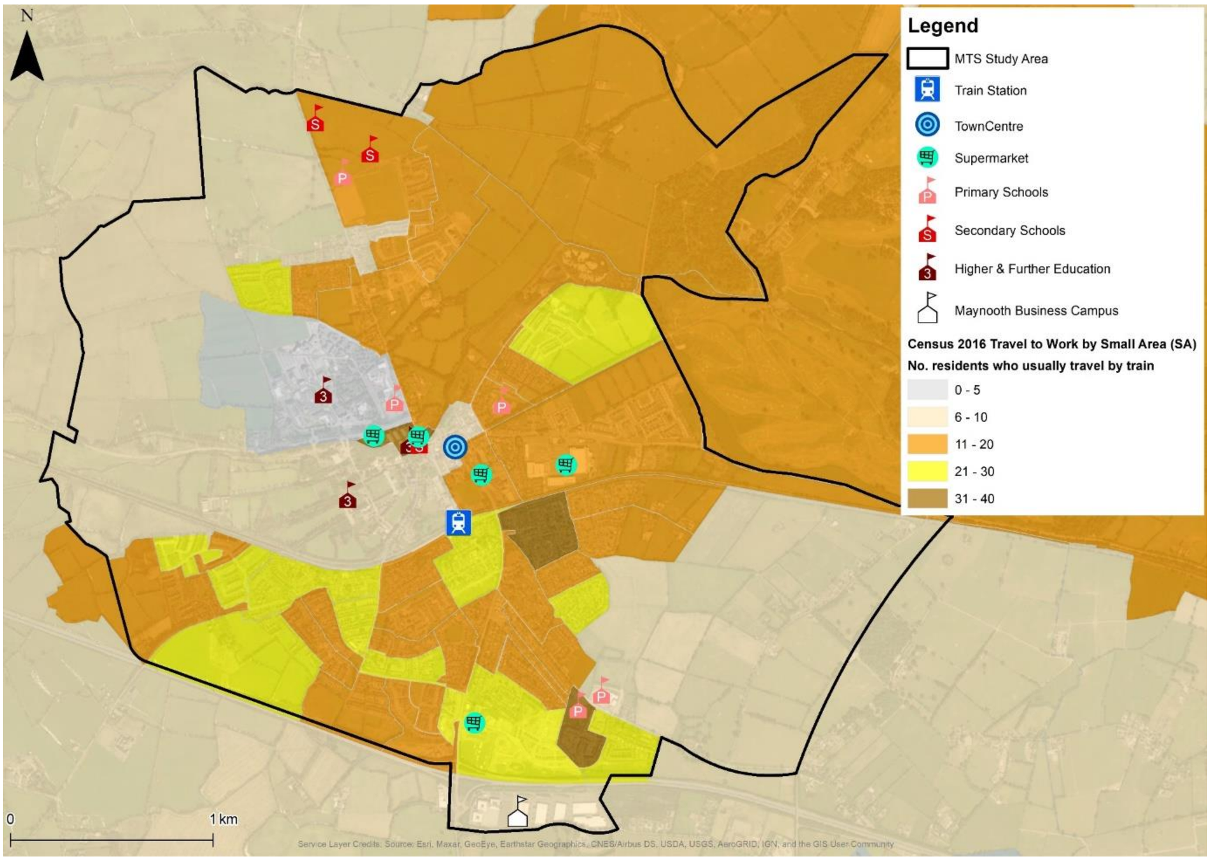


Figure 6-30 2016 Number of People Travelling to Work by Train from CSO Small Area

Figure 6-31 shows the number of residents who usually travelled to work by bus at the time of the 2016 Census. Unsurprisingly, there are greater numbers of people walking to bus stops from areas which are located in closer proximity to bus stops, with the higher numbers concentrated in the east and south of the town. In the north of the town, where there are no bus services, very few people are using the bus to get to work. The relatively low numbers of people walking to nearby bus stops along the Straffan Road and Rathcoffey Road may highlight potential issues with permeability to bus stops.

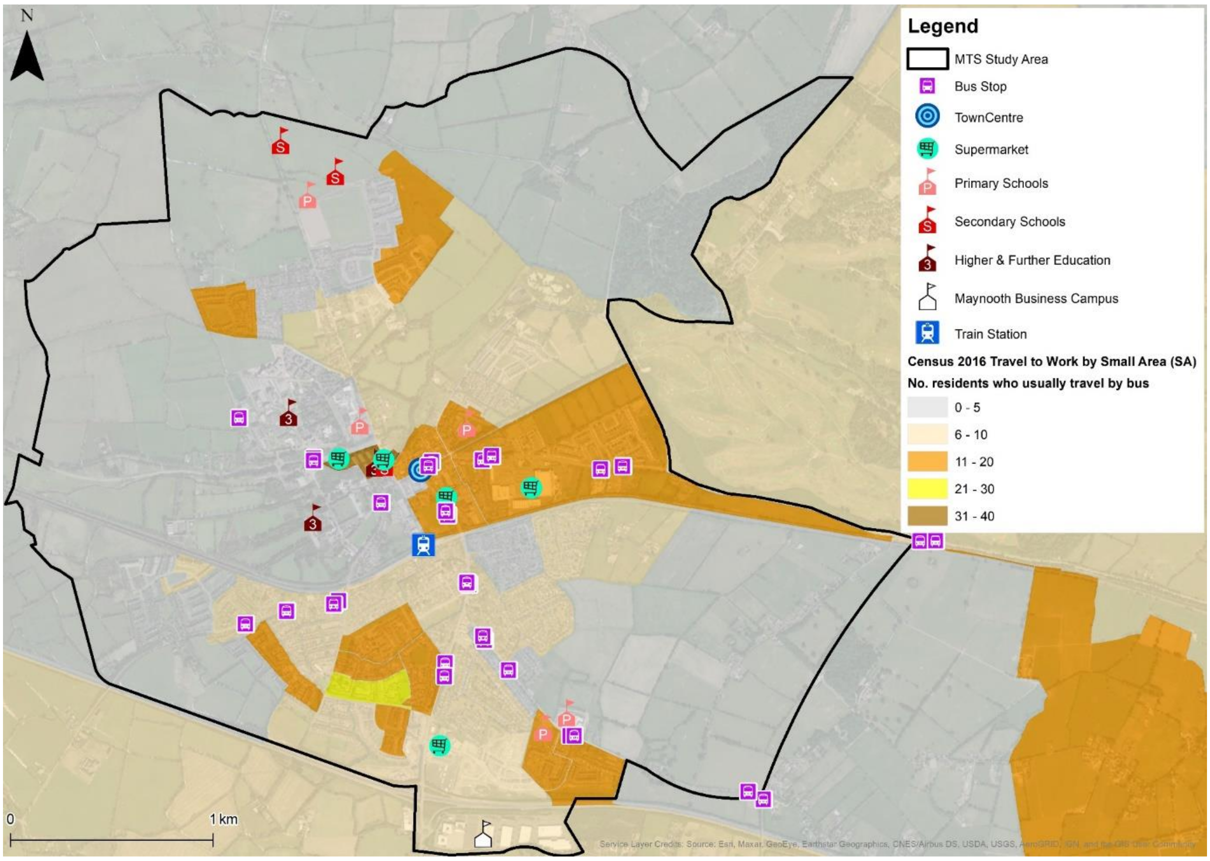


Figure 6-31 2016 Number of People Travelling to Work by Bus from CSO Small Area

6.4 Bus Stop Infrastructure Survey

Figure 6-32 shows the location of bus stops within the study area. As previously highlighted, there are no bus stops in the north of the study area, but the bus stops are well distributed throughout other parts of the study area. The quality of bus stops varies considerably. Physical infrastructure was located for a total of 29 bus stops, including a number located on the fringes or just slightly outside the study area boundary.

Seven of the bus stops (shown below in orange) have bus shelters, the remainder of stops in the town area have bus stop poles and are located on footpaths (shown in purple). There are four stops located on the edge of the study area which are not located on footpaths (shown in blue). These four stops do however provide a safe waiting area for people to stand and wait for the bus. The University Campus does not have a stop pole or shelter, but it is a safe stop, and it is well signposted and marked on university maps.

At the time of the first site visit in September 2021, many bus stops did not have timetables at the stops, while some had timetables which were difficult to read due to weathering. However, the NTA have been upgrading bus stops on an ongoing basis in connection with the implementation of the BusConnects C Spine and therefore most bus stops used by the Dublin Bus network within the town should now have legible timetables. The eastbound bus stop on Main Street has a Real Time Passenger Information sign.

Four bus stops in the survey area had cycle parking located nearby. These stops were all in the town centre area, two are on main street and two are at the Glenroyal stop which also has a turning circle.

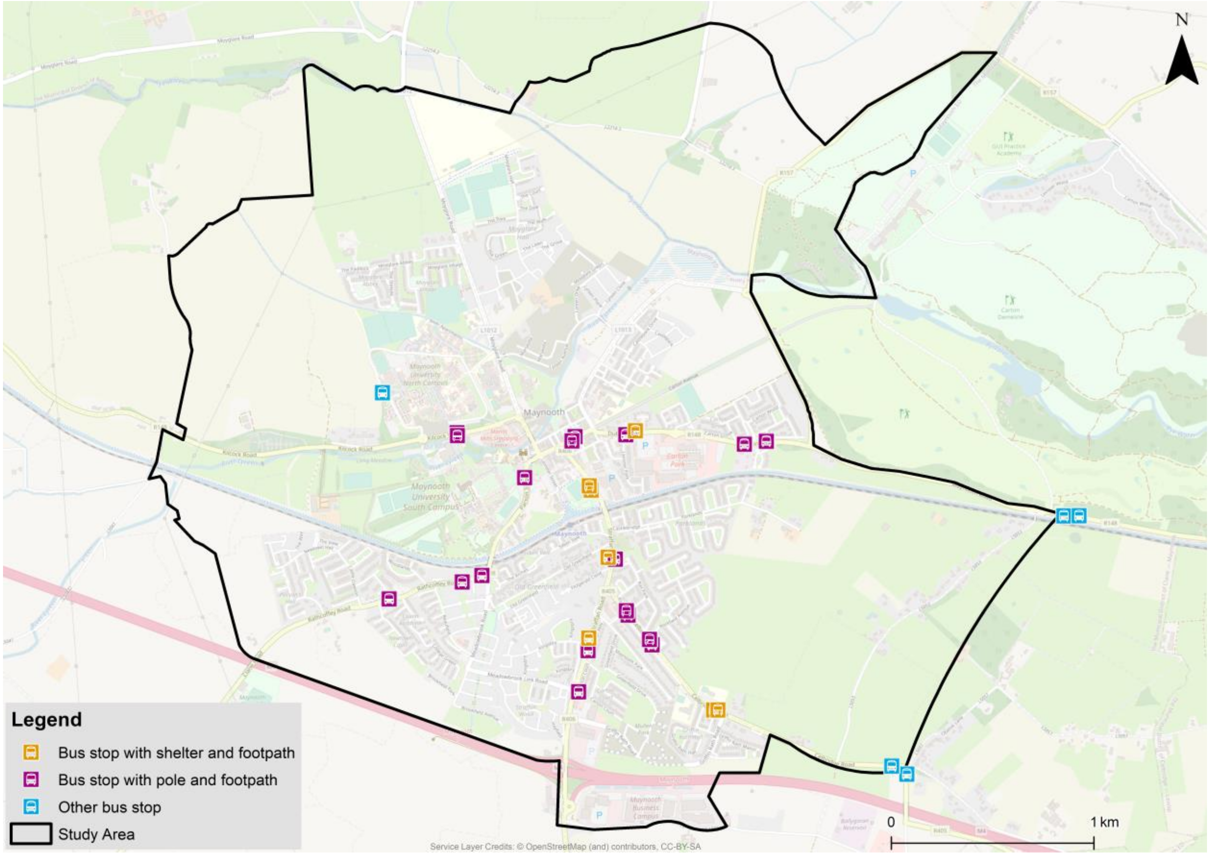


Figure 6-32 Bus Stop Survey

7. Conclusions and Next Steps

The Baseline Assessment has established a comprehensive review of available data to identify problems in the existing transport network and highlight opportunities for improvement in Maynooth. This evidence will feed into the development of options to improve conditions for all modes of transport, walking, cycling, roads, parking and public transport. In the final MEABTA report, these options will be assessed thorough a Multi-Criteria Analysis (MCA) process to identify the preferred solutions to be incorporated into strategies for each mode.

Table 7-1 provides a summary of the strengths, weaknesses, opportunities and threats (SWOT) analysis for the MEABTA study area to inform the development of the options for each mode.

Table 7-1 SWOT Analysis for Maynooth Area Based Transport Assessment Study Area

Strengths	Weakness
• Central location of the train station • Central retail areas (Manor Mills and Carton Retail Park) • Vibrancy of the town centre/Main Street • Presence and central location of Maynooth University • Proximity and strong connection to Dublin via bus and rail • Access to the Royal Canal Greenway • Local employment opportunities at the University, Maynooth Business Park and Intel • Proximity to the M4 and Junction 7 • Relatively flat topography • Growing population with a high percentage of young people • Architectural heritage – Maynooth Castle, Carton House, the University, Main Street etc.	• High level of car dependency and congestion • Unsafe conditions for active modes (e.g., poor infrastructure, dangerous driving, etc) • Schools and large business park located on the periphery of the town • Low housing densities and urban sprawl • Cul-de-sac design of housing estates and impermeable development • Severance caused by the canal, rail line and the Lyreen River • Lack of bus routes serving residential areas and schools to the north of the town • Public transport network focused on radial trips towards Dublin city • Lack of public lighting on Royal Canal Greenway and some walking routes • Lack of inter-urban walking/cycling connections to surrounding towns • No town centre bypass for vehicular or bus traffic • Limited bus priority measures in the town

Opportunities	Threats
• Improving safety and connectivity for active modes of travel • Improving public transport and active mode connections with nearby towns • Improving accessibility for people with mobility difficulties • Implementation of DART+ and potential for new train station west of Maynooth • New orbital service to Tallaght (W6) which will also serve the north of study area • Reduction in on-street parking for improvements to public realm/active modes • Change in commuter patterns due to Covid-19 • Delivery of compact growth including in-fill development close to the town centre • Provision of orbital traffic routes to take traffic out of the town centre • Maynooth has been selected as a Decarbonising Zone (DZ) • Supporting tourism and increasing visitors to the study area • New bus station/transfer facility at the university • Rising fuel costs promote shift to electric vehicles and sustainable travel modes	• Objections from residents or businesses to reallocation of road space to active modes and public transport and/or to measures to improve permeability • Reduced bus frequency on routes to Dublin and Celbridge as part of BusConnects • Continued Dublin-centric focus of public transport network • Insufficient co-ordination of the land use and transport plans • Further construction of low-density, single use, impermeable developments • Future peripheral education, employment, and retail developments • New orbital roads may increase appeal of car travel and contribute to induced demand • Increased transport demand linked to population growth and expansion of university • Insufficient funding for transport infrastructure • High level of commuting by car among university students and staff • Negative impact of Covid 19 regarding willingness to use public transport • Rising fuel prices and inflation make provision of public transport more expensive

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Appendix B: Land Use Assessment Report

Maynooth and Environs ABTA - Land-Use Modelling Report

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DRAFT

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1. Introduction

The population of Maynooth and Environs is expected to grow substantially over the next twenty years in order to meet the growth targets defined in National, Regional and County level planning policies. This will put significant pressure on the transport network, requiring careful land-use-transport planning to ensure this growth can be accommodated as part of a strategic plan which will promote sustainable travel and limit car dependency.

To provide an evidence base for future land-use planning decisions in Maynooth and Environs, this report contains the results from transport modelling and GIS analysis to inform the selection of the preferred land-use scenario for future development. There are four proposed land-use scenarios and the results allow for the unique implications of each different development scenario to be understood. The purpose of this exercise is to assess the relative merit of four alternative land-use scenarios to identify the preferred land-use approach for future growth in Maynooth in the years leading up to 2038.

The land-use scenarios were created by Kildare County Council (KCC) planning department in collaboration with AECOM. This report describes the bespoke land-use modelling methodology developed by AECOM to assess the four-alternative land-use scenarios in Maynooth and Environs, presents the results and evaluates the scenarios to identify the preferred development approach. Following this, the preferred land-use scenario is tested along with a series of modal split sensitivity tests to determine the assumptions to be used in the future year transport models.

This document forms part of the supporting evidence for the creation of the Maynooth and Environs Area Based Transport Assessment (MEABTA). The technical aspects of the creation of the future year transport model for Maynooth will be documented in the VISUM Traffic Modelling Report (TMR).

2. Land-Use Assessment Objectives

At the start of the assessment, the objectives for the land-use modelling were agreed with the KCC planning department. The land-use assessment objectives seek to meet the requirements of planning policy, such as promoting sustainable development and compact growth. In the land-use assessment process, the extent that each land-use scenario achieves these objectives will be evaluated along with the GIS and transport modelling results.

The land-use assessment objectives for Maynooth and Environs are as follows:

1. Support consolidation of the existing urban area through compact growth and discourage urban sprawl;

2. Encourage rail-oriented development by co-locating jobs and population in close proximity to existing or planned train stations;

3. Diversify land-use types to encourage shorter trip distances and model shift from car transport to sustainable travel modes;

4. Provide development in locations which allow for the efficient operation of the road network for passenger vehicles and freight; and

5. Ensure employment is provided in locations that align with national and regional policy requirements.

In assessing whether each land-use scenario achieves the objectives, the approach outlined in Table 2.1 will be used. The assessment will draw on a range of quantitative and qualitative evidence.

Table 2.1 Approach to Assessing Land-Use Objectives

No.	Land-Use Assessment Objective	Approach to Assessing Objective Achievement
1	Support consolidation of the existing urban area through compact growth and discourage urban sprawl	Qualitive assessment of the extent of infill development and outward urban expansion taking place in each scenario
2	Encourage rail-oriented development by co-locating jobs and population in close proximity to existing or planned train stations	Qualitive assessment of the extent of mixed-use development proposed near existing or proposed train stations
3	Diversify land-use types to encourage shorter trip distances and model shift from car transport to sustainable travel modes	Qualitative assessment of the extent that future development areas are mixed use and minimise trip distances to key destinations like schools or employment

No.	Land-Use Assessment Objective	Approach to Assessing Objective Achievement
4	Provide development in locations which allow for the efficient operation of the road network for passenger vehicles and freight	Quantitative assessment of traffic modelling (VISUM) network statistics e.g. which scenarios have the best volume/capacity results, lowest network delay, better average network speeds, etc.
5	Ensure employment is provided in locations that align with national and regional policy requirements	Qualitative assessment of the proportion of new employment growth which is provided in locations favoured by the Regional Spatial and Economic Strategy (RSES) while also considering National Planning Framework and transport policy requirements for compact/sustainable development.

3. Methodology

3.1 Maynooth and Environs VISUM Transport Model

This report uses the Maynooth and Environs VISUM Local Area Model to test the land-use scenarios, the preferred scenario and the modal split sensitivity tests. The Maynooth transport model has a base year of 2019 and the future years under assessment are 2028 and 2038. The zone structure of the transport model is based on different land-use types, as well as boundaries such as canals or roads. Maps showing the transport model zone structure are provided in Figure 6.5 and Figure 6.6 as part of Appendix A, these maps should be used as a reference in respect to specific zone codes mentioned throughout the text. The Maynooth VISUM model is used to assess the traffic impact of the different land-use scenarios in 2028 and 2038, with the results informing the Multi-Criteria Analysis (MCA) table and conclusions for the creation of the future year transport models.

3.2 Sustainable Travel Zone GIS Scoring Methodology

A bespoke methodology was developed in GIS to rate transport model zones according to their potential to promote sustainable travel. This method allows for transport model zones to be rated on a scale from poor to strong in relation to their ability to promote, or discourage, sustainable travel. This method was created so that growth in each land-use scenario could be categorised into areas which are good/bad areas for sustainable travel to inform the selection of the preferred land-use scenario i.e. identify which scenario which is locating jobs/population growth in the most suitable areas to promote sustainable travel.

The outputs of this process consist of maps showing growth overlaid on the sustainable travel scoring and tables which quantify the amount of growth in each sustainable travel area. The results of the GIS sustainable travel zone scoring are used to inform the Multi-Criteria Analysis (MCA) process for selecting the preferred land-use scenario. Furthermore, this scoring approach is used to confirm if the preferred land use scenario is an improvement on the prior scenarios.

3.2.1 Existing Situation and Future Situation Sustainable Travel Scoring

Two different scorings methodologies were developed; one for the existing situation, which is most relevant to the 2028 land-use scenarios, and another scoring system for the future situation, which is more relevant to the 2038 land-use scenario. The main difference in the ‘future’ scoring is the addition of new train stations (Maynooth West, Collinstown in Leixlip), new bus stops on a new BusConnects route along Moyglare Road and adjusted bus stop frequencies to account for the changes due to BusConnects.

The ‘future’ situation represents the ideal context for new development in Maynooth and Environs, where two new train stations have been provided to cater for long distance non-car trips. While the ‘existing’ situation scoring reflects a more conservative assessment of sustainable travel, based on current land-use and transport infrastructure conditions. In the land-use assessment, growth up until 2028 is rated using the ‘existing’ situation scoring and growth to 2038 is rated using the ‘future’ situation scoring.

Once the preferred land-use scenario has been identified, this is scored using both the ‘existing’ and ‘future’ situation rating systems so that the need for the new rail infrastructure is clearly understood, along with the implications of not delivering the new stations in time.

3.2.2 Sustainable Travel Scoring System

Each zone is assigned a score from 0 (Zero potential for sustainable travel) to 10 (Strong potential for sustainable travel). Based on the scores, each model zone is given a broad category to explain their potential to promote sustainable travel, as defined in Table 3.1.

Table 3.1 Sustainable Travel Zone Scoring

Zone Score	Broad Rating
0	Zero or extremely limited potential for sustainable travel
1	
2	
3	Poor potential for sustainable travel
4	
5	Fair potential for sustainable travel
6	
7	Good potential for sustainable travel
8	
9	Strong potential for sustainable travel
10	

3.2.3 Sustainable Travel Scoring Definition

The zone scoring is based on the straight line distance from the zone centroid (centre point) to the closest facility (e.g. bus stop, train station, town centre or Maynooth University). In the scoring, higher scores are applied for public transport access, when compared to the proximity of services, to reflect the key role of public transport in facilitating non-car households and providing a viable alternative to the private car. Distance to the town centre and university are used as proxy indicators to assess whether the new development area is close to the existing urban area, therefore promoting compact growth and the use of active modes.

3.2.3.1 Zone Scoring for Bus Services

Table 3.2 explains the scoring system used to rate zone access to bus services. The bus access scoring considers two aspects: (1) straight line distance from the model zone to the closest bus stop and (2) the frequency of bus services within a 500m circular buffer. New development areas will not have bus frequencies, so straight line distance is included to allow for greenfield sites to receive a score based on their proximity to existing bus services.

Similar to other indicators, shorter distance from the zone to the closest bus stop implies that compact growth is taking place as the site is closer to the existing urban area. In the ‘existing’ situation, the 2019 bus network is used for this assessment, whereas in the ‘future’ situation the BusConnects network is assumed to be implemented. As part of the future situation, new bus stops are assumed on the Moyglare Road to serve the new bus route and planned BusConnects frequencies are adopted. For routes which are not affected by BusConnects in the future situation, the frequencies are assumed to be the same as the existing (2019) situation.

Table 3.2 Scoring Zones for Access to Bus Services

Zone Bus Access Category	Distance to Closest Bus Stop	Distance to Bus Stop Score	Frequency (total bus services within 500m)[1]	Bus Frequency Score	Total Zone Score
Excellent	0-500m	1.5	High	1.5	3
Good	500-1km	1	Medium	1	2
Poor	1-1.5km	0.5	Low	0.5	1
No Access	1.5km+	0	None	0	0

3.2.3.2 Zone Scoring for Train Services

Table 3.3 shows the scoring for access to the closest train station. In the 'existing situation' scoring, this is assessed for just Maynooth Train Station, whereas in the 'future' situation, new stations are assumed at Maynooth West and the Collinstown site as described in the draft NTA GDA Transport Strategy.

Table 3.3 Scoring Zones for Access to Closest Train Station

Distance to Train Station	Score
Over 2km	0
1-2km	1
500m-1km	2
0-500m	3

3.2.3.3 Zone Scoring for Distance to Town Centre and Maynooth University (MU)

Table 3.4 shows the scoring used for distance to the town centre and university, which are used to indicate the potential for travel by active modes when accessing services and education. The same scoring system is used in both the existing and future situation.

[1] To calculate 'high', 'medium' and 'low' bus frequencies, an approach had to be used which assessed a scale from good to bad bus frequencies relative to the quality of bus services provided in Maynooth, rather than a universal standard of what would generally be regarded as a good or bad bus frequency in planning practice. The bus stops in the study area were given a 500m buffer and any zones which intersected with the buffers were regarded as having access to the bus service, with the number of services accessible to each zone was totalled. The zones were then ranked according to the number of total accessible bus services, with the high, medium and low categories defined on the basis of the distribution of results. This meant that the top third ranked zones were rated 'high, the middle third rated 'medium' and the bottom third rated 'low'.

Table 3.4 Scoring Zones for Access to the Town Centre and University

Distance to Town Centre	Distance to MU (North Campus) or Town Centre	Score
Over 2km	Over 2km	0
1-2km	1-2km	1
0-1km	0-1km	2

3.2.4 Model Zone Sustainable Travel Scoring

The maps showing the sustainable travel scoring for the ‘existing’ situation and the ‘future’ situation are provided in this section.

3.2.4.1 Existing Situation (2028) Sustainable Travel Scoring

Figure 3.1 shows the existing situation sustainable travel scoring for Maynooth and Environs. This highlights that the central areas, which are the most accessible to services and public transport, score the highest and are the most preferable areas for future development. The scores gradually decrease as distance from the town centre and public transport increases, showing the risk of greater car dependency if growth is accommodated through peripheral development to the north, west and east.

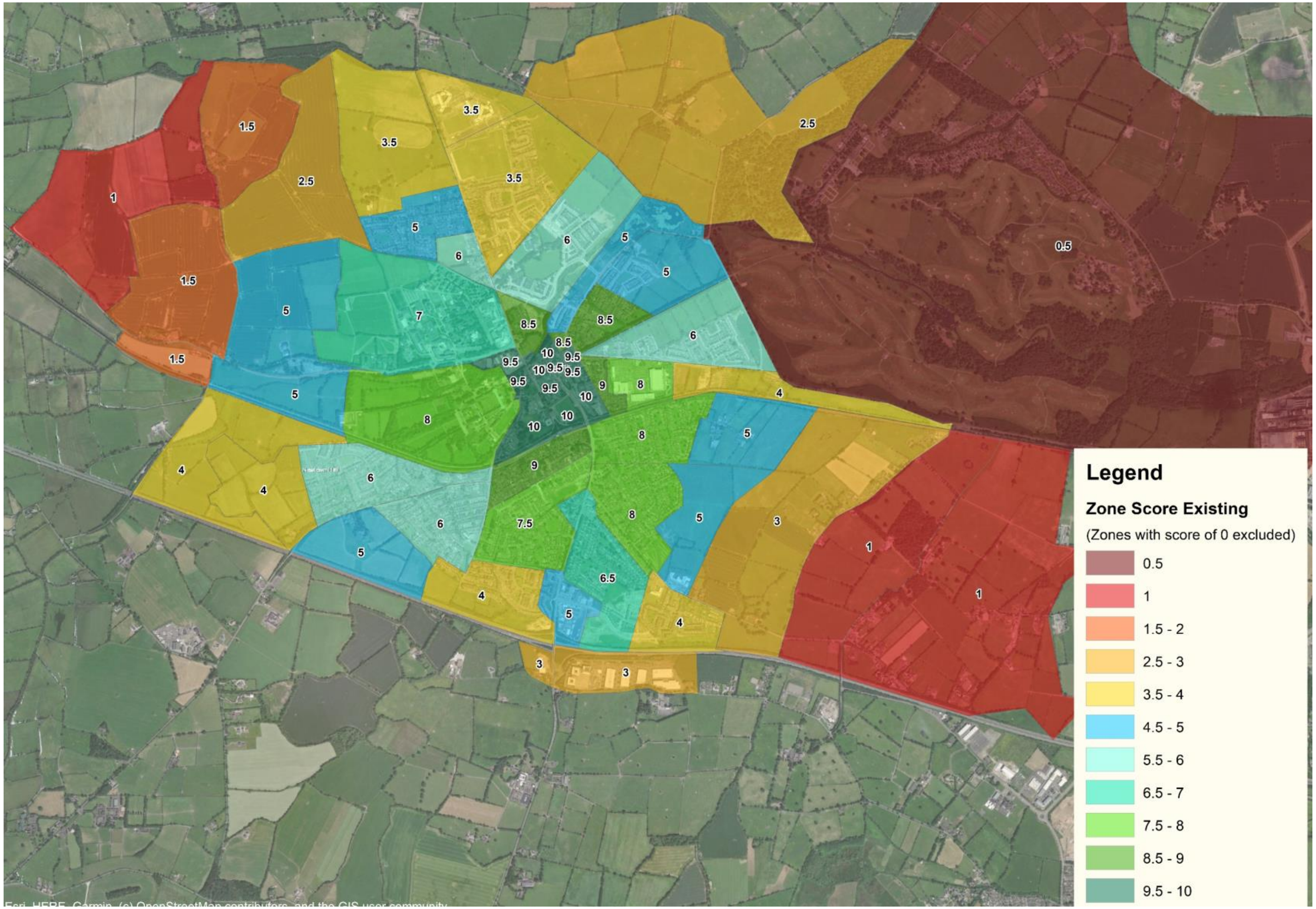

Figure 3.1 'Existing' Situation Sustainable Travel Zone Scoring

3.2.4.2 Future Situation (2038) Sustainable Travel Scoring

Figure 3.2 shows the future situation sustainable travel scoring for Maynooth and Environs. The addition of Maynooth West train station has increased the scores to the west of the town, while the addition of new bus stops on the Moyglare Road has improved scores to the north slightly.

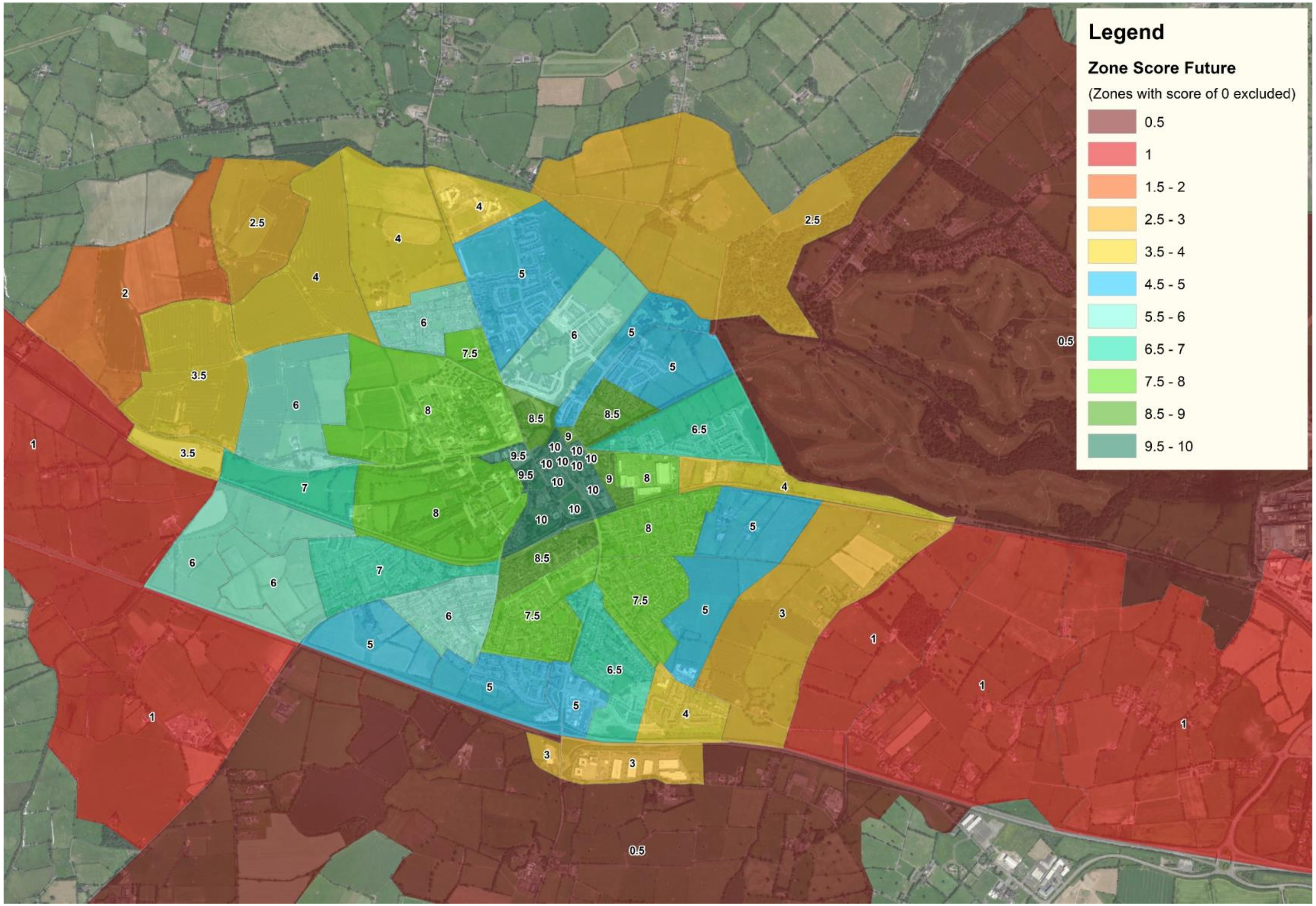

Figure 3.2 'Future' Situation Sustainable Travel Zone Scoring

3.3 Land-Use Modelling Methodology

The land-use modelling was produced using the VISUM strategic transport model for Maynooth and Environs. This section summarises the scenarios, trip rates, do-minimum road network and supporting road infrastructure. Further details of the modelling process used to create the future year transport models for Maynooth and Environs is documented in the Traffic Modelling Report (TMR), while the creation of the base model is described in the Model Development Report (MDR).

3.3.1 Modelled Land-Use Scenarios

KCC planning department created four different planning scenarios for future growth in Maynooth and Environs:

- **Scenario 1: Concentric Growth**

  This scenario consists of infill development in central areas of Maynooth and peripheral development in concentric circles further out from the town centre.

- **Scenario 2: Northern Growth**

  This scenario primarily consists of growth to the north of the town within the Kildare County boundary, as well as some peripheral development in other areas.

- **Scenario 3: Eastern Growth**

  This scenario primarily consists of growth to the east of the town, as well as some peripheral development in other areas.

- **Scenario 4: Western Growth**

  This scenario primarily consists of growth to the west of the town, near to the planned train station at Maynooth West, as well as some peripheral development in other areas.

Scenarios 1-4 allocate similar levels of growth to different locations in Maynooth and Environs in respect to population, commercial/services growth and school pupil growth[2] added to the 2019 baseline situation. The level of growth in 2028 and 2038 is summarised in Table 3.5. The focus of the assessment is on the best spatial distribution of this growth and identifying the best locations to promote sustainable travel, which inform the creation of the preferred land-use scenario.

[2] The large school pupil growth includes the addition of pupils in the large MEC school campus to the north of the town which was not included in the base model.

Table 3.5 Summary of Growth added to 2019 Base Model in 2028 and 2038

	By 2028			By 2038		
	Population Growth (No. People)	**Commercial and Service Growth (GFA)**	**School Growth (No. Pupils)**	**Population Growth (No. People)**	**Employment Growth (GFA)**	**School Growth (No. Pupils)**
Scenarios 1-4	~7,778[3]	~169,060	~3,353	~18,972	~343,320	~5,647

It should be noted that the proposed development in the Maynooth Environs (Moygaddy) is excluded from the four land-use scenarios and assessed separately as a sensitivity test.

Following these scenarios, the preferred land use scenario is modelled along with a series of modal split sensitivity tests.

3.3.2 Land-Use Spreadsheets and Trip Rates

KCC planning department provided spreadsheets which quantified the number of additional residential units and the Gross Floor Area (GFA) of development expected for each land-use type in every zone of the transport model. Trip rates were developed for each land-use type using the TRICS software and these rates were applied to convert the quantum of development into the number of trips to or from each zone in 2028 and 2038. The TRICS trip rates used in this project are listed in Table 3.6 for each land-use type.

A higher and lower rate of trip rate were used depending on the potential for each zone to promote sustainable travel. 'Good Sustainable Travel (ST) Access' trip rates were used for zones which scored between 6-10 in the sustainable travel area scoring, while 'Poor Sustainable Travel (ST) Access' trip rates were used for zones which scored 0-5.

For the 2028 models, the 'existing' sustainable travel scoring for zones was used, while for the 2038 models the 'future' sustainable travel area scoring applied. This means that zones with less potential to promote sustainable travel, have higher private car trip rates, which will have implications for the transport model indicators, such as network stats, used in the land-use assessment.

[3] The ~ symbol stands for 'circa' this number, there are slight variations in the numbers between Scenarios 1-4 but they are not different enough to warrant reporting individually.

Table 3.6 TRICS Land-Use Trip Rates used in Maynooth Project

TRICS Land-Use	Rate	Access to Sustainable Travel (ST)	AM Peak (08:00-09:00)		PM Peak (17:00-18:00)	
			Arrivals	Departures	Arrivals	Departures
Primary School	No. Students	Good ST Access	0.284	0.111	0.005	0.017
		Poor ST Access	0.335	0.264	0.026	0.051
Secondary School	No. Students	Good ST Access	0.131	0.089	0.025	0.021
		Poor ST Access	0.237	0.188	0.031	0.041
University	No. Students	Good ST Access	0.035	0.005	0.009	0.025
		Poor ST Access	0.047	0.013	0.01	0.022
Office	GFA (per 100 sq. m)	Good ST Access	0.411	0.05	0.034	0.337
		Poor ST Access	1.506	0.204	0.149	1.295
Retail	GFA (per 100 sq. m)	Good ST Access	1.312	0.813	1.331	1.904
		Poor ST Access	8.133	7.849	8.54	9.597
Hotels	No. Bedrooms	Good ST Access	0.095	0.126	0.101	0.074
		Poor ST Access	0.162	0.207	0.152	0.124
Industrial	GFA (per 100 sq. m)	Good ST Access	0.248	0.053	0.08	0.253
		Poor ST Access	0.58	0.049	0.049	0.551
Residential	No. units	Good ST Access	0.115	0.243	0.22	0.12
		Poor ST Access	0.101	0.328	0.301	0.15

3.3.3 Do-Minimum Road Network

A Do-Minimum (DM) road network is included in all future land-use scenarios. The DM network consists of two new roads which were not included in the 2019 base model, these are the Straffan Link Road and Lyreen Avenue, as shown in Figure 3.3.

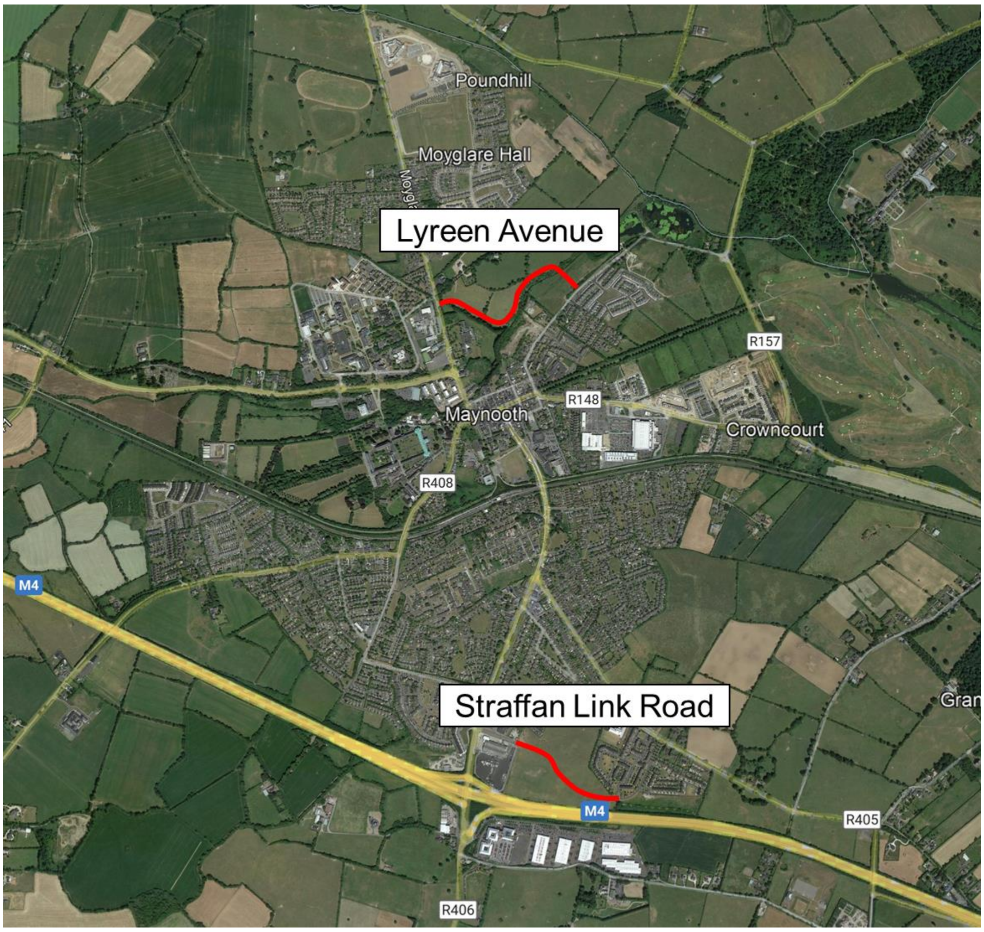

Figure 3.3 Maynooth and Environs Modelling DM Network

3.3.4 Minimum Supporting Road Infrastructure

In the land-use scenario modelling, a minimum amount of road infrastructure is required in some scenarios in order to provide realistic access to the future development areas and provide sufficient capacity for the road network to function correctly in the model. This additional infrastructure does not count as committed do-something road options, instead potential road options will be assessed separately as part of the MEABTA option selection process after the preferred land-use scenario has been selected.

The minimum road infrastructure in each scenario consists of two orbital roads as defined in Figure 3.4 to Figure 3.7. These routes are indicative routes, they do not represent MEABTA road options or planned/committed schemes. Each orbital road is assumed to have a speed limit of 80kph and 1,400 vehicles per hour capacity in the transport modelling. In the case of Scenario 3, eastern development, one of the new links consists of an upgrade of the existing L5053 as shown in Figure 3.6 rather than a new orbital road.

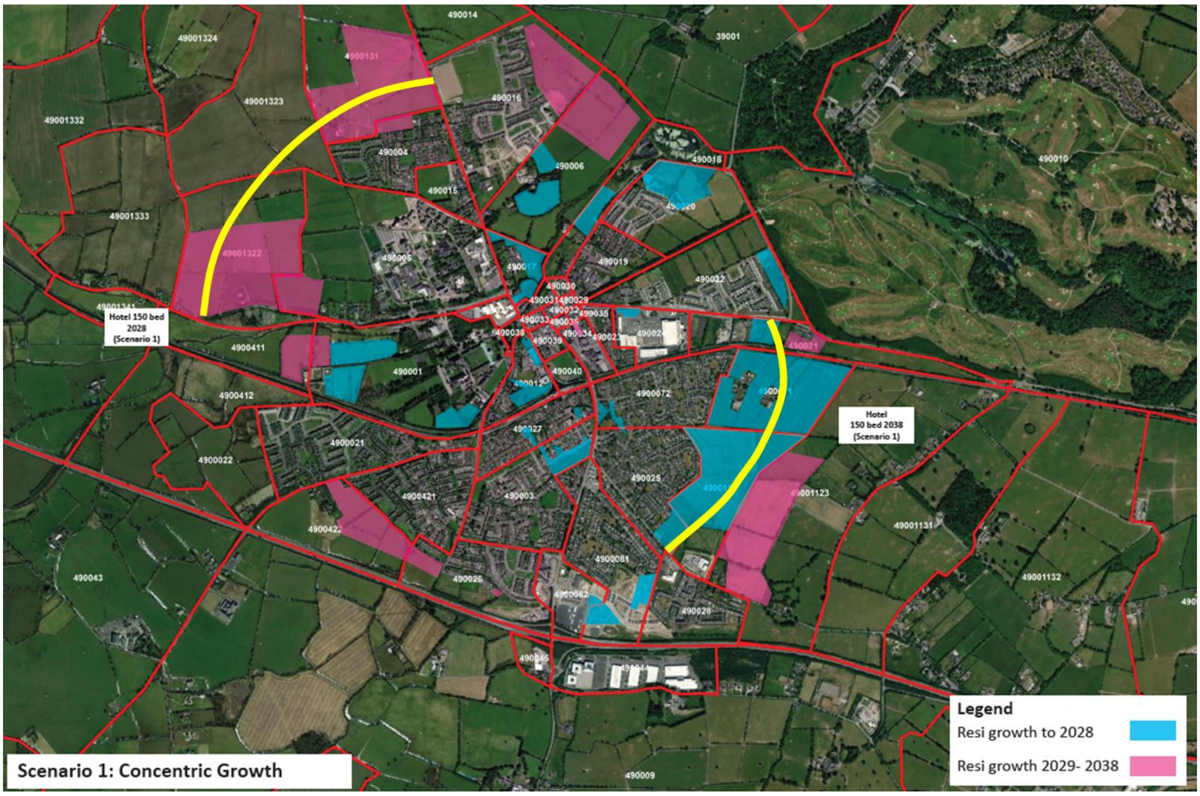

Figure 3.4 Scenario 1 – Minimum Road Infrastructure (Yellow Lines) and Scenario Growth

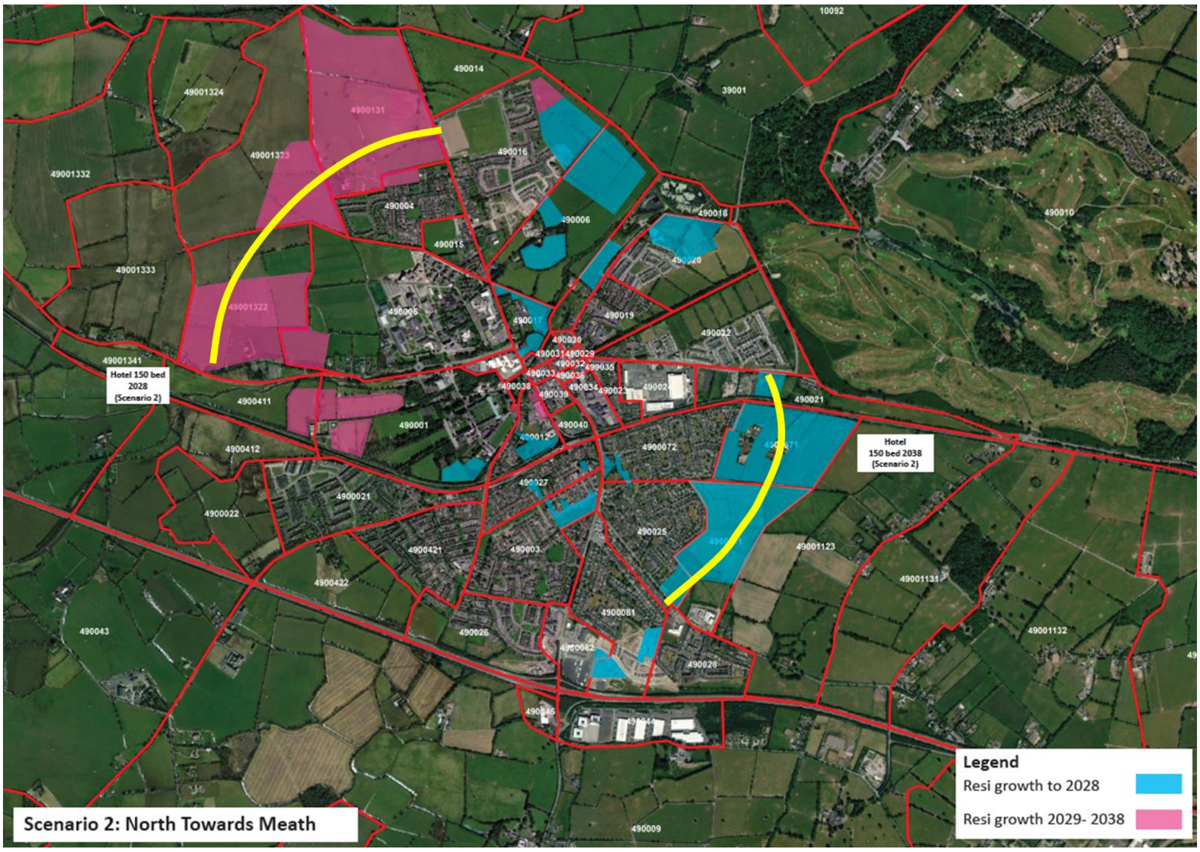

Figure 3.5 Scenario 2 – Minimum Road Infrastructure (Yellow Lines) and Scenario Growth

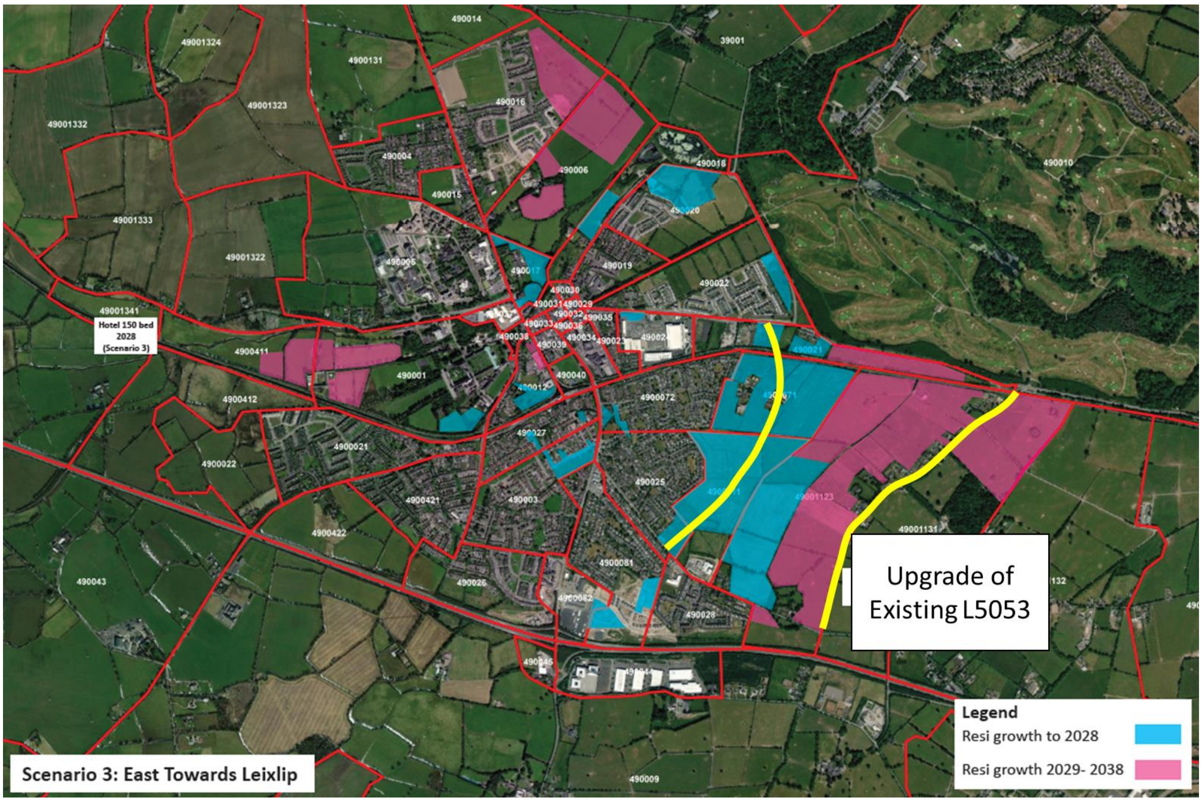

Figure 3.6 Scenario 3 – Minimum Road Infrastructure (Yellow Lines) and Scenario Growth

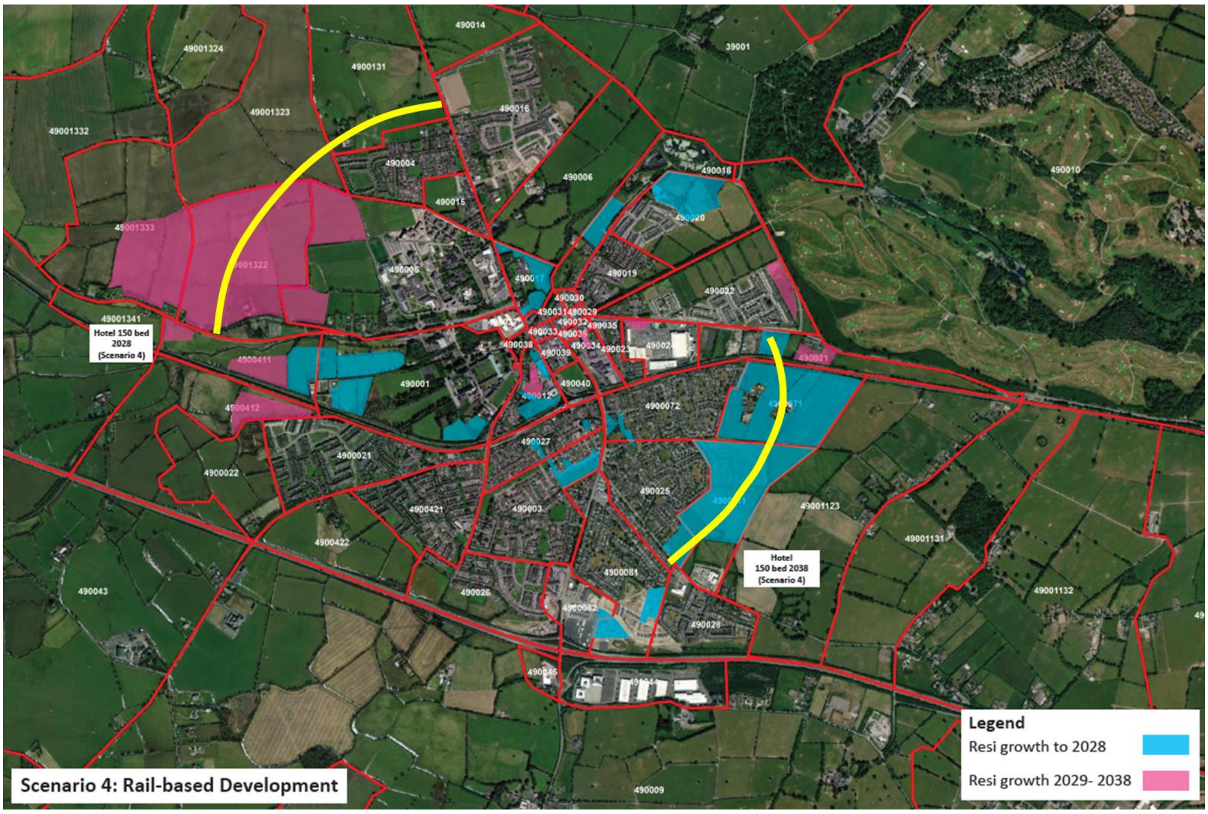

Figure 3.7 Scenario 4 – Minimum Road Infrastructure (Yellow Lines) and Scenario Growth

3.4 Approach to Land-Use Modelling and Multi-Criteria Analysis (MCA)

The steps required to undertake the land-use modelling and Multi-Criteria Analysis (MCA) assessment were as follows:

1. The four land-use scenarios were modelled with just the DM network;
2. Due to the scale of growth, the road network would not be able to accommodate the additional traffic on the network, therefore the minimum road infrastructure was introduced for the next model run;
3. Network statistics and maps were produced for each land-use scenario to compare and understand their relevant merit;
4. A sensitivity test which includes the Maynooth Environs (Moygaddy) development in Meath for the four scenarios was also run;
5. The scenarios were assessed in an MCA which draws on the model data, the objectives and the GIS sustainable travel scoring process. From this process, recommendations were identified which will inform KCC in developing the preferred land-use scenario;
6. The preferred land-use scenario was run in the model and assessed in a standalone MCA to confirm it is the correct choice which improves on the original four scenarios;
7. Several modal split sensitivity tests were conducted using the preferred land-use scenario to determine the appropriate modal split assumption to be used in the future year transport model; and
8. Once the preferred land-use scenario had been selected, along with the modal split assumptions, then the future year models were created for use in option selection and road strategy development for the Maynooth and Environs ABTA.

4. Initial Land-Use Scenarios Assessment

The land-use assessment and the recommendations for the preferred scenario are primarily informed by the GIS assessment as this provides clearer indications of the positive and negative aspects of each scenario to inform the MCA assessment. Each scenario was also tested in the transport model, but these results generally show that the road network is under severe pressure across all land-use scenarios due to the high level of growth, rather than helping to differentiate between the scenarios.

This section presents the GIS results, the transport modelling results and the assessment of objectives to inform the MCA tables and the recommendations which will inform the creation of the preferred land-use scenario.

4.1 Sustainable Travel Assessment of Development in Zones

This section categorises the land-use growth in each scenario according to their sustainable travel GIS zone scores, rated from poor to strong, based on the GIS scoring methodology explained in Section 3. To simplify the assessment process and produce tables of a manageable size; the land-use types were grouped into three categories of growth:

- **Population Growth**: Population growth is measured in the number of extra people;
- **Commercial/Service Growth**: Office, industrial, retail and community land-uses were combined to create this category. The commercial/service growth is measured using Gross Floor Area (GFA); and
- **School Growth**: School growth is measured by the number of additional school pupils for primary and secondary schools.

There are a number of growth types from the land-use spreadsheets provided by KCC Planning Department which were excluded from this assessment. Firstly, university student growth is excluded because college growth is the same across all scenarios and this information would not inform the selection of the preferred land-use scenario.

Secondly, hotel growth has been excluded from the commercial/service category because this growth was provided in the number of additional beds, which could not be combined with commercial/service GFA. As there are only a small number of hotels proposed, it was assumed they would have a negligible impact on transport and excluding this growth would not materially affect the selection of the preferred land-use scenario. Given the fact that the tables and maps need to compare three categories of land-use across four scenarios with five categories of sustainable land-use scoring, excluding hotels also allows for simpler tables which are easier to understand.

Thirdly, it is important to note that the cross-scenario assessment tables in this section consider County Kildare growth only, with the Maynooth Environs (Moygaddy) growth assessed separately. The Maynooth Environs (Moygaddy) zone growth is the same across all scenarios, so it is sensible to assess this growth separately in a standalone sub-section as it does not help to differentiate between scenarios.

4.1.1 Existing Situation Assessment of 2028 Land-Use Growth

This section presents tables and maps which quantify the amount of land-use growth allocated to good or bad sustainable travel areas in each scenario. These results are for the 2028 land-use scenarios, scored based on the 'existing situation' sustainable travel scoring methodology. There are many similarities in the allocation of growth across the scenarios, hence the commentary focuses on the differences to highlight the positive or negative aspect of each scenario. To simplify interpretation of the tables, the standout positive aspects of each scenario are highlighted in **green**, while the standout negative aspects of each scenario are highlighted in **orange** to draw attention to the differentiating factors.

4.1.1.1 2028 Population Growth

Table 4.1 shows the proportion of population growth allocated in zones based on their ability to promote or discourage sustainable travel. It can be observed that Scenarios 1 and 4 allocate larger amounts of population growth to good or strong sustainable travel zones. In contrast with this, higher proportions of population growth are allocated to fair or poor sustainable travel zones in Scenarios 2 or 3.

Table 4.1 Population Growth Allocated to Different Sustainable Travel Zones by 2028

'Existing Situation' Scoring	Scenario 1 - Concentric Growth	Scenario 2 – Northern Growth	Scenario 3 – Eastern Growth	Scenario 4 – Western Growth
Zero/extremely limited potential for ST	0	0	0	0
Poor potential for sustainable travel	146	751	1,876	146
Fair potential for sustainable travel	3,598	4,475	3,199	3,584
Good potential for sustainable travel	2,679	1,386	1,537	2,693
Strong potential for sustainable travel	1,355	1,165	1,165	1,355

Figure 4.1 shows the spatial distribution of population growth in each 2028 land-use scenario overlaid on the existing situation sustainable travel scoring. This map helps to explain the quantification table results by identifying the good/bad aspects of each scenario. The map highlights that Scenario 1 and 4 have stronger results due to the allocation of population growth to the west of St. Patrick's College Maynooth and central areas which are more accessible to sustainable travel. Scenario 2 and 3 allocate more population growth to a northern zone on the Moyglare Road or a south-eastern zone respectively, which both have lower sutainable travel scores.

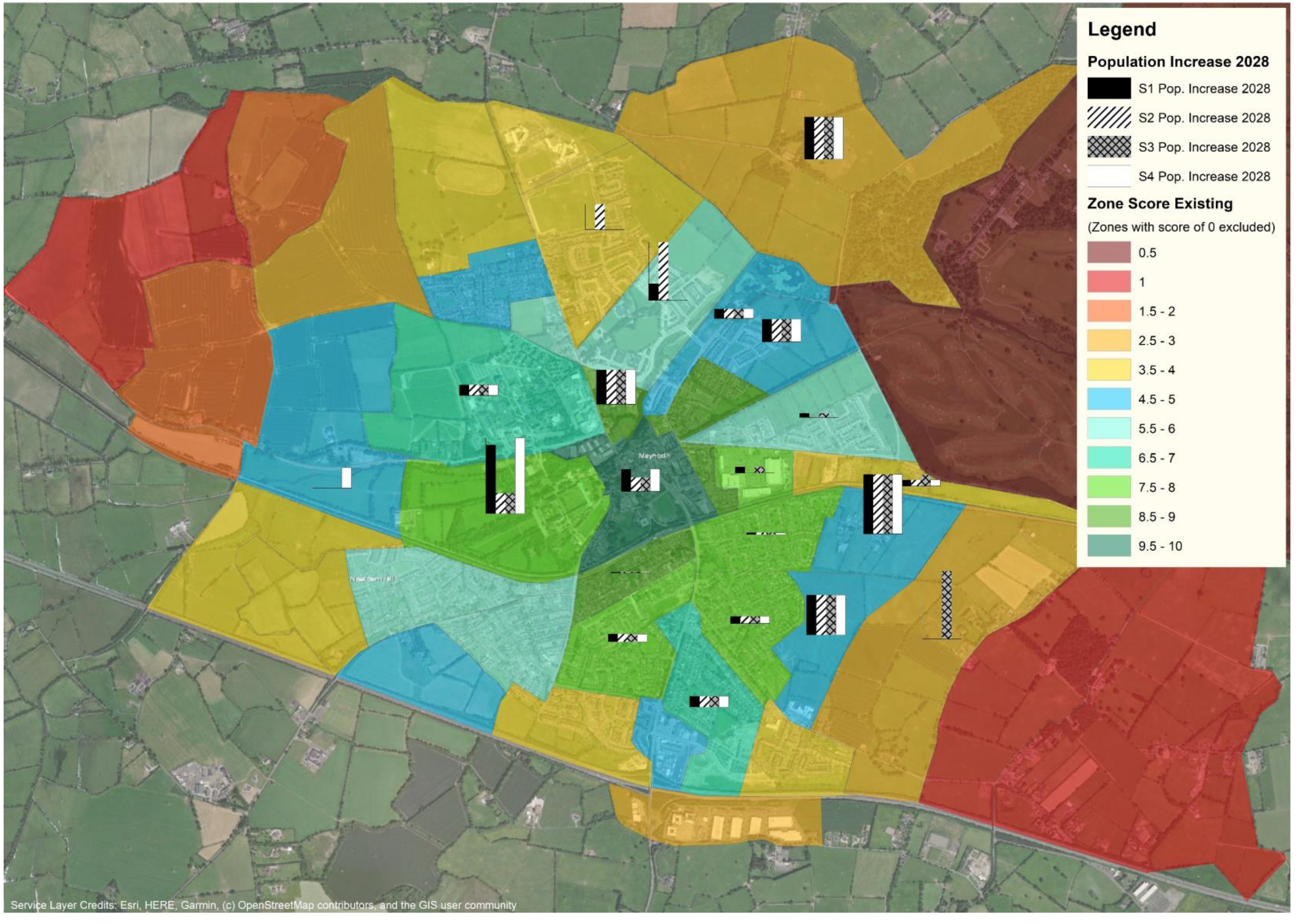

Figure 4.1 Population Growth Allocated to Different Sustainable Travel Zones by 2028

4.1.1.2 2028 Commercial/Service Growth

Table 4.2 shows the proportion of commercial/service growth allocated in zones based on their ability to promote or discourage sustainable travel. None of the scenarios perform particularly well in this assessment, with a large amount of growth allocated to areas with poor or non-existent sustainable travel infrastructure. Scenario 3 allocates a higher amount of commercial/service growth to areas with a ‘fair’ sustainable travel rating, and this is the best rated scenario for this land-use type in 2028, followed by Scenario 1 in second place. In contrast with this, Scenarios 2 and 4 allocate a larger amount of growth to zones with zero potential for sustainable travel, with Scenario 4 performing worse than Scenario 2 in this regard.

Table 4.2 Commercial Growth (m^2) Allocated to Different Sustainable Travel Zones by 2028

‘Existing Situation’ Scoring	Scenario 1 - Concentric Growth	Scenario 2 – Northern Growth	Scenario 3 – Eastern Growth	Scenario 4 – Western Growth
Zero/extremely limited potential for ST	0	54,800	0	83,700
Poor potential for sustainable travel	78,800	24,000	24,000	23,500
Fair potential for sustainable travel	28,900	28,900	83,700	500
Good potential for sustainable travel	0	0	0	0
Strong potential for sustainable travel	4,500	4,500	4,500	4,500

Figure 4.2 shows the spatial distribution of commercial/service growth in each 2028 land-use scenario overlaid on the existing situation sustainable travel scoring. The map highlights that Scenarios 2 and 4 are allocating higher amounts of growth to a zone further to the west of Maynooth which has a poorer sustainable travel rating. In contrast with this, Scenario 3 allocates more growth to a zone adjacent to the west of Maynooth University, which has fair sustainable travel access, while Scenario 1 allocates this growth to a zone to the north-west of Maynooth University which has a lower sustainable score but is still less peripheral than the growth in Scenarios 2 and 4.

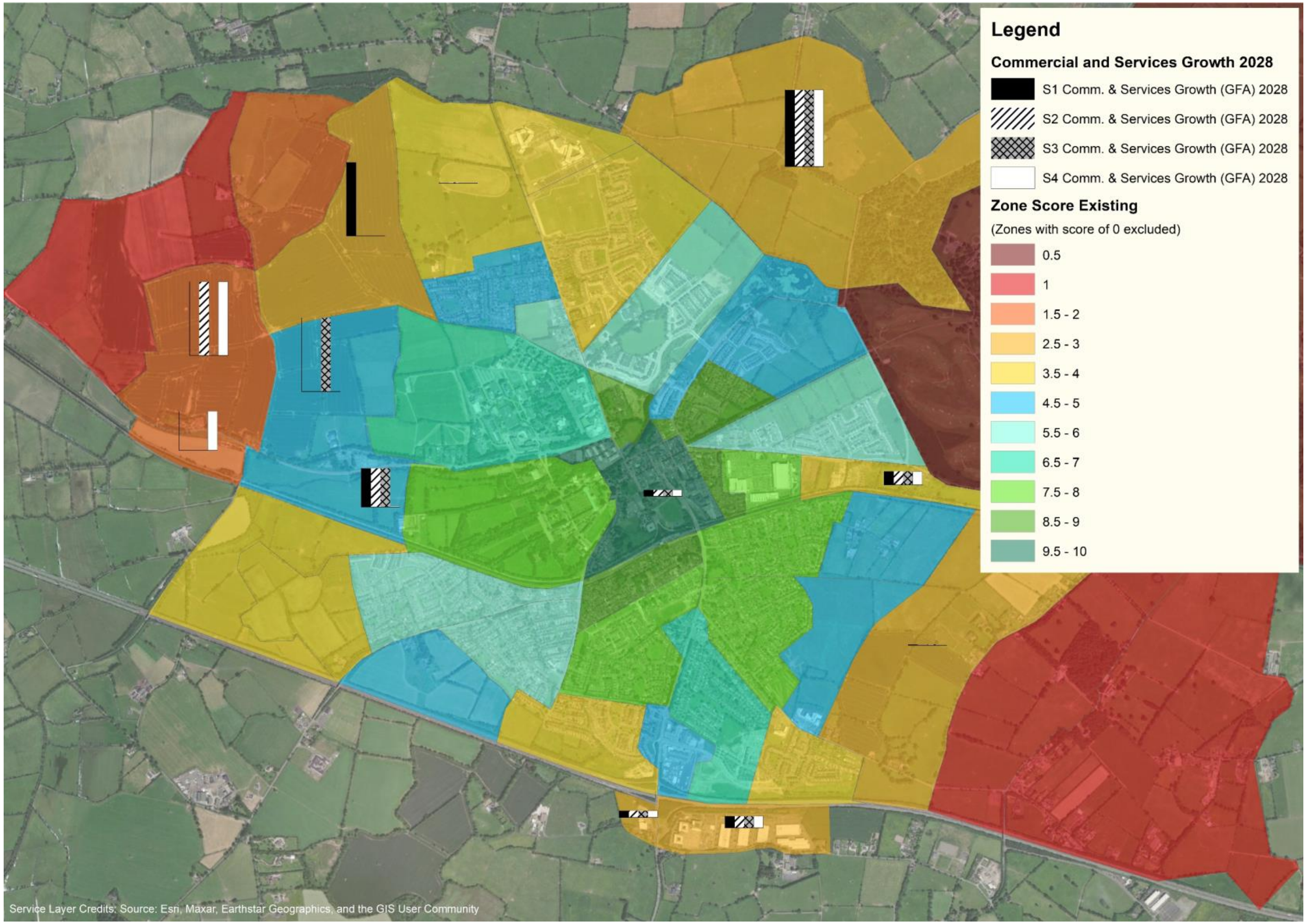

Figure 4.2 Commercial/Service Growth Allocated to Different Sustainable Travel Zones by 2028

4.1.1.3 2028 School Pupil Growth

Table 4.3 shows the proportion of school pupil growth allocated to zones based on their ability to promote or discourage sustainable travel. None of the scenarios perform particularly well in this assessment with a large amount of school growth allocated to areas with poor or fair sustainable travel ratings. It should be noted that the 2028 scenario includes growth to account for the Maynooth Education Campus (MEC) to the north because these trips were not included in the 2019 base model. The MEC campus accounts for 2,000+ pupils in a zone with a 'fair' sustainable travel rating. The differences between the scenarios are marginal, with Scenarios 1 and 2 performing slightly better than Scenarios 3 and 4.

Table 4.3 School Pupil Growth Allocated to Different Sustainable Travel Zones by 2028

'Existing Situation' Scoring	Scenario 1 - Concentric Growth	Scenario 2 – Northern Growth	Scenario 3 – Eastern Growth	Scenario 4 – Western Growth
Zero or extremely limited potential for ST	0	0	205	205
Poor potential for sustainable travel	2,337	2,337	2,337	2,337
Fair potential for sustainable travel	705	705	500	500
Good potential for sustainable travel	311	311	311	311
Strong potential for sustainable travel	0	0	0	0

Figure 4.3 shows the spatial distribution of school pupil growth in each 2028 land-use scenario overlaid on the existing situation sustainable travel scoring. This shows that the slightly higher rating for Scenarios 1 and 2 is from locating a school to the west of the Maynooth University campus, which is slightly closer to public transport services than the more perhipheral schools located in Scenarios 3 and 4 to the east and west. Overall, it should be noted that nearly all school growth is located in peripheral areas which have lower sustainable travel scores, rather than central areas which are more accessible to all residents.

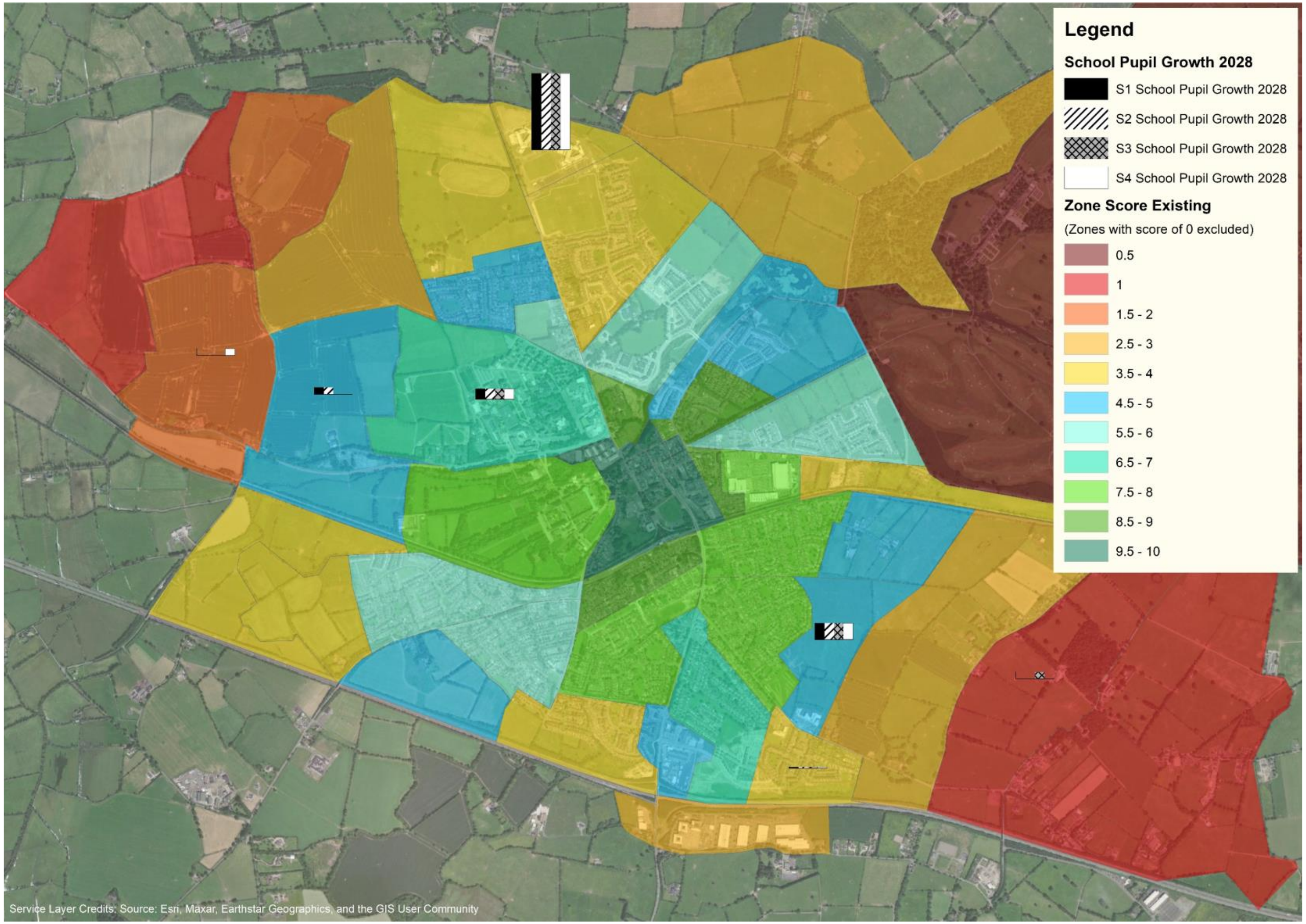

Figure 4.3 School Pupil Growth Allocated to Different Sustainable Travel Zones by 2028

4.1.2 Future Situation Assessment of 2038 Land-Use Growth

This section presents tables and maps which quantify the amount of land-use growth allocated to good or bad sustainable travel areas in each scenario. These results are for the 2038 land-use scenarios and they are scored based on the 'future situation' sustainable travel scoring methodology. There are many similarities in the allocation of growth across the scenarios, so the commentary will focus on the differences to highlight the positive or negative aspect of each scenario.

To simplify interpretation of the tables, the standout positive aspects are highlighted in **green**, while the standout negative aspects of the scenarios are highlighted in **orange** to draw attention to the differentiating factors.

4.1.2.1 2038 Population Growth

Table 4.4 shows the proportion of population growth allocated in zones based on their ability to promote or discourage sustainable travel. It can be observed that Scenario 4 allocates the largest amount of population growth to good or strong sustainable travel zones, with lower growth allocated to poor or zero sustainable travel areas. In contrast with this, higher proportions of population growth are allocated to zero or poor sustainable travel zones in Scenarios 2 or 3.

Between these two poorly rated scenarios, Scenario 3 has a marginally worse score than Scenario 2. Overall, this assessment shows that the western growth Scenario (No. 4), which locates a large proportion of future residences closer to the new Maynooth West train station, has the best potential to promote sustainable travel among residents.

Table 4.4 Population Growth Allocated to Different Sustainable Travel Zones by 2038

'Future Situation' Scoring	Scenario 1 - Concentric Growth	Scenario 2 – Northern Growth	Scenario 3 – Eastern Growth	Scenario 4 – Western Growth
Zero/extremely limited potential for ST	0	0	1,551	0
Poor potential for sustainable travel	3,831	5,008	6,779	2,396
Fair potential for sustainable travel	9,133	8,271	5,163	8,364
Good potential for sustainable travel	4,584	4,336	4,121	6,510
Strong potential for sustainable travel	1,424	1,355	1,355	1,699

Figure 4.4 shows the spatial distribution of population growth in each 2038 land-use scenario overlaid on the future situation sustainable travel scoring. It can be observed that Scenario 4 performs best because it allocates more growth either closer to the existing urban area, or near the new Maynooth West train station. In contrast with this, Scenario 2 and Scenario 3 allocate a lot of population growth to

zones in the north and far east respectively which are a substantial distance away from public transport and the existing urban area.

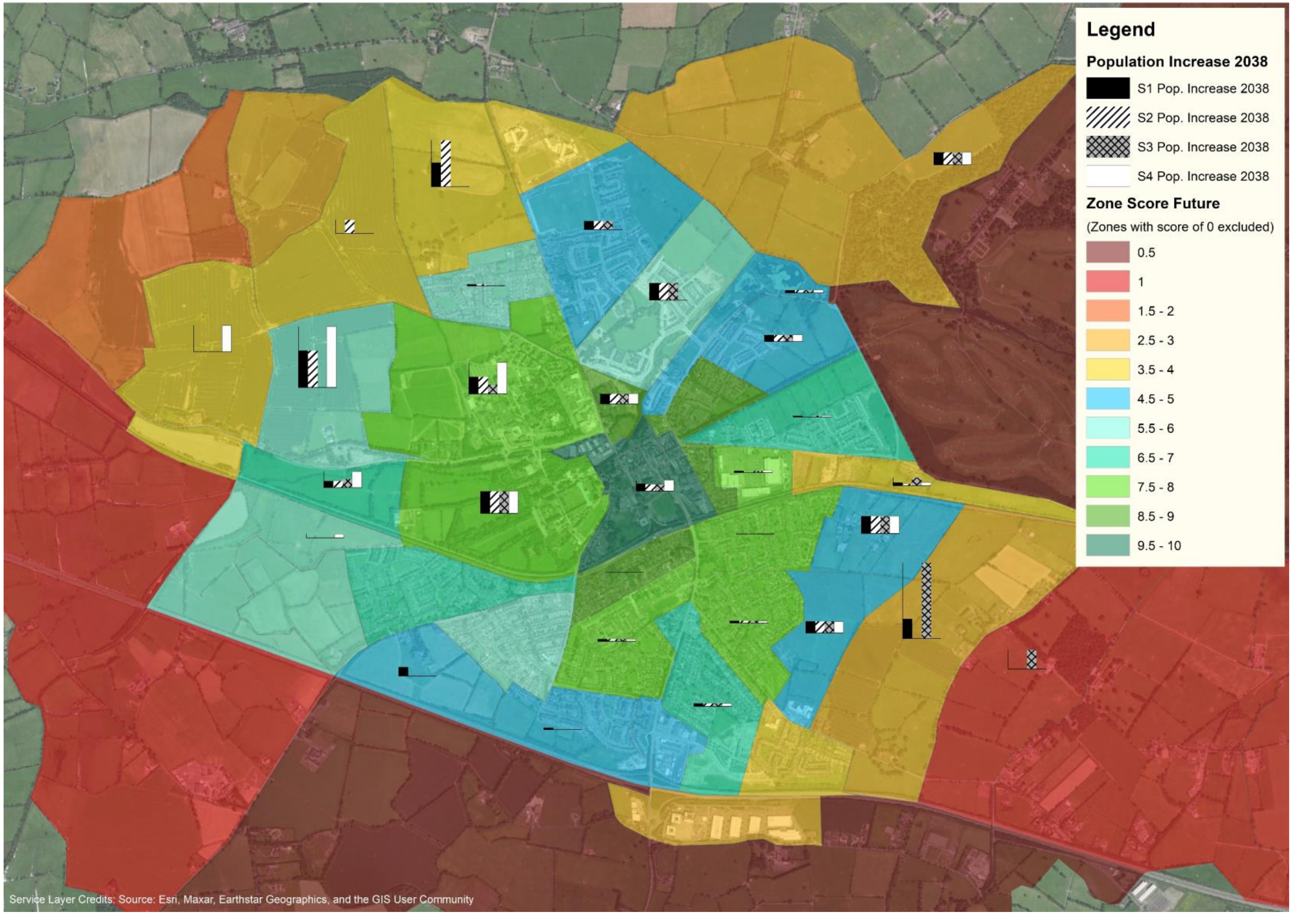

Figure 4.4 Population Growth Allocated to Different Sustainable Travel Zones by 2038

4.1.2.2 2038 Commercial/Service Growth

Table 4.5 shows the proportion of commercial/service growth allocated in zones based on their ability to promote or discourage sustainable travel. Scenarios 1, 2 and 4 allocate large amounts of growth to poor sustainable travel areas, while in contrast with this, Scenario 3 (eastern growth) allocates the majority of its growth into fair or good sustainable travel areas. For this reason, Scenario 3 has the strongest result for 2038 commercial/service growth. Scenario 4 is the worst performing scenario with most commercial/service growth allocated to areas where sustainable travel is unlikely.

Table 4.5 Commercial Growth (m^2) Allocated to Different Sustainable Travel Zones by 2038

'Future Situation' Scoring	Scenario 1 - Concentric Growth	Scenario 2 – Northern Growth	Scenario 3 – Eastern Growth	Scenario 4 – Western Growth
Zero/extremely limited potential for ST	0	0	0	0
Poor potential for sustainable travel	172,970	172,970	48,320	201,370
Fair potential for sustainable travel	0	0	126,150	0
Good potential for sustainable travel	50,900	50,900	49,400	22,500
Strong potential for sustainable travel	4,500	4,500	4,500	4,500

Figure 4.5 shows the spatial distribution of commercial/service growth in each 2038 land-use scenario overlaid on the future situation sustainable travel scoring. This shows that the particularly positive results for Scenario 3 are due to the location of most commercial growth in a zone in close proximity to the new western train station and the university, while in Scenarios 1, 2 and 4 this growth is located further away from the urban area in the western periphery, which has a lower sustainable travel score.

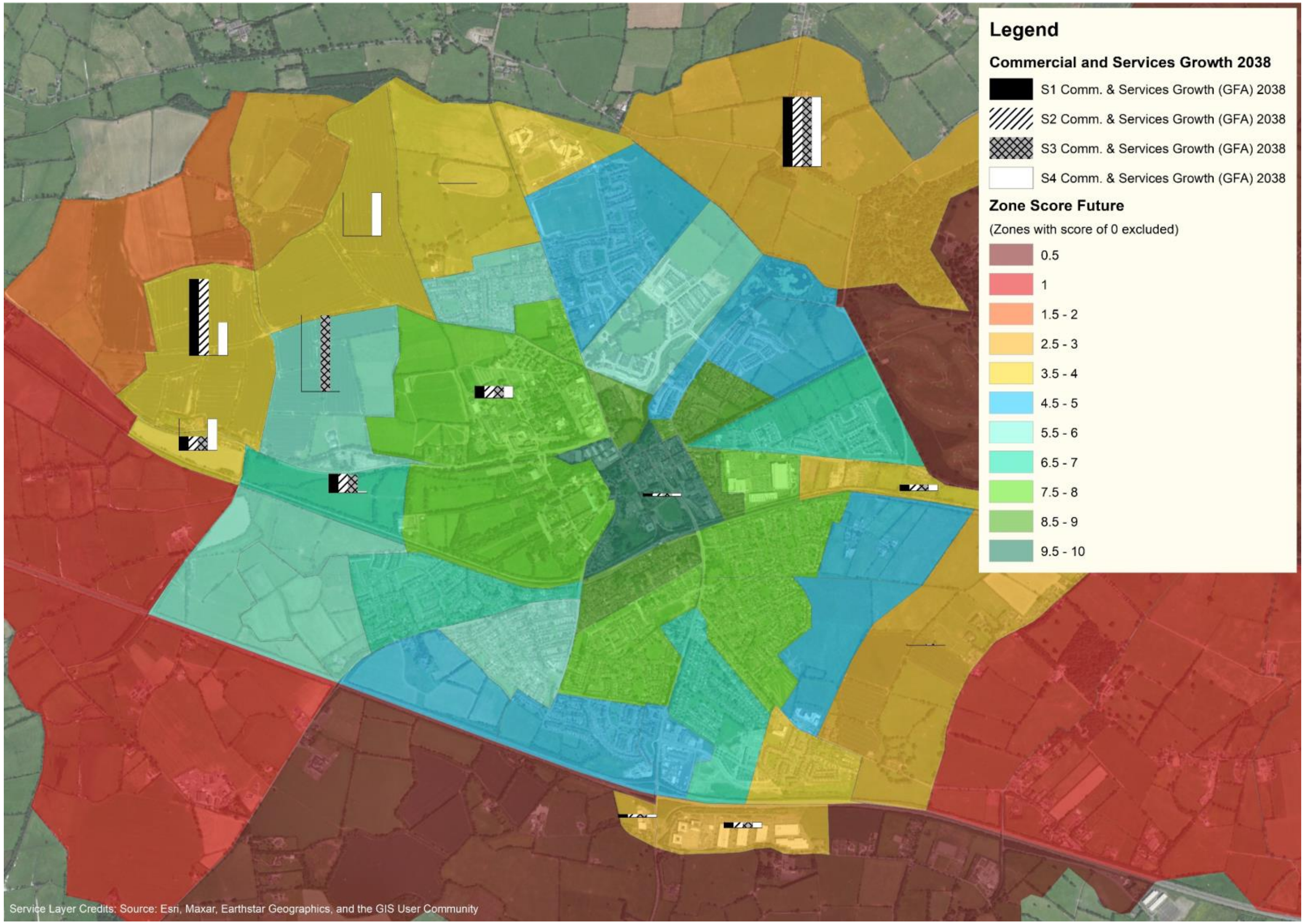

Figure 4.5 Commercial/Service Growth Allocated to Different Sustainable Travel Zones by 2038

4.1.2.3 2038 School Pupil Growth

Table 4.6 shows the proportion of school pupil growth allocated in zones based on their ability to promote or discourage sustainable travel. The best performing scenarios are Scenario 1 and 2, which allocate a large proportion of new school growth in areas which are rated as ‘fair’ for promoting sustainable travel, with less growth allocated to zero sustainable travel areas. In contrast with this, Scenario 3 allocates the majority of school growth to areas with zero/extremely limited or poor potential for sustainable travel and it is the worst performing scenario. Scenario 4 performs poorly, but slightly better than Scenario 3 because no growth is assigned to zero sustainable travel areas.

Table 4.6 School Pupil Growth Allocated to Different Sustainable Travel Zones by 2038

‘Future Situation’ Scoring	Scenario 1 - Concentric Growth	Scenario 2 – Northern Growth	Scenario 3 – Eastern Growth	Scenario 4 – Western Growth
Zero/extremely limited potential for ST	0	0	2,124	0
Poor potential for sustainable travel	2,589	2,589	2,589	4,713
Fair potential for sustainable travel	2,624	2,624	500	500
Good potential for sustainable travel	434	434	434	434
Strong potential for sustainable travel	0	0	0	0

Figure 4.6 shows the spatial distribution of school pupil growth in each 2038 land-use scenario overlaid on the future situation sustainable travel scoring. This shows that the poor results for Scenario 3 are due to the location of a large school in the far eastern periphery. Similarly, Scenario 4 locates a large school in the western periphery, which has a slightly better sustainable travel score than Scenario 3, but it is still likely to encourage car trips due to the lack of sustainable travel alternatives. In contrast with this, the equivalent school is located closer to the the existing urban area in Scenario 1-2 in a zone to the west of the Maynooth University campus and this results in a more postive score.

It should be noted that while there are differences between the scenarios, none of them perform particularly well in respect to allocating school growth into the areas best suited to promote sustainable travel as most growth is located in the periphery rather than the centre.

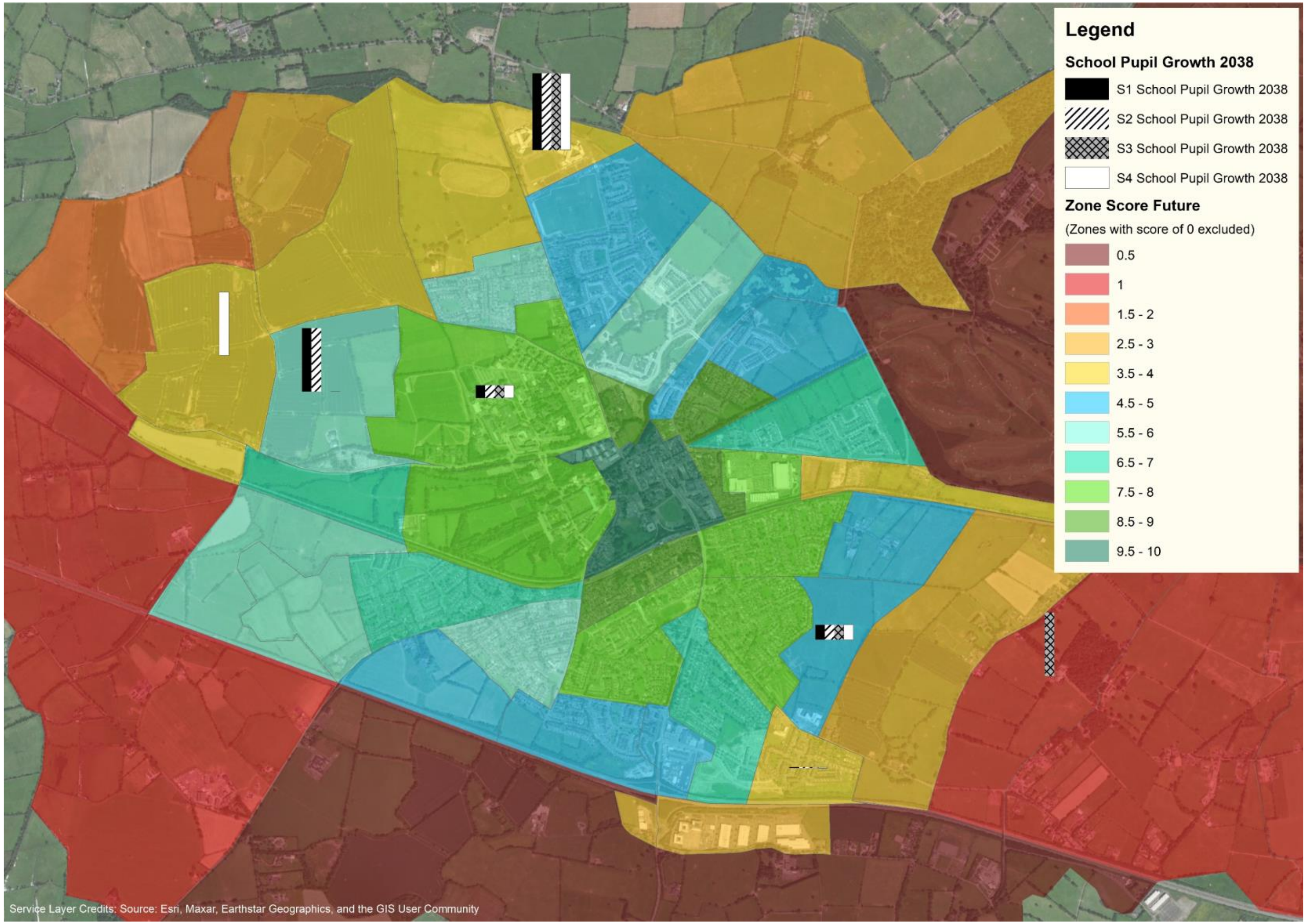

Figure 4.6 School Pupil Growth Allocated to Different Sustainable Travel Zones by 2038

4.1.3 Maynooth Environs (Moygaddy) Sustainable Travel Assessment

The Maynooth Environs (Moygaddy) in County Meath are located in Zone 39001 in the transport model, which has a ‘poor’ rating for sustainable travel in both the existing and future situation scoring. The growth allocated to Maynooth Environs (Moygaddy) is the same across all four land-use scenarios (Table 4.7). The population of this zone will grow by 1,000 people by 2028 with the majority of other development consisting of commercial/service uses.

Table 4.7 Maynooth Environs (Moygaddy) Zone Growth

2028	
Population Growth (No. People)	1,000
School (No. Pupils)	0
Commercial/Service Growth (GFA m^2)	56,860
2038	
Population Growth (No. People)	1,000
School (No. Pupils)	0
Commercial/Service Growth (GFA m^2)	114,950

4.2 VISUM Scenario Results

This section presents the results of the VISUM strategic transport modelling for the four land-use scenarios. As explained in the methodology, first the models are run without supporting road infrastructure to assess how the network performs, following this the models are re-run with supporting orbital roads and the addition of growth in the Maynooth Environs (Moygaddy) as a sensitivity test. In these results, the mapping outputs focus on the 2038 AM results for brevity, but the full suite of 2028 and 2038 AM/PM results have been provided to Kildare County Council separately.

4.2.1 Land-Use Scenarios without Supporting Orbital Road Infrastructure

This section presents the results of the initial run of land-use scenarios where the only supporting road infrastructure is the DM (do minimum) road network.

4.2.1.1 Volume/Capacity Comparison

Figure 4.7 shows the volume/capacity maps for the four land-use scenarios in 2038 AM peak with the DM road network. Volume/capacity maps show whether a road is operating within capacity (green lines) or experiencing different levels of congestion (blue, orange, red). The significant increase in growth has resulted in a large number of additional trips which are causing capacity issues in central areas and radial roads. In particular, the Kilcock Road, Moyglare Road, Parson Street and Mill Street are operating at, or beyond capacity, across all scenarios.

While there are minor differences between the scenarios, the main conclusion is that the road network will require additional infrastructure to cater for the extra growth as the maps show that the DM road network cannot accommodate this level of demand.

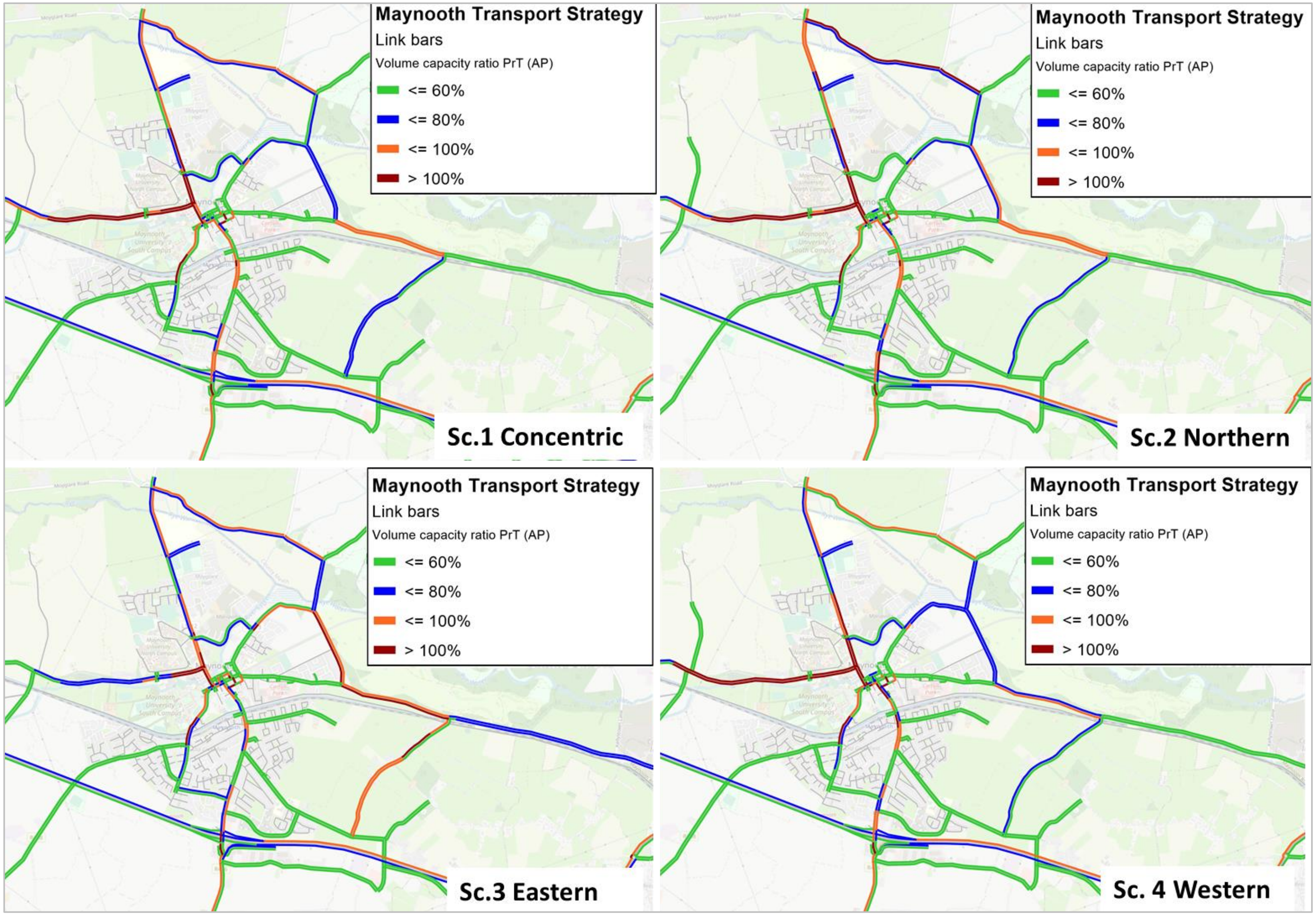

Figure 4.7 Comparison of Land-Use Scenarios without Supporting Road Infrastructure: V/C Maps 2038 AM

4.2.1.2 Network Statistics

Table 4.8 shows the AM network statistics for the 2019 base model and the four land-use scenarios in 2038 with the DM network. This shows that compared to the base model (2019), the additional growth will cause a major increase in total vehicle kilometres travelled and total journey time, along with a significant reduction in average network speed. In the next section, the four land-use scenarios were run with supporting road infrastructure so that a more realistic assessment can be conducted.

Table 4.8 Network Statistics DM Network – 2038 AM Peak – Light and Heavy Vehicles

Scenario	Total Network Trips	Total Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 AM Base	16,711	151,522	3,148	48.1
2038 AM SC1 DM	23,100	208,590	5,596	37.3
2038 AM SC2 DM	23,104	209,567	5,680	36.9
2038 AM SC3 DM	23,292	210,608	5,303	39.7
2038 AM SC4 DM	23,428	213,579	6,093	35.1

4.2.2 Land-Use Scenarios with Supporting Orbital Road Infrastructure

This section presents the results of the second run of land-use scenarios where two supporting orbital roads are added to each scenario, in addition to the DM road network, to allow for access to the new development sites and provide additional capacity to support this level of growth.

4.2.2.1 Volume/Capacity Comparison

Figure 4.8 shows the volume/capacity maps for the four land-use scenarios in 2038 AM peak, run with the DM road network and two orbital roads to support each land-use scenario (as defined in the methodology in Section 3). This shows that effectively doubling the size of the town will still cause significant pressure on the road network in all scenarios, even with supporting orbital roads. There are similar themes across the V/C maps with greater congestion on the links providing access to/from the new growth areas e.g. links in the West in Scenario 4.

The added orbital roads provide access to the new growth areas, but more substantial infrastructure will be required for the road network to operate effectively due to the scale of development taking place – the type of additional road infrastructure will be determined as part of the MEABTA road option selection process.

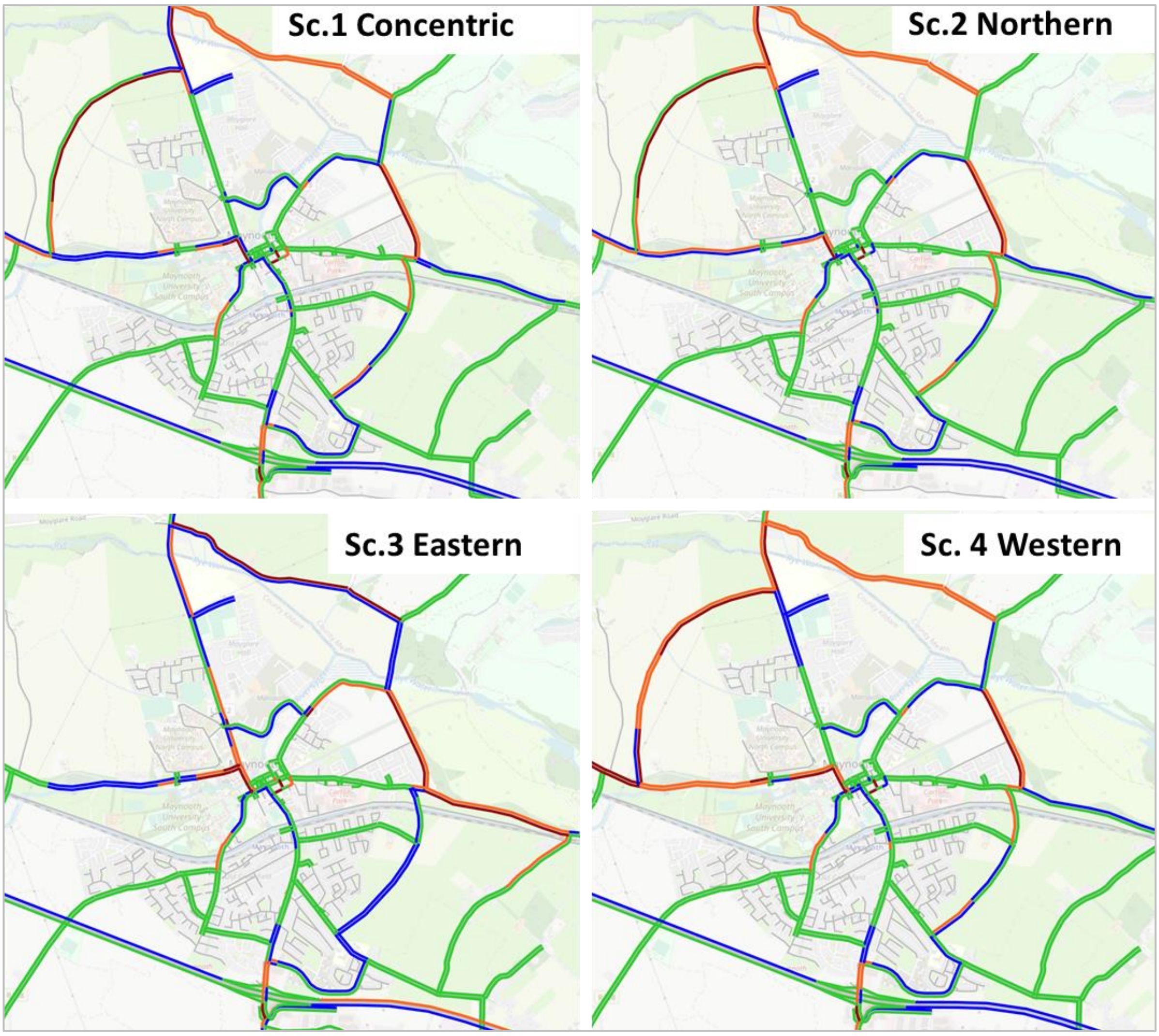

Figure 4.8 Comparison of Land-Use Scenarios <u>with</u> Supporting Roads: V/C Maps 2038 AM

4.2.2.2 Difference Plots

The difference plot maps show the traffic impact of adding two orbital roads in each scenario, indicating where traffic has increased and rerouted from. **Green** links represent a decrease in traffic flows, while **red** links represent an increase in traffic flow. Difference plot maps are provided for 2038 AM Peak for Scenario 1 (Figure 4.9), Scenario 2 (Figure 4.10), Scenario 3 (Figure 4.11) and Scenario 4 (Figure 4.12).

In general, the difference plots show the role of the minimum road infrastructure links in providing access to new development areas and managing the significant increase in growth. In Scenario 1, 2 and 4; the western orbital link reduces pressure on the town centre road network, Kilcock Road and Moyglare Road. In all scenarios, the new south-eastern orbital link reduces traffic on the L5053 as well as town centre traffic to a certain extent.

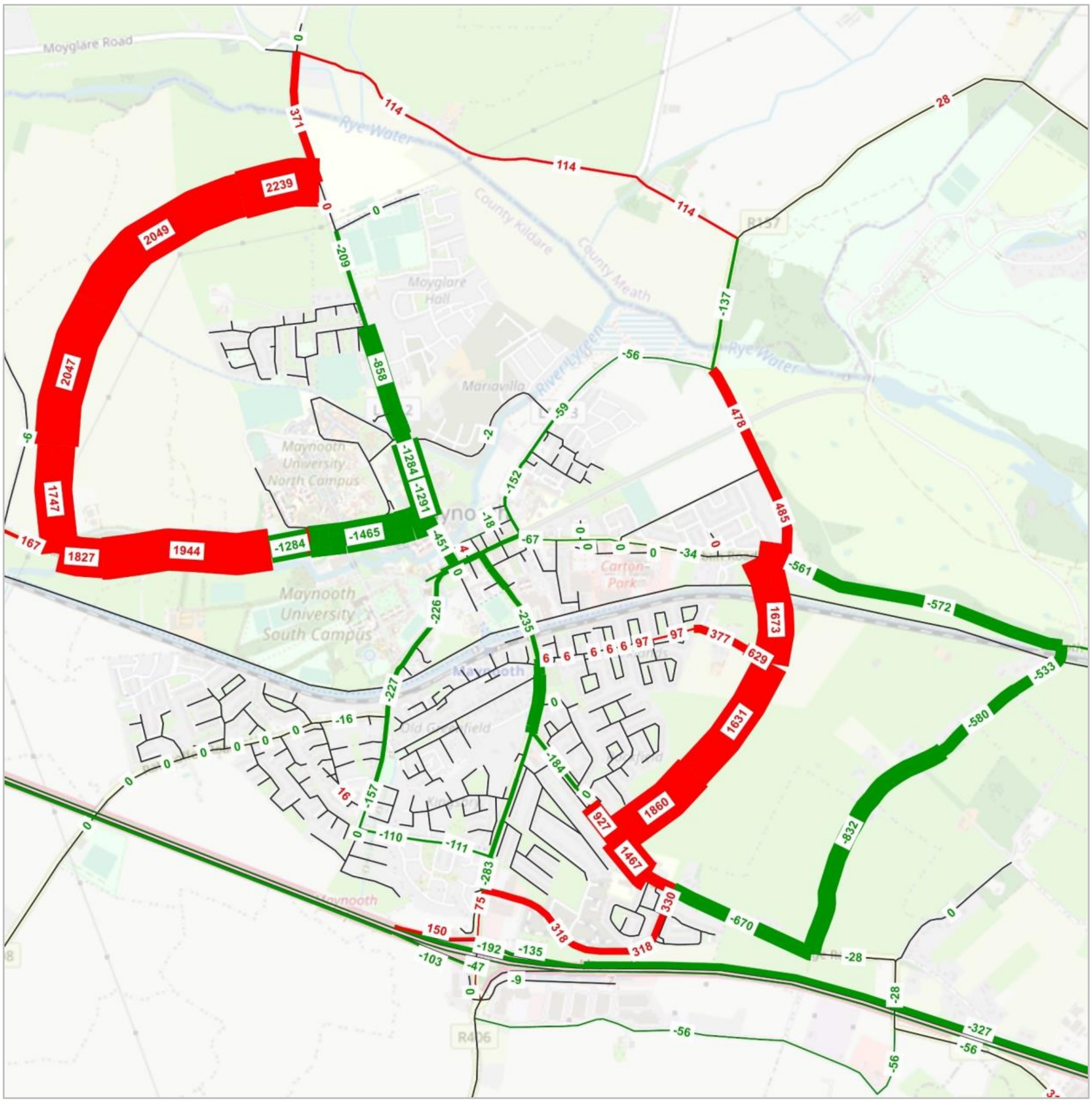

Figure 4.9 Scenario 1 2038 AM – Difference Plot showing Impact of New Roads

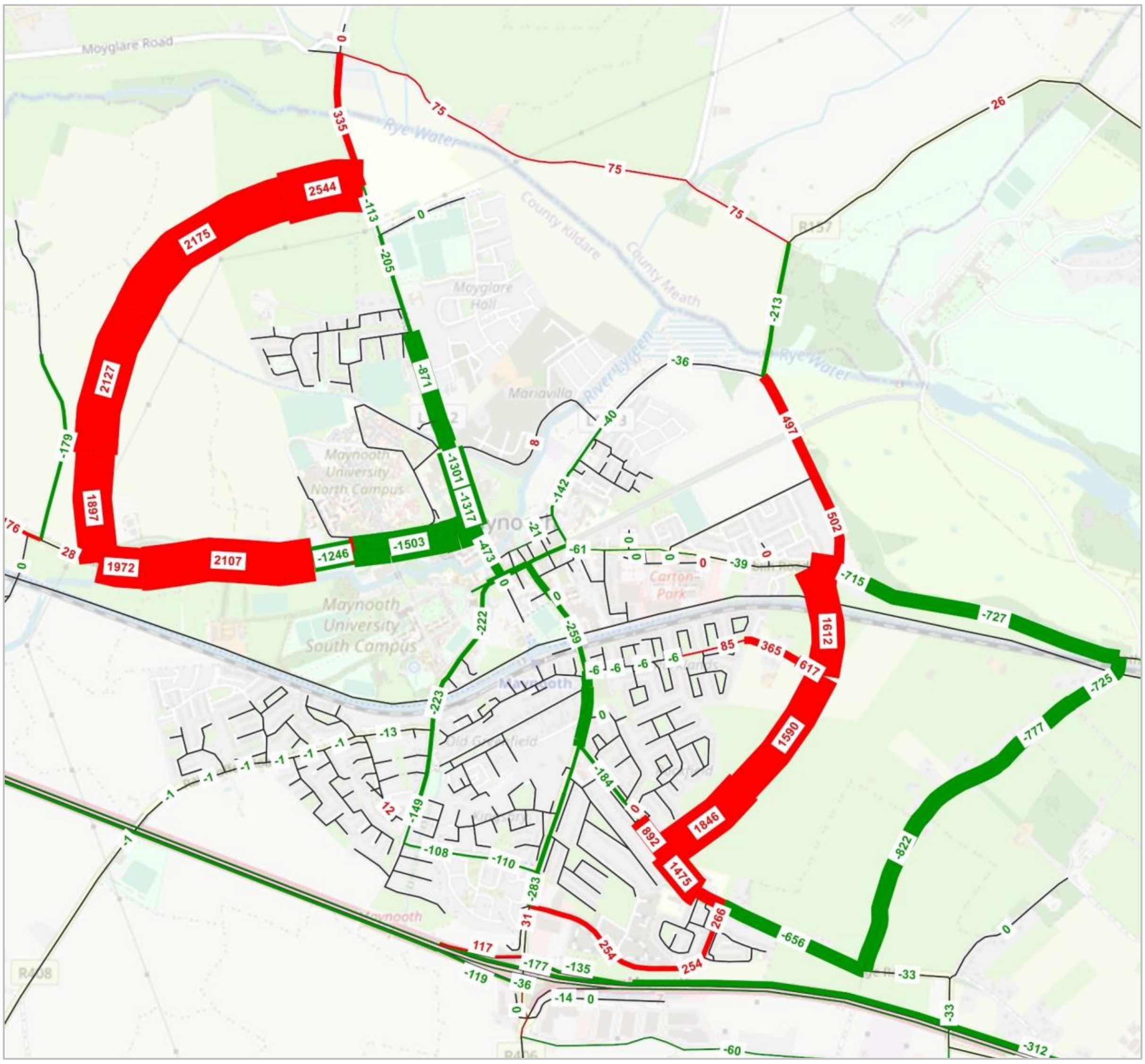

Figure 4.10 Scenario 2 2038 AM – Difference Plot showing Impact of New Roads

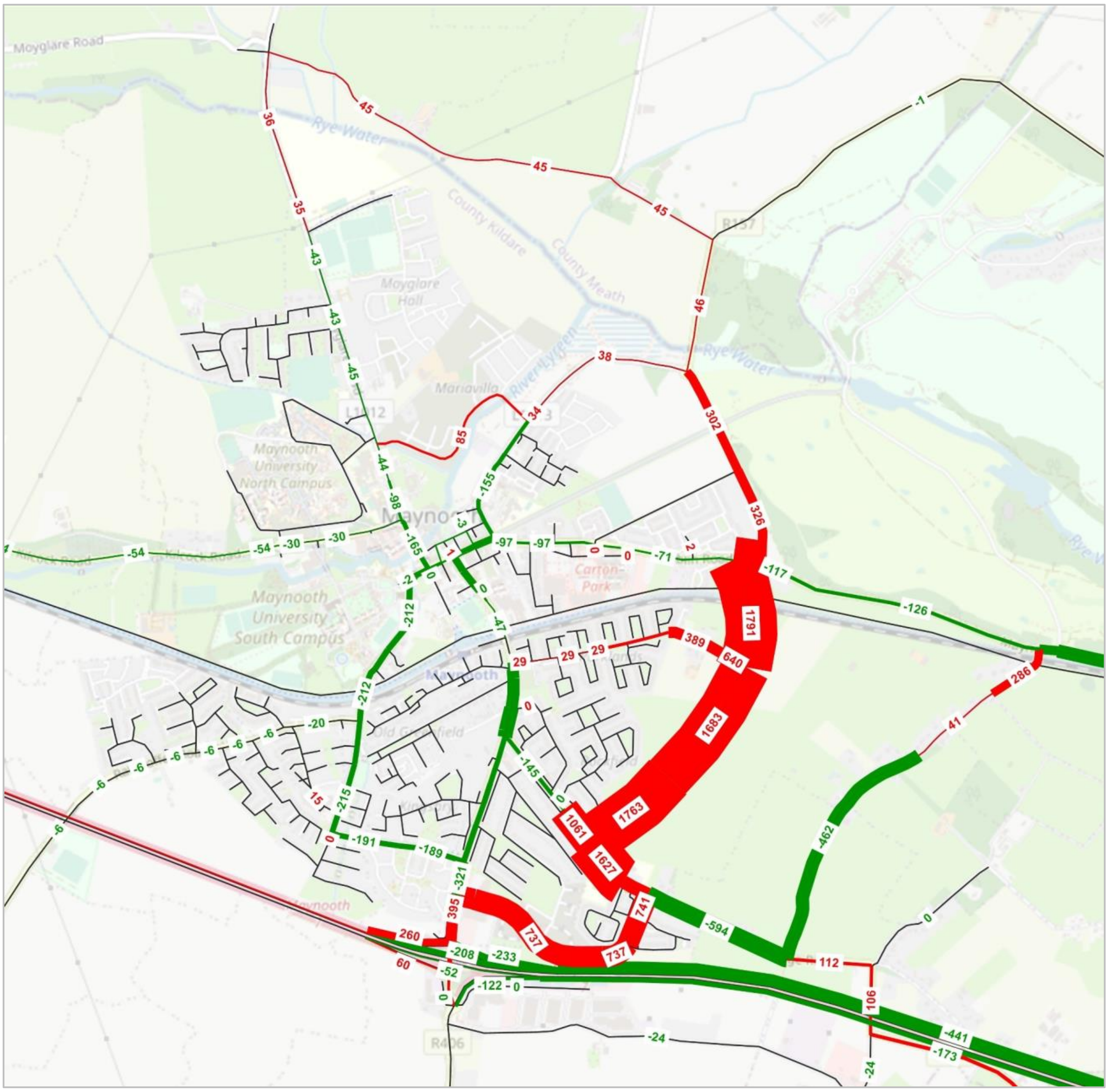

Figure 4.11 Scenario 3 2038 AM – Difference Plot showing Impact of New Roads

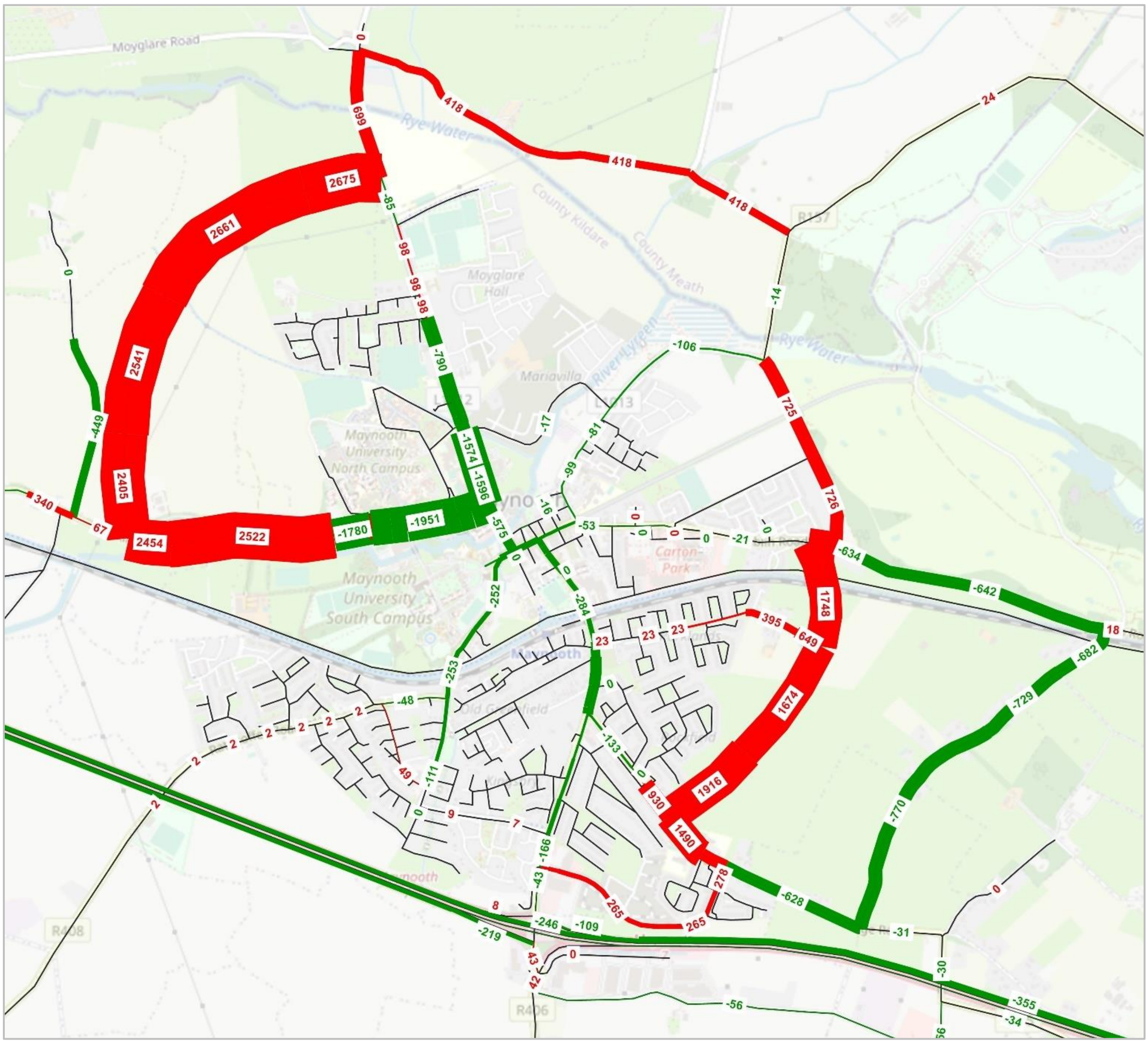

Figure 4.12 Scenario 4 2038 AM – Difference Plot showing Impact of New Roads

4.2.2.3 Network Statistics

Table 4.9 shows the 2028 AM Peak and Table 4.10 shows the 2028 PM peak network statistics for the four land-use scenarios, with the minimum supporting road infrastructure, when compared to the base model. When compared to the base model, it can be observed that 2028 growth adds additional trips to the network which increases total vehicle kilometres travelled and journey times, while also reducing average speed. There are only marginal differences between the four scenarios in 2028 and the network statistics do not help to identify the preferred scenario.

Table 4.9 Network Statistics DS Network – 2028 AM Peak – Light and Heavy Vehicles

Model	Total Network Trips	Total Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 Base AM	16,711	151,522	3,148	48.1
2028 AM SC1	20,414	182,492	3,975	45.9
2028 AM SC2	20,422	183,387	4,022	45.6
2028 AM SC3	20,432	183,972	4,166	44.2
2028 AM SC4	20,421	183,991	4,023	45.7

Table 4.10 Network Statistics DS Network – 2028 PM Peak – Light and Heavy Vehicles

Model	Total Network Trips	Total Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 PM	18,392	165,043	3,514	47.0
2028 PM SC1	21,472	193,593	4,248	45.6
2028 PM SC2	21,484	194,542	4,289	45.4
2028 PM SC3	21,508	194,616	4,379	44.4
2028 PM SC4	21,484	195,018	4,308	45.3

Table 4.11 shows the 2038 AM Peak and Table 4.12 shows the 2038 PM peak network statistics for the four land-use scenarios, with the minimum supporting road infrastructure, when compared to the base model.

The differences are very marginal, with Scenario 1 and 2 performing best in respect to total travel time and average network speed. Scenarios 3 and 4 perform worst in the network statistics, but these development approaches are more favourable from a sustainable transport perspective as the GIS assessment has indicated. In reality, Scenario 4 (western) is the rail-centric scenario and substantial modal shift would be expected at this site which would improve the results by lowering the number of vehicle trips, but this change is not reflected in a highway-only transport model.

Table 4.11 Network Statistics DS Network – 2038 AM Peak – Light and Heavy Vehicles

Model	Total Network Trips	Total Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 AM	16,711	151,522	3,148	48.1
2038 AM SC1	23,100	205,125	4,780	42.9
2038 AM SC2	23,104	205,114	4,804	42.7
2038 AM SC3	23,292	208,011	5,019	41.4
2038 AM SC4	23,428	208,905	5,010	41.7

Table 4.12 Network Statistics DS Network – 2038 PM Peak – Light and Heavy Vehicles

Model	Total Network Trips	Total Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 PM	18,392	165,043	3,514	47.0
2038 PM SC1	23,871	216,195	5,010	43.2
2038 PM SC2	23,883	216,181	5,032	43.0
2038 PM SC3	23,943	217,299	5,173	42.0
2038 PM SC4	23,982	217,983	5,167	42.2

4.2.3 Land-Use Scenarios with Maynooth Environs (Moygaddy) Sensitivity Test

This section provides results of the Maynooth Environs (Moygaddy) sensitivity test, which assesses the impact of adding planned growth to the Maynooth Environs (Moygaddy) zone in County Meath. These scenarios also use the minimum supporting road infrastructure used in the previous section.

The Maynooth Environs (Moygaddy) growth to 2038 consists of; 1000 extra people, 24,200 GFA office space and 90,750 GFA industrial space. As the land-uses are primarily commercial, the zone attracts more trips than it generates in the AM peak. In total there are 967 arrivals and 443 departures in AM peak and 951 departures and 388 arrivals in PM peak 2038.

4.2.3.1 Volume/Capacity Comparison

Figure 4.13 to Figure 4.16 compare the V/C maps for the AM 2038 scenarios (with minimum road infrastructure) without growth in Maynooth Environs (Moygaddy) vs with Maynooth Environs (Moygaddy) growth included. In these maps, it can be observed that the addition of growth in Maynooth Environs (Moygaddy) puts significant additional pressure on the road network across all scenarios. In particular, it is notable that the eastern road network (i.e. a combination of the eastern orbital, R157 and local lanes) is acting as an eastern bypass for trips to/from Maynooth Environs (Moygaddy) and the M4, with many of these links operating beyond 100% capacity.

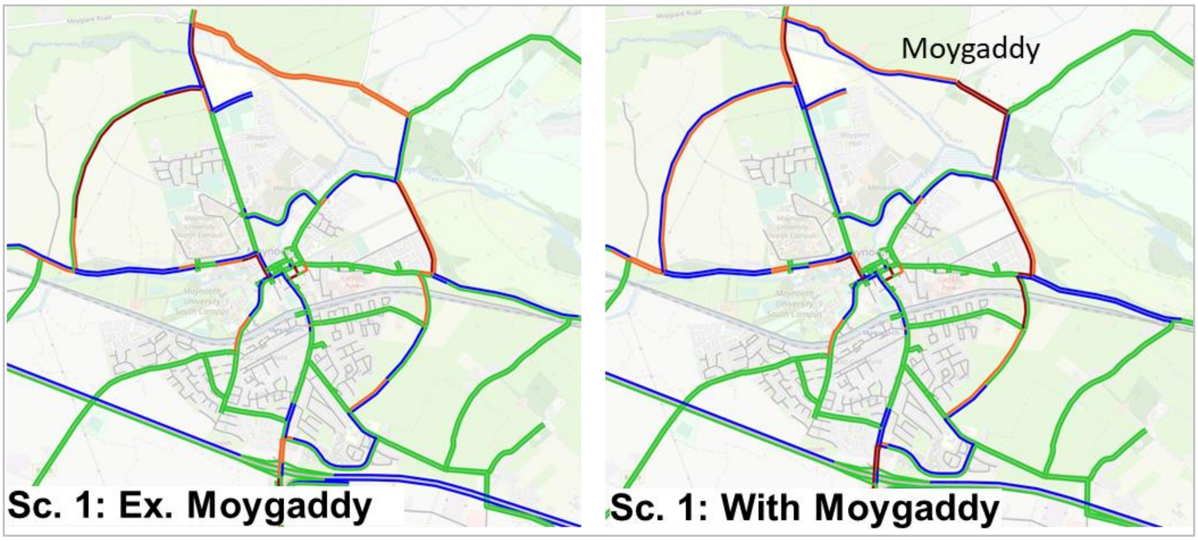

Figure 4.13 Scenario 1 - Comparison of V/C With vs Without Maynooth Environs (Moygaddy) Growth: 2038 AM DS Network

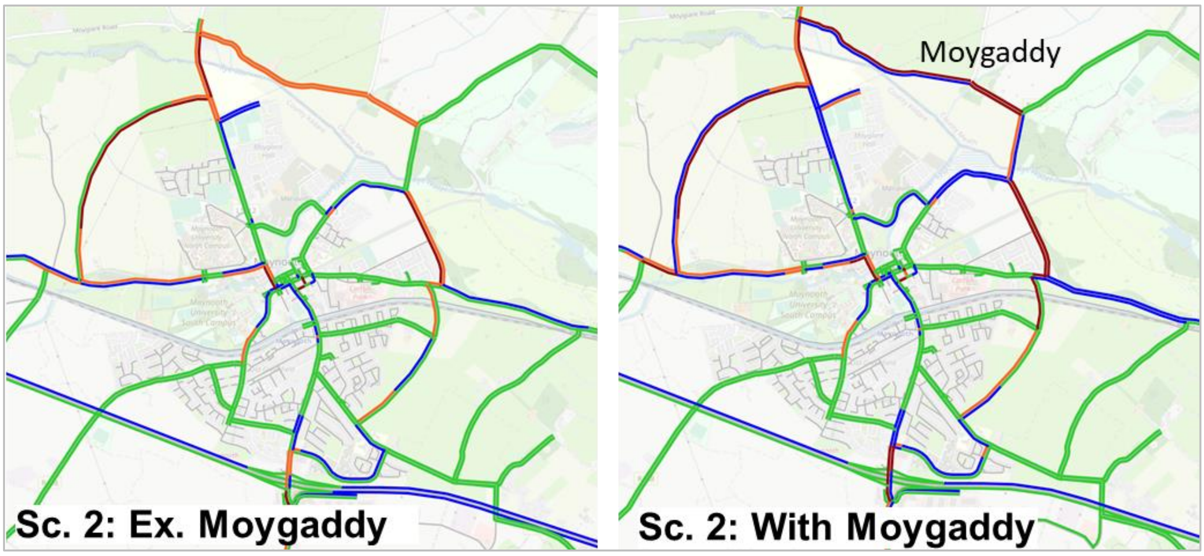

Figure 4.14 Scenario 2 - Comparison of V/C With vs Without Maynooth Environs (Moygaddy) Growth: 2038 AM DS Network

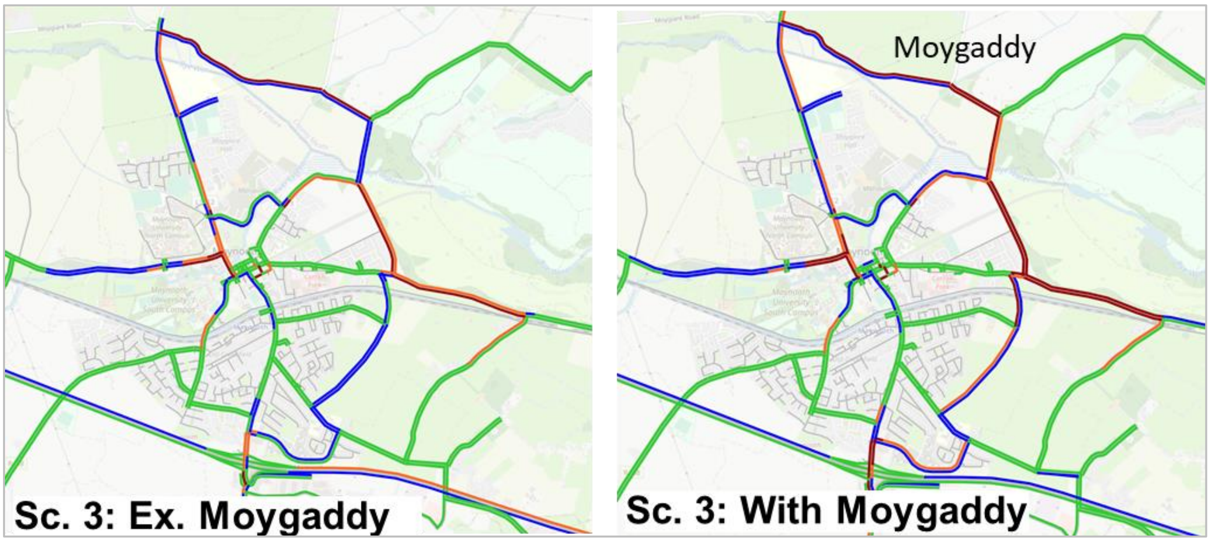

Figure 4.15 Scenario 3 - Comparison of V/C With vs Without Maynooth Environs (Moygaddy) Growth: 2038 AM DS Network

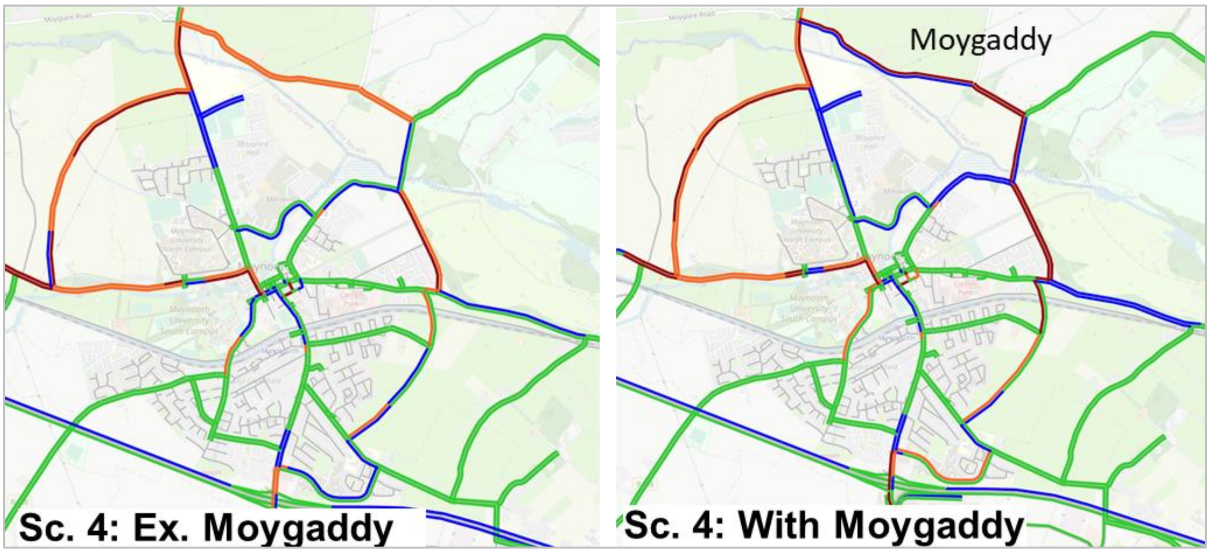

Figure 4.16 Scenario 4 - Comparison of V/C With vs Without Maynooth Environs (Moygaddy) Growth: 2038 AM DS Network

4.2.3.2 Maynooth Environs (Moygaddy) Difference Plots

The difference plots show the impact of adding additional growth to the Maynooth Environs (Moygaddy) zone in the 2038 AM models which use the minimum supporting road infrastructure. The difference plots are produced by comparing the number of trips on links without Maynooth Environs (Moygaddy) growth vs links with the Maynooth Environs (Moygaddy) growth, to understand the additional trips along routes to/from the zone. **Green** links represent a decrease in traffic flows, while **red** links represent an increase in traffic flow. The difference plots are shown in Figure 4.17 to Figure 4.20 for Scenario 1-4 in the 2038 AM DS (minimum road infrastructure) scenarios.

In the difference plots, it can be observed that Maynooth Environs (Moygaddy) growth is adding circa 600-900 vehicles along the eastern orbital route (R157, eastern orbital link and local lanes) between and the M4 junction in Scenarios 1, 2 and 4. In scenario 3 (Eastern), where there is no north-west orbital road, the number of vehicles on the eastern orbital route to Maynooth Environs (Moygaddy) increases to circa 1,100-1,300 additional vehicles. Furthermore, in all scenarios it can be noted that increased congestion in Maynooth has caused a certain amount of rerouting of vehicles from the Maynooth M4 junction to the Leixlip M4 junction.

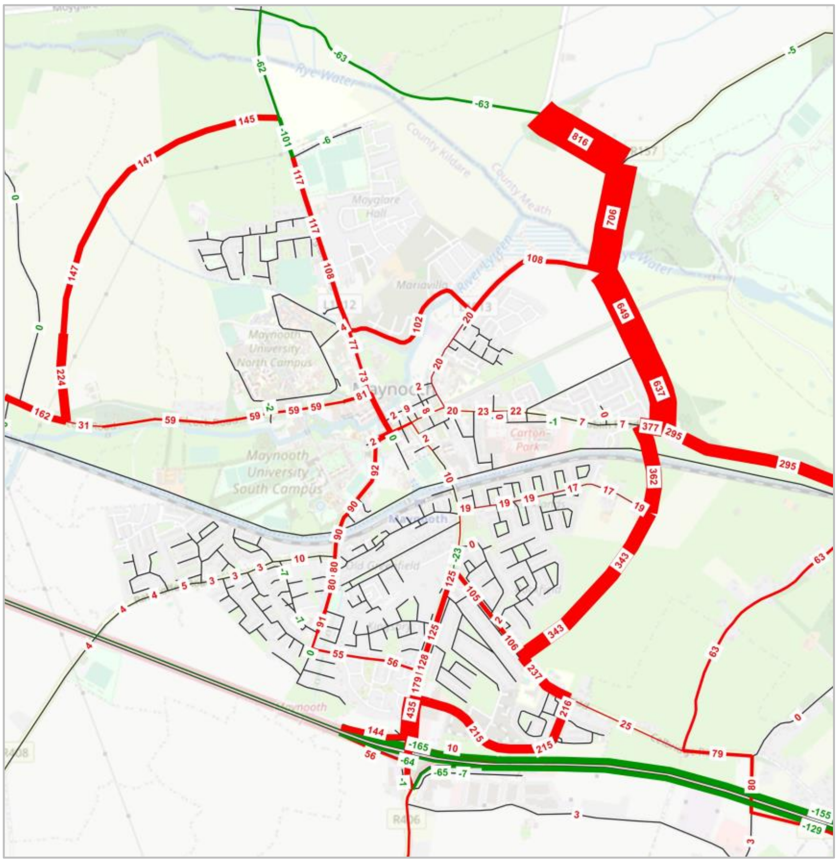

Figure 4.17 Difference Plot With vs Without Maynooth Environs (Moygaddy): Scenario 1 2038 AM DS Network

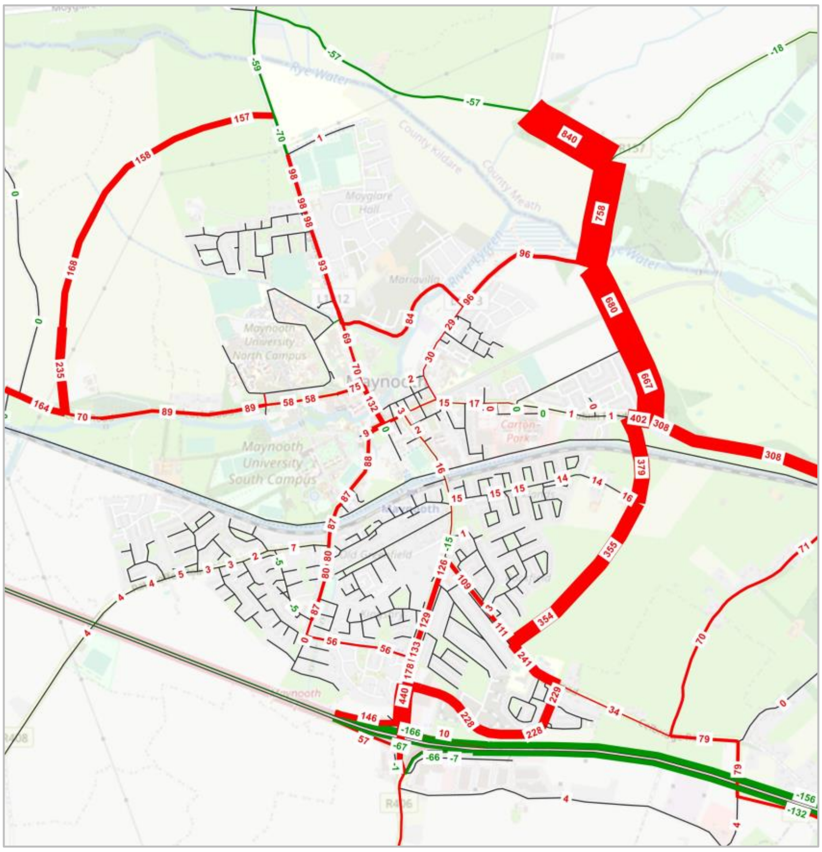

Figure 4.18 Difference Plot With vs Without Maynooth Environs (Moygaddy): Scenario 2 2038 AM DS Network

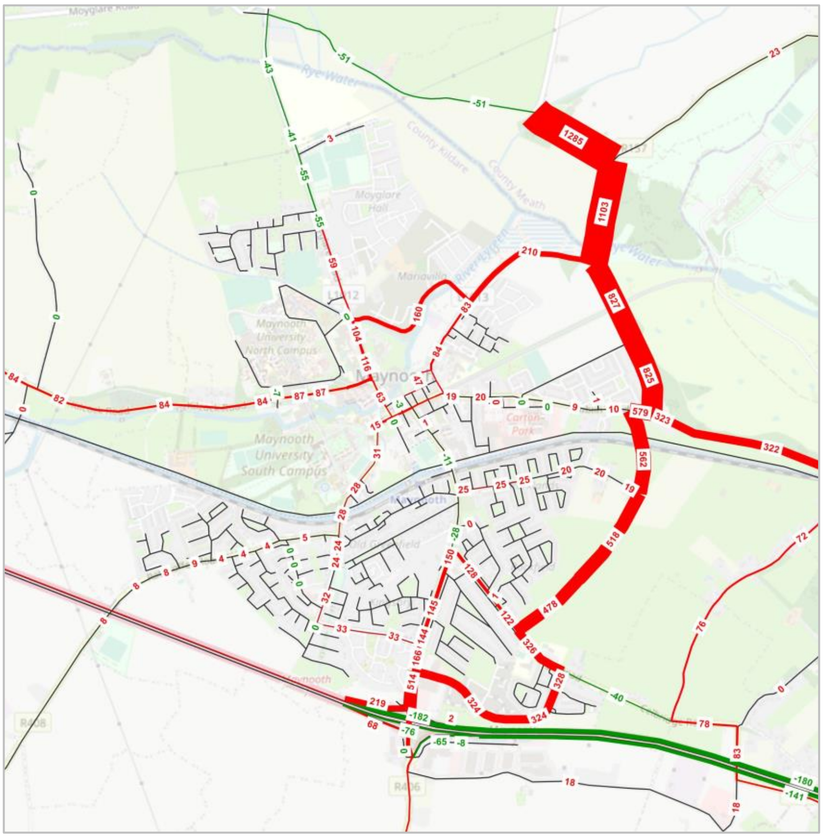

Figure 4.19 Difference Plot With vs Without Maynooth Environs (Moygaddy): Scenario 3 2038 AM DS Network

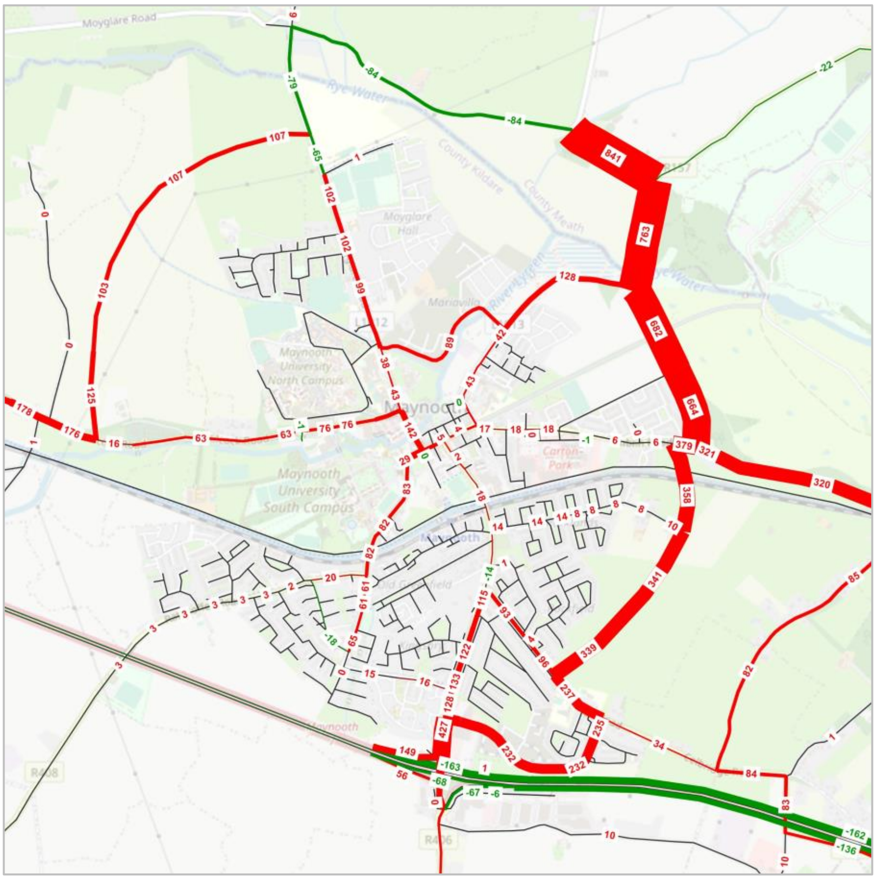

Figure 4.20 Difference Plot With vs Without Maynooth Environs (Moygaddy): Scenario 4 2038 AM DS Network

4.2.3.3 Maynooth Environs (Moygaddy) Sensitivity Test Network Statistics

The network statistics for the Maynooth Environs (Moygaddy) scenarios from 2028 to 2038 are shown in Table 4.13 to Table 4.16.

Table 4.13 Maynooth Environs (Moygaddy) Network Statistics DS Network – 2028 AM Peak – LV + HV Vehicles

Model	Total Network Trips	Total Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 AM Base	16,711	151,522	3,148	48.1
2028 AM SC1 Moygaddy	20,874	186,711	4,153	45.0
2028 AM SC2 Moygaddy	20,880	187,612	4,202	44.7
2028 AM SC3 Moygaddy	20,893	188,575	4,368	43.2
2028 AM SC4 Moygaddy	20,880	188,051	4,199	44.8

Table 4.14 Maynooth Environs (Moygaddy) Network Statistics DS Network – 2028 PM Peak – LV + HV Vehicles

Model	Total Network Trips	Total Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 AM Base	18,392	165,043	3,514	47.0
2028 AM SC1 Moygaddy	21,921	197,934	4,410	44.9
2028 AM SC2 Moygaddy	21,933	198,919	4,454	44.7
2028 AM SC3 Moygaddy	21,957	199,163	4,562	43.7
2028 AM SC4 Moygaddy	20,880	188,051	4,199	44.8

Table 4.15 Maynooth Environs (Moygaddy) Network Statistics DS Network – 2038 AM Peak – LV + HV Vehicles

Model	Total Network Trips	Total Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 AM Base	16,711	151,522	3,148	48.1
2028 AM SC1 Moygaddy	23,804	211,685	5,119	41.4
2028 AM SC2 Moygaddy	23,811	211,939	5,159	41.1
2028 AM SC3 Moygaddy	23,972	215,240	5,417	39.7
2028 AM SC4 Moygaddy	24,136	215,551	5,367	40.2

Table 4.16 Maynooth Environs (Moygaddy) Network Statistics DS Network – 2038 PM Peak – LV + HV Vehicles

Model	Total Network Trips	Total Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 AM Base	18,392	165,043	3,514	47.0
2028 AM SC1 Moygaddy	24,554	222,842	5,300	42.0
2028 AM SC2 Moygaddy	24,556	222,925	5,324	41.9
2028 AM SC3 Moygaddy	24,617	224,338	5,514	40.7
2028 AM SC4 Moygaddy	24,656	224,542	5,465	41.1

4.3 Multi-Criteria Analysis

4.3.1 Multi-Criteria Analysis (MCA) Scoring System Approach

This section presents the MCA table which assesses the four land-use scenarios to help to identify the preferred scenario. The MCA table scorings are based on the land-use scenarios with supporting orbital infrastructure modelling in Section 4.2.2, the GIS sustainable travel assessment quantification tables and the alignment with the land-use objectives assessed in Section 4.3.2. Each land-use scenario is rated on a five-point scale as shown in Table 4.17.

Table 4.17 MCA Scoring System

Colour	Description
(dark green)	Highly Positive
(light green)	Positive
(yellow)	Minor Positive/Minor Negative
(orange)	Negative
(red)	Highly Negative

The MCA scoring process is based on the relative merit of each scenario within the context of the four scenarios. This means that when all scenarios score poorly for an indicator (e.g. school growth) then the best performing of the scenarios will receive a positive score on the basis of their relative merit. This approach allows for the preferred scenario to be identified, as well as the positive/negative aspects of each scenario which could inform an amalgamated scenario of the best aspects.

The difference between ‘highly positive’ and ‘positive’, or ‘negative’ and highly negative’, is based on the scale of relative difference. If the differences between the scenarios are minor, then most results will be ‘positive’ or ‘negative’ scores, but if there are substantial differences between the scenarios the scores will be ‘highly positive’ or ‘highly negative’.

4.3.2 Scenario Alignment with Land-Use Objectives to Inform MCA

Table 4.18 assesses the scenario alignment with the land-use objectives to inform the completion of this column in the MCA assessment criteria.

Table 4.18 Assessment of Full Scenario Development (2038) Alignment with Land-Use Objectives

Land-Use Objective		Scenario 1 Comment	Scenario 2 Comment	Scenario 3 Comment	Scenario 4 Comment
1. Support consolidation of the existing urban area through compact growth and discourage urban sprawl		This scenario is more compact than most scenarios with most growth occurring closer to the centre, so this supports the compact growth objective. However, Sc1 does not locate schools in central locations.	This scenario promotes population growth in the northern periphery and school growth in the western periphery, which is not aligned with compact growth, but its commercial growth is located closer to the urban centre.	This scenario locates most population and school growth in the periphery, contrary to the compact growth objective, commercial growth however is located closer to the centre	This scenario concentrates population growth near the new train station and closer to the existing urban area, but the commercial and school expansion involves urban sprawl beyond the new population areas.
2. Encourage rail-oriented development by co-locating jobs and population in close proximity to existing or planned train stations		This scenario locates a reasonable proportion of population, commercial and school growth near the new or existing train stations.	This scenario locates a reasonable proportion of commercial and school growth near the new train station, but also locates a substantial amount of population growth far away on the northern periphery.	This scenario locates most population and school growth to the east, a significant distance from rail access.	This scenario locates most growth to the west near the site of the new train station, helping to achieve this objective.
3. Diversify land-use types to encourage shorter trip distances and model shift from car transport to sustainable travel modes		This scenario encourages co-location of schools, commercial and population land-uses in sites to the west of Maynooth.	This scenario encourages co-location of schools, commercial and population land-uses in sites to the west of Maynooth. However, this scenario also includes a large amount of peripheral single use residential growth.	This scenario separates commercial and population growth, with new residences in the east and new commercial areas in the west. Little evidence of diversification of new development areas.	This scenario encourages co-location of schools, commercial and population land-uses in sites to the west of Maynooth in larger volumes than Scenario 1 or 2.
4. Provide development in locations which allow for the efficient operation of the road network for passenger vehicles and freight		The scale of growth, rather than the location of growth, is the primary issue putting pressure on the road network.	This scenario locates growth to the north, which results in a large volume of cross-town trips between this area and the M4.	This scenario locates growth near to the existing M4 junction which reduces unnecessary cross-town trips/congestion.	This scenario locates growth to the west of the town, which without a full western bypass, puts additional pressure of the town centre road network for cross-town trips to the M4.
5. Ensure employment is provided in locations that align with national and regional policy requirements		This scenario locates commercial growth on the western periphery, which is not compact, but within reasonable distance of the new train station, which may encourage sustainable travel	This scenario locates commercial growth on the western periphery, which is not compact, but within reasonable distance of the new train station, which may encourage sustainable travel	This scenario locates commercial growth closer to the existing urban area, making it more compact, in close proximity to the new train station.	This scenario locates commercial growth on the western periphery, which is not compact, and only some of these sites are within reasonable distance of the new train station.
Objective Alignment Score:	Obj. 1	Positive	Negative	Negative	Minor +/-
	Obj. 2	Positive	Minor +/-	Highly Negative	Highly Positive
	Obj. 3	Positive	Minor +/-	Negative	Highly Positive
	Obj. 4	Minor +/-	Negative	Positive	Negative
	Obj. 5	Minor +/-	Minor +/-	Highly Positive.	Negative
	Score:	**Highly Positive**	**Highly Negative**	**Negative**	**Positive**

4.3.3 MCA Land-Use Assessment Table

The MCA table for the four land-use scenarios, which draws on evidence from the GIS scoring assessment, land use objective assessment and VISUM results, is presented in Table 4.19.

Table 4.19 MCA of Four Land-Use Scenarios

Scenario	2028 Sustainable Travel Scoring			2038 Sustainable Travel Scoring			2028 VISUM	2038 VISUM	Alignment with Land-Use Objectives
	Population Growth	Commercial Growth	School Pupil Growth	Population Growth	Commercial Growth	School Pupil Growth	Network Statistics[4]	Network Statistics[5]	
Scenario 1: Concentric Circle									
Scenario 2: Northern Growth									
Scenario 3: Eastern Growth									
Scenario 4: Western Growth									

[4] The network statistics for 2028 only have marginal differences which do not help to identify the preferred scenario. Therefore, these scenarios are rated minor positive/negative to reflect this.
[5] The 2038 network statistics have clearer differences than 2028 so positive/negative relative scores are adopted. As noted, several times in the report, the clearest guide regarding the preferred land-use scenario is the GIS sustainable travel scoring and quantification of growth, with the MCA table reflecting this conclusion.

4.4 Preferred Land-Use Scenario Recommendations

The MCA table provides an overview of how each scenario performs according to the different indicators; sustainable travel scoring, transport modelling and land-use objectives. While Scenario 1 (Concentric) technically scores the best overall, the primary conclusion of the MCA is there are positive and negative aspects of each scenario, and the preferred scenario should be an amalgamation of the best aspects from each. For instance, Scenario 4 (rail oriented) has the best scores for population growth across all scenarios, but its overall score is weakened by the poor location of commercial and school growth. Similarly, Scenario 3 (eastern) scores best in respect to commercial growth, but its rating is reduced by the poor location of school and population growth.

This section highlights the positives of each scenario, which could be amalgamated by KCC planning department to create the preferred land-use scenario in Maynooth and Environs in respect to Kildare County growth. Negative aspects which could be avoided are also documented, along with some additional commentary on the suitability of Maynooth Environs (Moygaddy) for development. The positive aspects of each scenario are primarily informed by the GIS sustainable scoring as this gives the clearest direction.

4.4.1 Kildare Scenario Recommendations

It is recommended that the preferred scenario utilises the following approaches:

- **Population Growth Recommendations**: Use Scenario 4 approach with new population growth focused on rail centric areas to the west closer to the existing urban area (Zone 49001322). However, the population growth in zones with a sustainable travel rating less than 4.5 (Zone 49001333) should be reallocated to less peripheral sites with increased housing densities;

- **Commercial/Service Growth Recommendations**: Use Scenario 3 approach which places commercial/service growth closer to the new rail station in the west and the existing urban area. This involves the same zone (49001322) as most Scenario 4 population growth so there may be space restrictions which affect this approach. If this is the case, then the underutilised[6] zones to the south-west of Maynooth, namely zones 4900412, 4900022 and 4900422 could be used for commercial growth as these areas all have sustainable travel scores of 4.5+ and currently no growth is allocated to them in any scenarios; and

- **School Growth Recommendations**: Scenarios 1 and 2 locate a large new school in the same zone (49001322) as recommended for population and commercial growth, which is well located near the existing urban centre and close to mixed use development. Furthermore, the new school places in the Maynooth University northern campus zone and the rail park site in

[6] It is acknowledged that some of these zones are marked as water retention areas for the new DART Depot. Given their prime location, with excellent access to sustainable travel infrastructure and Maynooth, consideration should be given to whether an engineering solution could be found to develop these areas for residential, commercial or school uses as well as the depot.

Scenarios 1-4 are well placed. However, no future schools are currently planned for the centre of Maynooth, which is equally accessible to all residents across the town, or the south-west which has a good sustainable travel scoring and no existing school. Consideration should be given to whether new schools could be provided in these areas instead.

It is recommended that the preferred land-use scenario avoids the following approaches:

- **Population Growth Approaches to Avoid**: Population growth should not occur in zones with a sustainable travel scoring less than 4.5-5 (future situation scoring). Currently, Scenarios 1, 2, 3 and 4 all locate population in these areas and this is likely to result in car dependent neighbourhoods with poor modal split for active modes and public transport.

- **Commercial/Service Growth Approaches to Avoid**: Commercial/service growth should not occur in zones with a sustainable travel scoring less than 4.5-5. Currently, all scenarios locate at least some of this growth in these areas, with the largest volumes in Scenario 1, 2 and 4.

- **School Growth Approaches to Avoid**: School growth should not occur in zones with a sustainable travel scoring less than 4.5-5. Excluding the MEC school campus to the north, Scenarios 3-4 are the primary issue in this regard with large schools located in zone 49001333 to the west and Zone 49001131 to the east. These new schools could be relocated as described in the recommendations section.

4.4.2 Maynooth Environs Planning Implications and Recommendation

4.4.2.1 Maynooth Environs (Moygaddy) Car Dependency and Sustainable Travel Issues

The GIS sustainable travel scoring analysis showed that the Maynooth Environs (Moygaddy) site is poorly positioned to promote sustainable travel and future travel to this area will likely be car dependent. There is no local public transport near to the site and the distance from Maynooth University, town centre and schools guarantees that few people will walk or cycle to the Maynooth Environs (Moygaddy). While the existing Moygaddy CSO Small Area is predominantly rural, which will change when the site is developed, it is revealing to compare the modal split for the existing Maynooth settlement and Moygaddy small area in Table 4.20 based on Census 2016. This table shows that the levels of car dependency in Maynooth for work trips, which is already high at 65.5%, increases significantly to 78.9% in the Moygaddy small area. At present, 4 out of 5 residents drive to work from Moygaddy and this reflects the poor suitability of this location for sustainable development, with less than 1% of existing Moygaddy residents walking or cycling to work.

Table 4.20 Comparison of Modal Split in Maynooth Environs (Moygaddy) and Maynooth Settlement in Census 2016

Mode	Moygaddy Small Area – % Modal Split	Maynooth Settlement - % Modal Split
Walk	0.9%	9.1%
Cycle	0.9%	2.0%
Bus	4.4%	6.5%
Rail	10.5%	14.6%
Private Motor Vehicle	78.9%	65.5%
Work From Home	4.4%	2.3%

While the proposal for the Maynooth Environs (Moygaddy) involves the co-location of new residential and commercial land-uses, which will promote a certain amount of local walking and cycling for employees living nearby[7], the large distances involved in travelling from the Maynooth Environs (Moygaddy) to Maynooth Town Centre, Maynooth University, existing bus stops or the train station will ensure that Maynooth Environs (Moygaddy) remains primarily car dependent. Figure 4.21 highlights that most of the Maynooth Environs (Moygaddy) site is over 2km from the town centre, which would be around a 24 minute[8] walk for a typical person. Figure 4.22 shows the distance of Maynooth Environs (Moygaddy) from the three proposed train stations in the MEABTA study area, with most of the Maynooth Environs (Moygaddy) site being over 2km from the nearest train station.

[7] Co-location of residences and workplaces does not guarantee local commutes because of the complexity of the labour market which means that a skilled job may need to be filled by someone living in a catchment across the Greater Dublin Area, rather than someone living next door. Also, two-income families means that residential location choices are a compromise between two locations, which often means that families cannot live within walking distance of one of the two jobs.

[8] Assuming 1km takes a typical person 12 minutes to walk

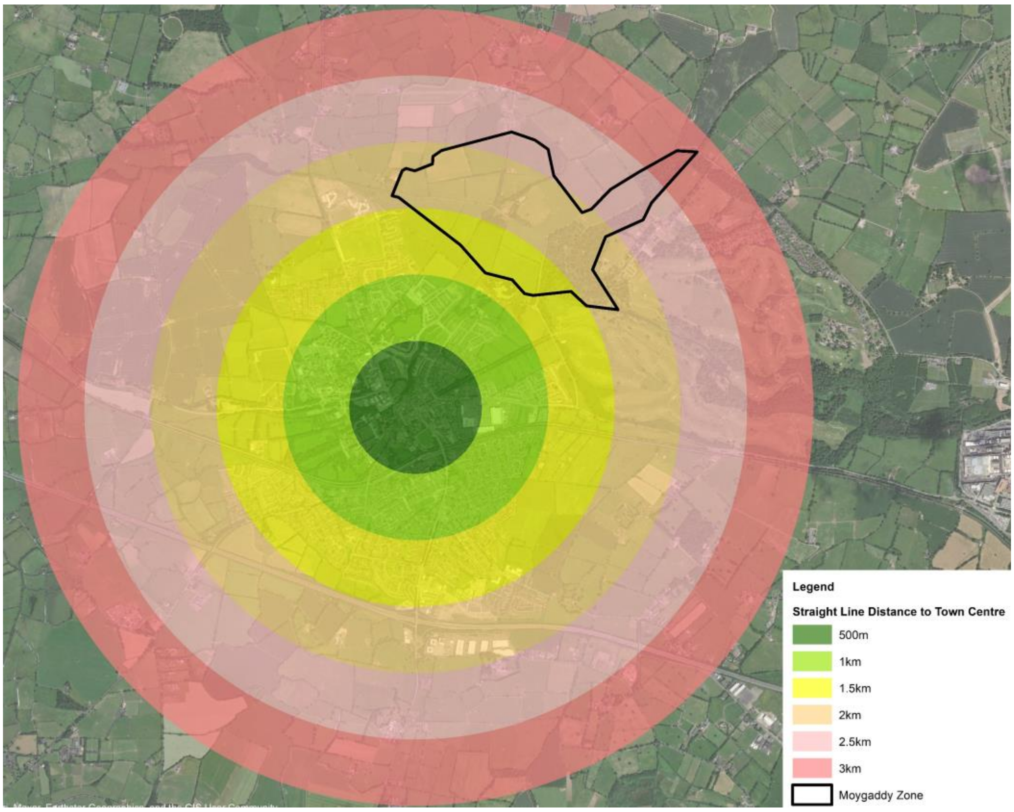

Figure 4.21 Maynooth North-East Environs (Moygaddy) Development Distance from Maynooth Town Centre

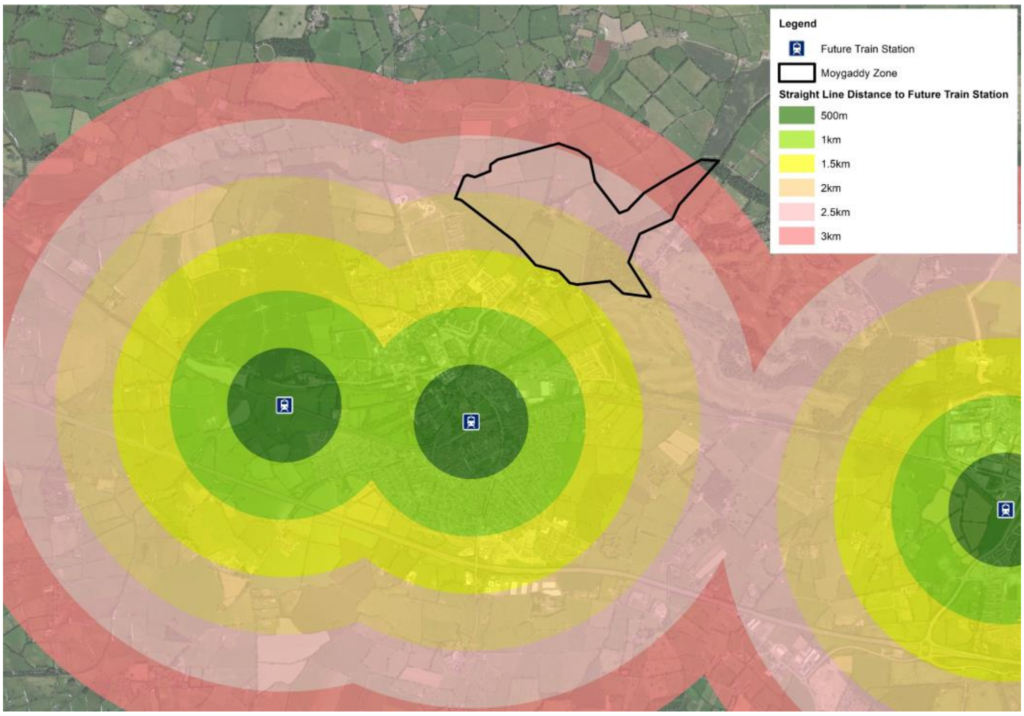

Figure 4.22 Distance from Maynooth Environs (Moygaddy) to Nearest Train Stations (Future Situation)

The issue of distance is compounded by the lack of radial infrastructure connecting the site with Maynooth, with current access provided by local lanes which are unsuitable for sustainable transport modes without major upgrades. Furthermore, the only road connection proposed in the last LAP was an orbital distributor road (part of the Maynooth Outer Orbital Route) through the Maynooth Environs (Moygaddy) which is more suited to cars than for active modes or buses due to the indirect routing.

4.4.2.2 Maynooth Environs (Moygaddy) Road Network Implications

From a road's perspective, the Maynooth Environs (Moygaddy) development is on the wrong side of Maynooth as the main desire line is from the M4 motorway junction in the south to Maynooth Environs (Moygaddy). This will lead to a large number of M4-Maynooth Environs (Moygaddy) cross-town trips, which will put additional pressure on the road network, even if orbital distributor roads are provided. Considering the large volume of commercial development zoned for the Maynooth Environs (Moygaddy), this area will attract a substantial number of HGVs for deliveries which will have to cross the length of the town to make deliveries and return to the M4 motorway. When the VISUM network statistics were considered, unsurprisingly, the addition of the Maynooth Environs (Moygaddy) development led to greater vehicle kilometres travelled across the Maynooth network, which will have a negative impact on emissions, air quality and safety.

4.4.2.3 Maynooth Environs (Moygaddy) and Inconsistent Alignment with National Planning Policy

The Eastern RSES specifically states that *'Lands at Moygaddy within the Maynooth Environs of County Meath have also been identified for Science and Technology based employment'.*

This is the basis of the rationale for development in the Maynooth Environs (Moygaddy) but it is important to note that the RSES does not designate this location for residential development, instead the population target for 1,000 additional people in Maynooth Environs (Moygaddy) comes from the Meath County Development Plan. While county and regional policy has designated the Maynooth Environs (Moygaddy) for residential and commercial development, it is clear that this location is poorly suited for sustainable travel and does not contribute to the National Planning Framework (NPF) National Strategic Outcome (NSO) for 'compact growth', which states that:

> *"Carefully managing the sustainable growth of compact cities, towns and villages will add value and create more attractive places in which people can live and work.* ***All our urban settlements contain many potential development areas, centrally located*** *and frequently publicly owned, that are suitable and capable of re-use to provide housing, jobs, amenities and services, but which need a streamlined and co-ordinated approach to their development, with investment in enabling infrastructure and supporting amenities, to realise their potential.* ***Activating these strategic areas and achieving effective density and consolidation, rather than more sprawl of urban development, is a top priority."***

This land-use assessment report has highlighted the large number of development areas close to Maynooth which are within walking distance of public transport, schools, the university, town centre and supermarkets. In response, the preferred land-use scenario has sought to maximise the use of space through higher density, compact development in areas which have the greatest potential to promote sustainable development.

It is important to note that the Maynooth Environs (Moygaddy) development is the opposite of this, being a peripheral car-centric site which will contribute to urban sprawl. The concept art shown in Figure 4.23 clearly shows how the Maynooth Environs (Moygaddy) development will contribute to urban sprawl north into Meath by extending the built-up area of Maynooth away from the train station, town centre and university. This would appear to be contrary to the NPF NPO for compact growth and the principles of sustainable development.

Figure 4.23 Artist's Impression of Proposed Moygaddy Masterplan (Source: https://www.oms.ie/moygaddy.html)

4.4.2.4 Maynooth Environs (Moygaddy) Development Recommendation

Given these issues, consideration should be given to whether it is appropriate for the Maynooth Environs (Moygaddy) development to proceed as currently planned. There are prime development sites, with better potential for sustainable travel, located throughout the Maynooth study area which would be more suited for growth than Moygaddy. However, it is acknowledged that the requirement to align with regional and county planning policy may mean that Maynooth Environs (Moygaddy) is included in the preferred development scenario.

5. Preferred Land Use Scenario

5.1 Rationale for the Preferred Land Use Scenario

Drawing on the analysis and land-use recommendations in Section 4, Kildare County Council planning department created a 'preferred land-use scenario' which sought to resolve issues and improve the conditions for sustainable travel in Maynooth. The preferred scenario is based on the following:

- The land-use assessment objectives described in Section 2;
- The preliminary results of the Maynooth Land Use Modelling Assessment Section 4, specifically:
  - Removing commercial and residential growth from areas with poor sustainable travel scores
  - Reducing peripheral residential growth to the north, east and west with a greater focus on consolidation closer to the town
  - New peripheral schools moved closer to town to be near more compact residential developments
  - Commercial/employment growth maintained in the western periphery due to its proximity to the new Maynooth West station and in line with a requirement for employment in this location in the RSES
- Incorporating extant planning permissions within Maynooth;
- Maximising the amount of residential development within or adjacent to the Maynooth settlement CSO boundary;
- Reduction in the population target in response to the significant traffic and transport problems which would be caused by this level of growth.
- Inclusion of Maynooth Environs (Moygaddy) into the preferred scenario, rather than as a separate sensitivity test, to align with the requirements in the RSES and the Meath CDP.

5.1.1 Note on Reduced Growth in the Preferred Scenario

Instead of using the entire 10,000 additional persons allocated to Maynooth to 2031 under National Policy Objective (NPO) 68 by the Metropolitan Area Strategic Plan Implementation Group, the preferred scenario only uses 50% of that allocation (i.e. 5,000 persons) which reduces the overall population growth by 2038 to a more manageable level. This decision was made my KCC Planning Department in response to the extensive pressure on the road network observed in the initial land-use scenarios when the full growth figure was applied. While scaled back, the level of growth planned in the preferred land-use scenario is still vast with 16,808 additional people[9] living in Maynooth by 2038, which will double the size of the town in a mere 15 years. Assuming an even higher level of growth than this was not realistic and the population allocations were scaled back accordingly.

It should be noted that there is no growth allocated to certain lands near the new Maynooth West train station due to the presence of a significant flood plain, as shown in Figure 5.1. The inability to develop the lands on the flood plain limits the amount of growth which can be allocated sustainable travel areas in the preferred scenario, which is another reason for reducing the population targets to a more realistic level.

Figure 5.1 Flood Plain to the West of Maynooth

5.1.2 Note on the Inclusion of Maynooth Environs (Moygaddy) in the Preferred Scenario

The Maynooth Environs (Moygaddy) is designated in the RSES for commercial development and the Meath CDP for residential development. Section 4.4.2 outlined the extensive planning issues regarding the development and the implications for car dependency and urban sprawl. However, the Joint Maynooth and Environs LAP is lower in the planning hierarchy than the RSES and the Meath CDP, which means that it must fulfil the development objectives set in these higher planning documents.

[9] This number includes the growth in the Moygaddy zone because it has been added into the preferred scenario.

As a result, the Maynooth Environs (Moygaddy) development is included in the preferred land-use scenario, which will be used in the future year Local Area Model for Maynooth and Environs.

However, it should be noted that the inclusion of the Maynooth Environs (Moygaddy) is done out of obligation to align with planning policy, rather than on the basis of evidence in this report, as the report clearly shows that is not a favourable location for sustainable development. The MEABTA transport strategy will seek to mitigate these issues as much as possible through the creation of walking, cycling and public transport links to the new Moygaddy development.

5.2 Standalone Assessment of Preferred Land-Use Scenario

This section presents the GIS scoring of the preferred scenario, the VISUM modelling of the preferred scenario and a standalone MCA assessment of the preferred scenario to confirm it is an improvement on the previous four land-use scenarios which were assessed.

5.2.1 Preferred Scenario: Land-Use GIS Zone Scoring

This section presents tables and maps which quantify the amount of land-use growth allocated to good or bad sustainable travel areas in the preferred land-use scenario. The preferred scenario is assessed in the years 2028, scored on the basis of the ‘existing situation’ sustainable travel scoring methodology, and 2038 scored on the basis of the ‘future situation’ scoring method. Furthermore, this section concludes with a comparison of total 2038 growth when scored in both the existing and future situation to highlight the importance of delivering future train stations to ensure the sustainable travel benefits are realised.

5.2.1.1 Preferred Scenario – 2028 Growth: Existing Situation Scoring

Table 5.1 shows the proportion of population growth allocated in zones based on their ability to promote or discourage sustainable travel. Only 13.2% of population growth is allocated to areas with poor potential for sustainable travel and 0% is allocated to the worst sustainable travel category. It is important to note that the majority of the 13.2% of population growth in the poor sustainable travel area regards the 1,000 additional people allocated to the Maynooth Environs (Moygaddy). Overall, a clear majority of growth is allocated to zones rated ‘fair’, ‘good’, or ‘strong’ for sustainable travel.

Table 5.1 Preferred Scenario: Population Growth Sustainable Travel Scoring - 2028

‘Existing Situation’ Scoring	*Population Growth (No. People) to 2028*	%
Zero/extremely limited potential for ST	0	0.0%
Poor potential for sustainable travel	1,151	13.2%
Fair potential for sustainable travel	3,500	40.0%
Good potential for sustainable travel	2,720	31.1%
Strong potential for sustainable travel	1,369	15.7%

Figure 5.2 shows the spatial distribution of 2028 population growth overlaid on the sustainable travel scoring in the existing situation sustainable travel scoring. With the exception of the Maynooth Environs (Moygaddy), this figure highlights how the preferred land-use scenario focuses on consolidation and densification of the existing urban area as well as compact peripheral development where required to meet population targets.

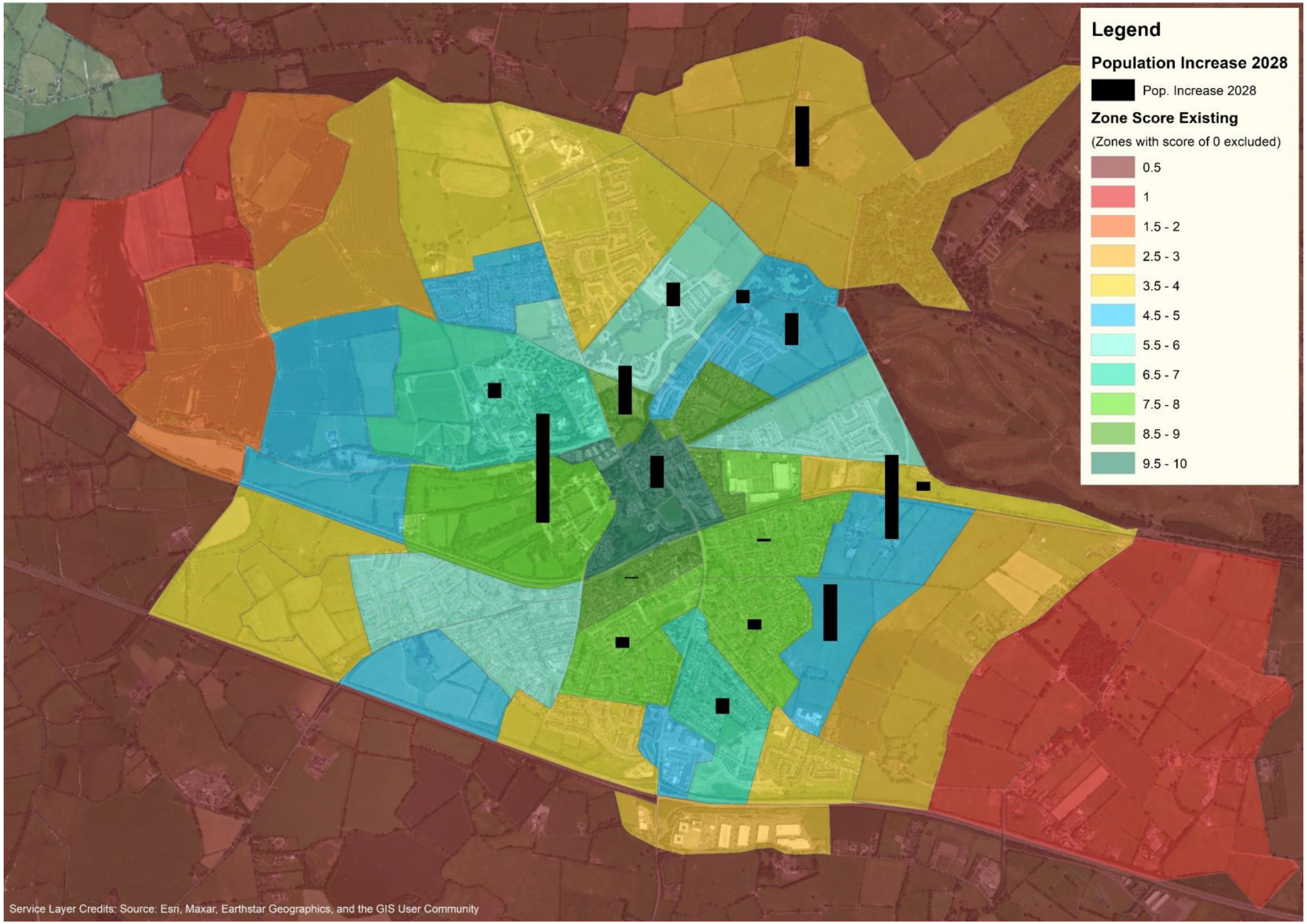

Figure 5.2 Preferred Scenario - Population Growth Allocated to Sustainable Travel Zones by 2028

Table 5.2 shows the proportion of commercial/service growth allocated in zones based on their ability to promote or discourage sustainable travel. In contrast with the population growth, a majority of commercial growth is allocated to poor or zero sustainable travel areas in the preferred scenario. As will be shown in the distribution map, this is primarily due to the RSES requirement for peripheral commercial development in Maynooth Environs (Moygaddy) and the lands to the west of the University which accounts for the majority of this growth and cannot be influenced by the LAP.

Table 5.2 Preferred Scenario: Commercial Growth Sustainable Travel Scoring - 2028

'Existing Situation' Scoring	*Commercial/Service Growth (GFA) to 2028*	%
Zero/extremely limited potential for ST	60,750 m^2	27.3%
Poor potential for sustainable travel	134,480 m^2	60.4%
Fair potential for sustainable travel	500 m^2	0.2%
Good potential for sustainable travel	22,460 m^2	10.1%
Strong potential for sustainable travel	4,500 m^2	2.0%

Figure 5.3 Preferred Scenario – Commercial/Service Growth Allocated to Sustainable Travel Zones by 2028 shows the spatial distribution of 2028 commercial/service growth overlaid on the sustainable travel scoring in the existing situation sustainable travel scoring. As noted earlier, there is a certain amount of commercial/service growth which is compact and close to the existing built-up areas of Maynooth but the majority of growth is in areas which are scored poorly in the Maynooth Environs (Moygaddy) and to the west. It should be noted that the commercial/service development in the west will be scored better in the future situation when the Maynooth West train station is included in the assumption for 2038 growth.

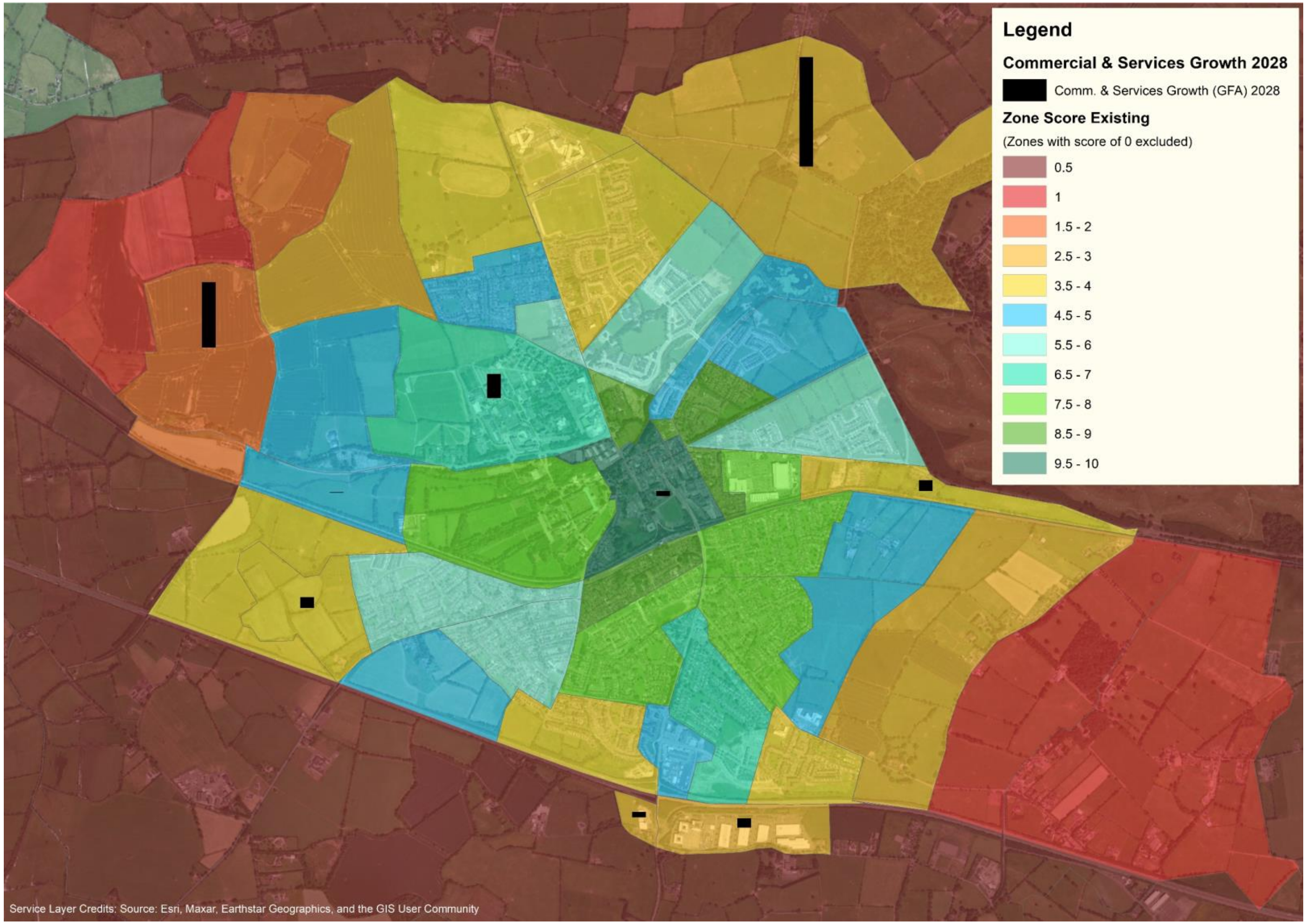

Figure 5.3 Preferred Scenario – Commercial/Service Growth Allocated to Sustainable Travel Zones by 2028

Table 5.3 shows the proportion of school pupil growth allocated in zones based on their ability to promote or discourage sustainable travel. The majority of school pupil growth to 2028 is in the MEC school campus to the north and 2,000 of these pupils already study there in 2022, this growth is included to update the 2019 base model to the present day. In respect to the actual post 2022 future growth to 2028, most of this growth is allocated to zones with a fair or good sustainable travel rating.

Table 5.3 Preferred Scenario: School Pupil Growth Sustainable Travel Scoring - 2028

'Existing Situation' Scoring	*School Pupil Growth to 2028*	%
Zero/extremely limited potential for ST	0	0.0%
Poor potential for sustainable travel	2,139	66.9%
Fair potential for sustainable travel	613	19.2%
Good potential for sustainable travel	444	13.9%
Strong potential for sustainable travel	0	0.0%

Figure 5.4 Preferred Scenario – School Pupil Growth Allocated to Sustainable Travel Zones by 2028 shows the spatial distribution of the school pupil growth to 2028 overlaid on the sustainable travel scoring. With the exception of the MEC campus, this shows that school pupil growth has been allocated to zones close to the existing urban area of Maynooth such as the new residential area to the south-east and the Maynooth University zone which contains a boys school.

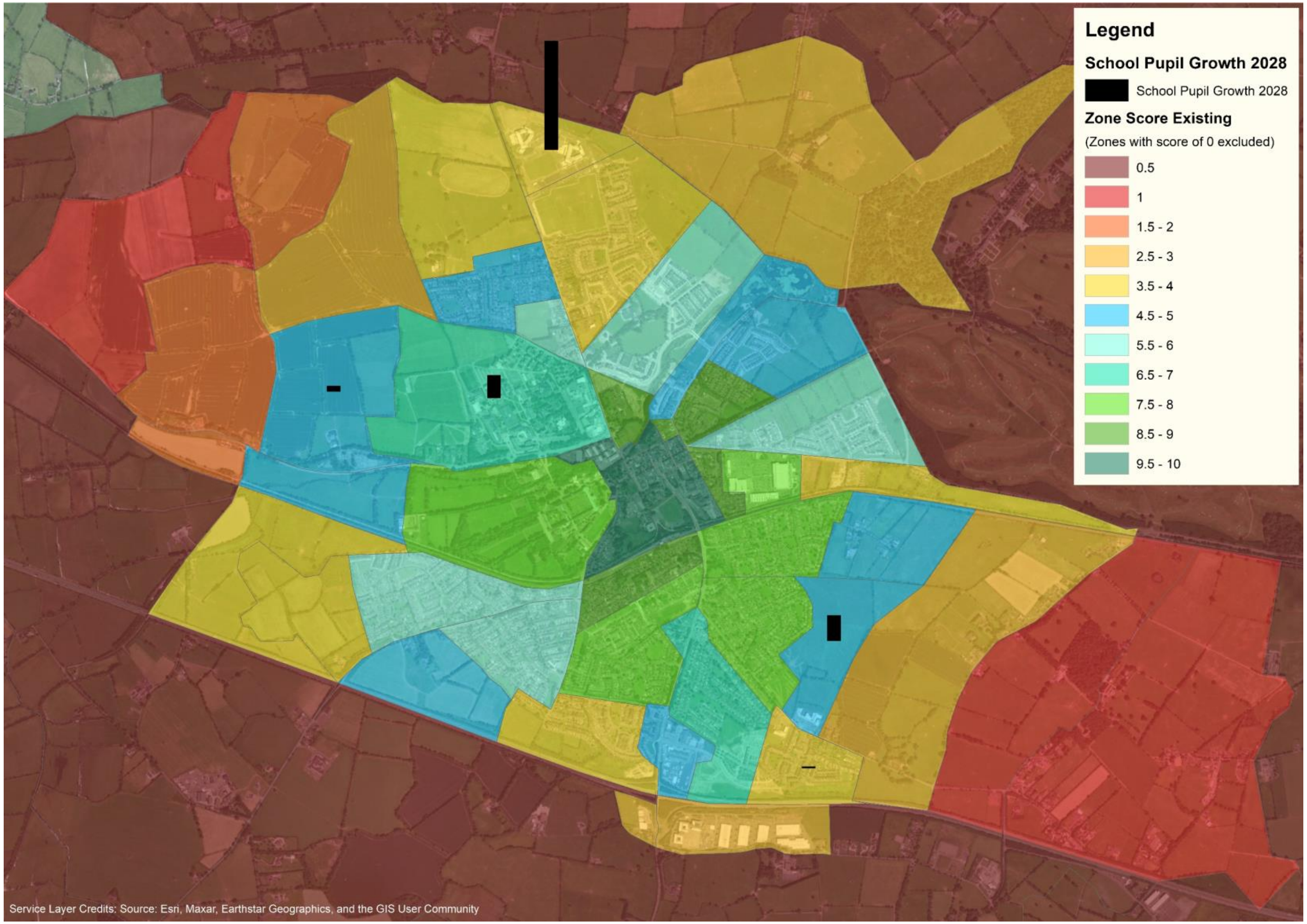

Figure 5.4 Preferred Scenario – School Pupil Growth Allocated to Sustainable Travel Zones by 2028

5.2.1.2 Preferred Scenario - 2038 Future Situation Scoring

Table 5.4 shows the breakdown of population growth in 2038 according to the sustainable travel zone scoring. When compared to 2028, it can be observed that a larger proportion of population growth is in fair or good sustainable travel areas in 2038, with a lower proportion allocated to poor sustainable travel areas.

Table 5.4 Preferred Scenario: Population Growth Allocated to Different Sustainable Travel Zones by 2038

'Existing Situation' Scoring	*Population Growth (No. People) to 2038*	%
Zero/extremely limited potential for ST	0	0.0%
Poor potential for sustainable travel	1,272	7.6%
Fair potential for sustainable travel	7,438	44.3%
Good potential for sustainable travel	6,264	37.3%
Strong potential for sustainable travel	1,834	10.9%

Figure 5.5 shows the distribution of population growth in 2038 overlaid on the future situation sustainable travel scoring. With the exception of the Maynooth Environs (Moygaddy) , it can be observed that all zones with substantial population growth have a sustainable travel score of 4.5 or above, showing how the growth has been reallocated in the preferred scenario to prioritise locations where non-car alternatives are viable for future residents.

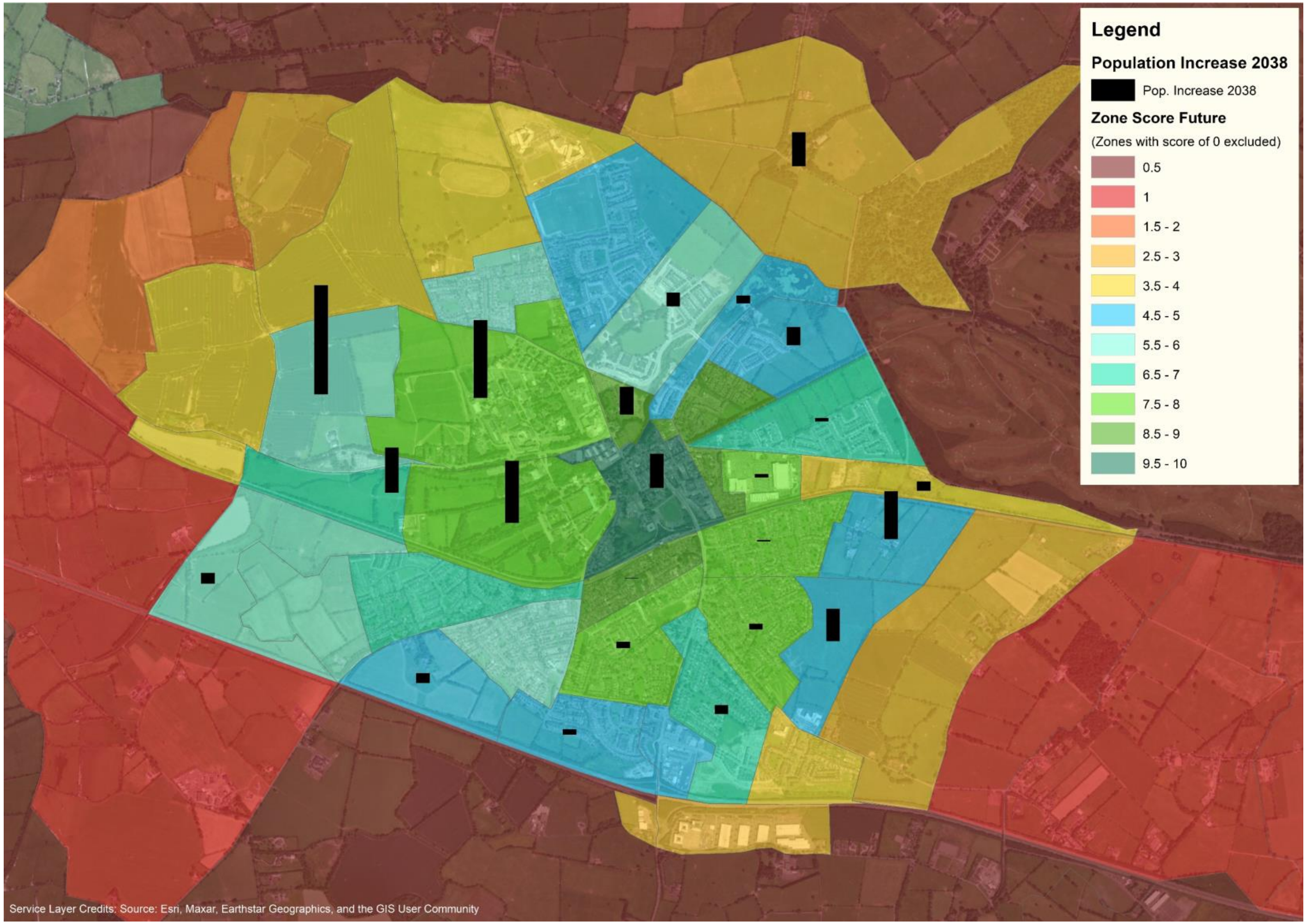

Figure 5.5 Preferred Scenario – Population Growth Allocated to Sustainable Travel Zones by 2038

Table 5.5 shows the breakdown of commercial/service growth in 2038 according to the sustainable travel zone scoring in the future situation. Compared to the 2028 results where 27.3% of commercial growth was in zero sustainable travel areas, the majority of commercial growth in the 2038 scenario is located in poor sustainable travel areas. This change is primarily through the introduction of the Maynooth West train station in the future situation which improves public transport access to the commercial development area to the west.

Table 5.5 Commercial Growth Allocated to Different Sustainable Travel Zones by 2038

'Existing Situation' Scoring	*Commercial/Service Growth (GFA) to 2038*	%
Zero/extremely limited potential for ST	0	0.0%
Poor potential for sustainable travel	233,530 m^2	77.3%
Fair potential for sustainable travel	22,000 m^2	7.3%
Good potential for sustainable travel	41,920 m^2	13.9%
Strong potential for sustainable travel	4,500 m^2	1.5%

Figure 5.6 shows the distribution of commercial growth in the 2038 future situation sustainable travel scoring. The majority of commercial growth is in the western and north-eastern periphery, as required by RSES policy.

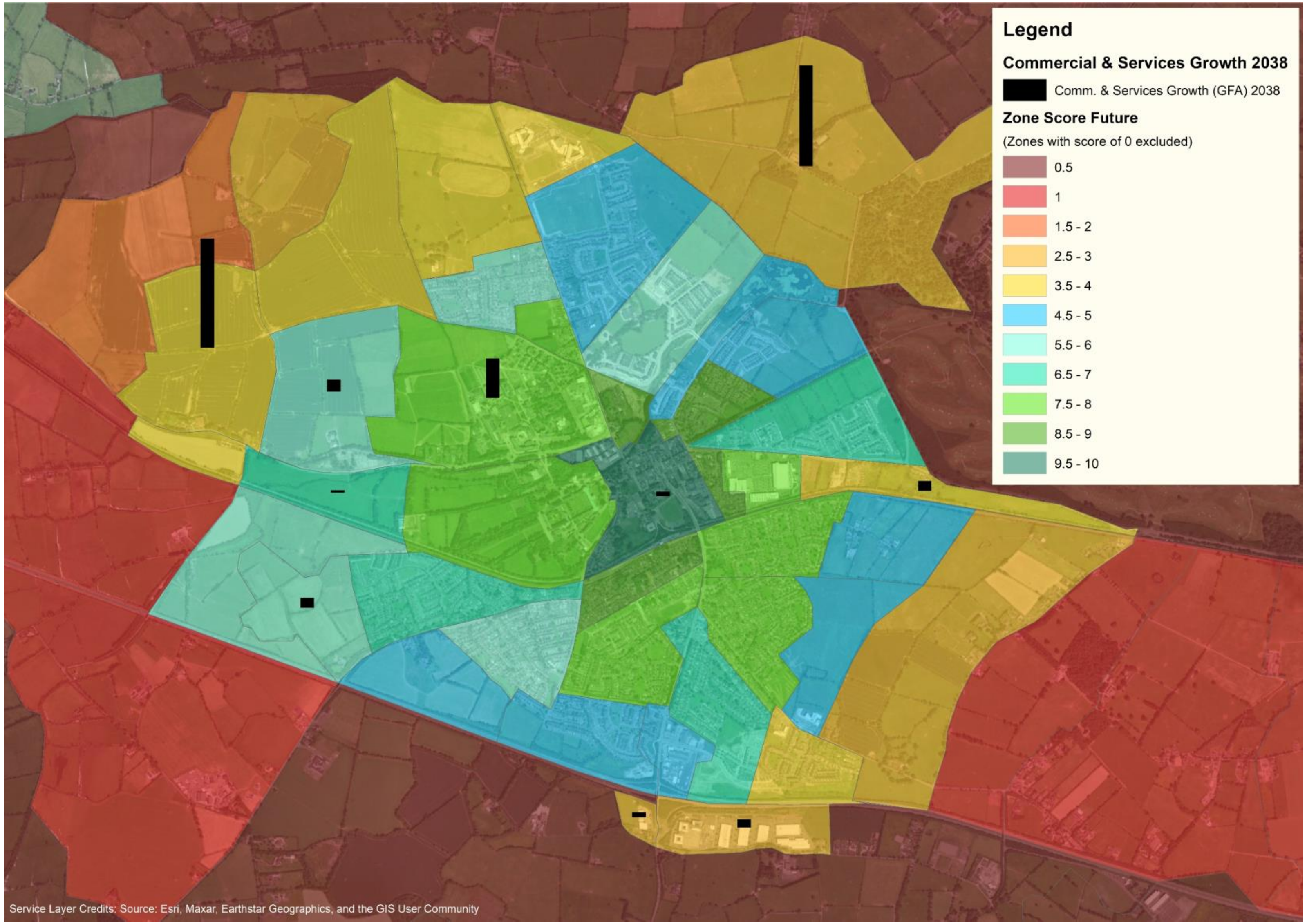

Figure 5.6 Preferred Scenario – Commercial/Service Growth Allocated to Sustainable Travel Zones by 2038

Table 5.6 shows the allocation of school pupil growth in 2038 using the future situation scoring. This shows similar themes to the 2028 growth, but with a higher proportion of overall growth in fair rather than poor sustainable travel areas.

Table 5.6 School Pupil Growth Allocated to Different Sustainable Travel Zones by 2038

'Existing Situation' Scoring	*School Pupil Growth to 2038*	*%*
Zero/extremely limited potential for ST	0	0.0%
Poor potential for sustainable travel	2,589	54.5%
Fair potential for sustainable travel	1,714	36.1%
Good potential for sustainable travel	444	9.4%
Strong potential for sustainable travel	0	0.0%

Figure 5.7 shows the distribution of school pupil growth in 2038 using the future situation sustainable travel scoring. With the exception of the existing MEC school campus, all future school pupil growth is allocated to zones with a sustainable travel score of 4.5 or above.

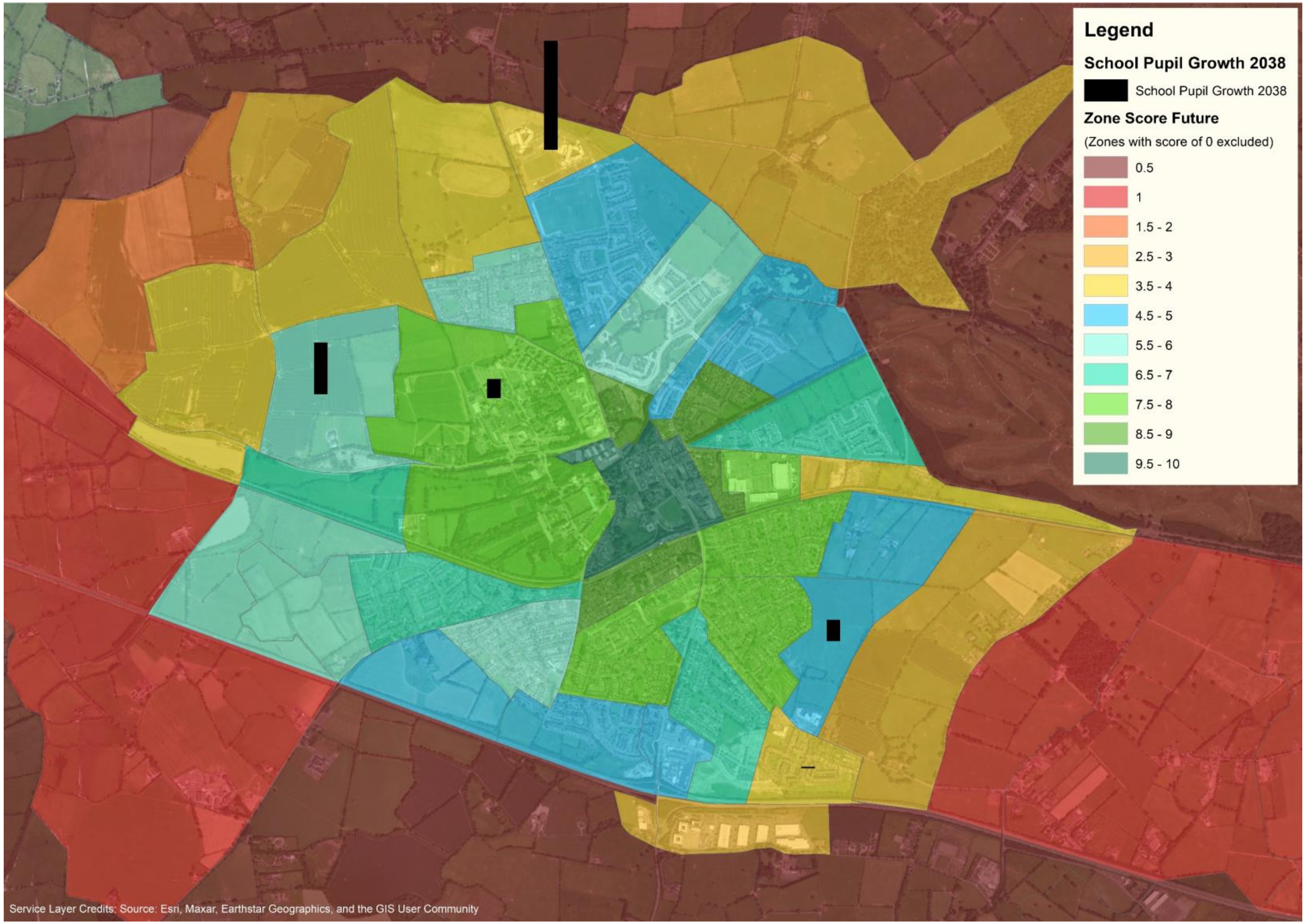

Figure 5.7 Preferred Scenario – School Pupil Growth Allocated to Sustainable Travel Zones by 2038

5.2.1.3 Comparison of 2038 Growth in Existing vs Future Situation Scoring

In the GIS assessment, 2038 growth is scored using the future situation which assumes that a new train station has been constructed to the west of Maynooth and a new BusConnects route is provided to the north. To show the importance of the 'future situation' being realised, the 2038 growth was scored in both the 'existing' and 'future' situation. Figure 5.8 shows a comparison of the 2038 population growth and Figure 5.9 shows a comparison of the 2038 commercial/service growth in this regard. There is no difference in scoring for 2038 school pupil growth, so a graph is not provided.

In the population growth comparison, it can be observed that the addition of the new rail/bus infrastructure reduces the amount of growth in poor or fair rated areas and results in a higher proportion living in the good sustainable travel areas where car dependency is less likely. In the commercial graph, the new western station improves the score for a substantial amount of commercial growth from zero sustainable travel areas to poor sustainable travel areas. These graphs highlight the importance of future public transport infrastructure in realising the 'future situation' scoring, which is the basis of the growth allocations in the preferred scenario. Careful phasing will be required to ensure that development to the west does not occur until the new station is in place to support sustainable travel choices.

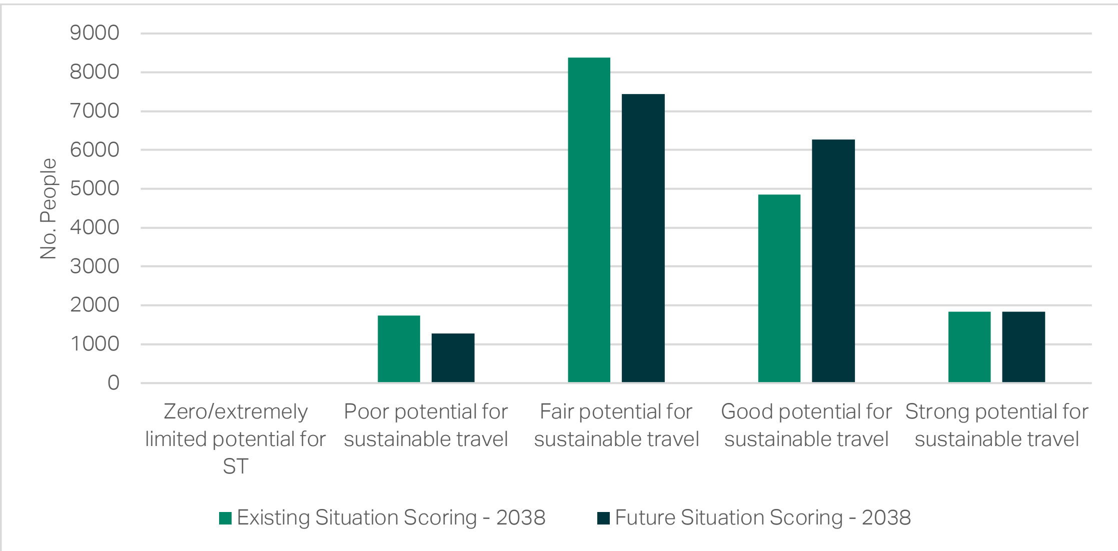

Figure 5.8 Comparison of 2038 Population Growth when Scored in Existing vs Future Situation

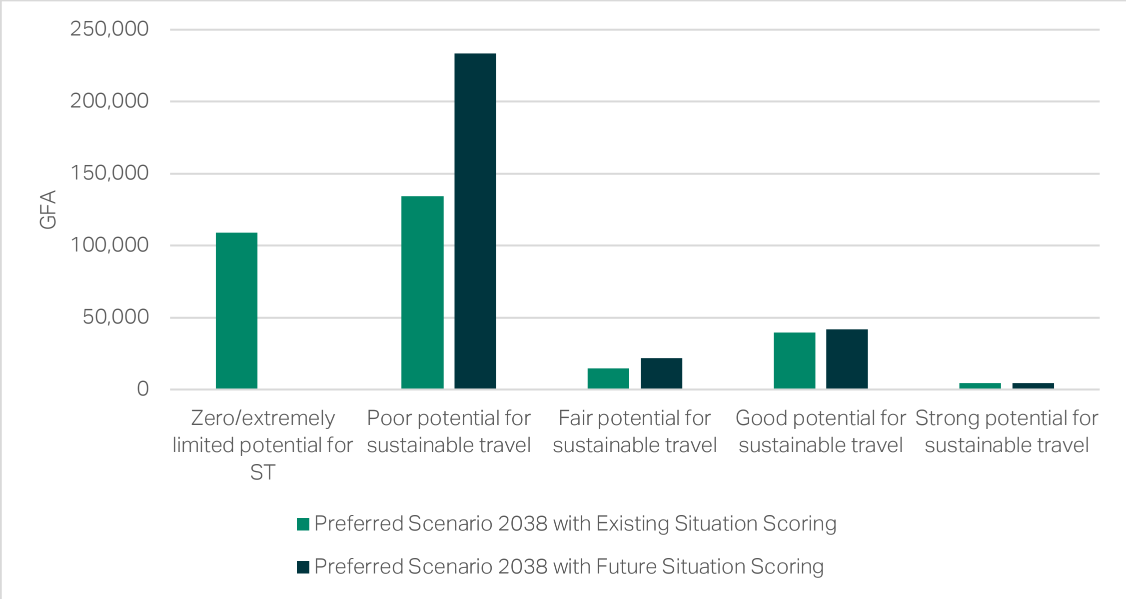

Figure 5.9 Comparison of 2038 Commercial Growth when Scored in Existing vs Future Situation

5.2.2 Preferred Land-Use Scenario VISUM Results

This section presents the VISUM results for the preferred land use scenario.

5.2.2.1 Preferred Scenario: Volume/Capacity

Figure 5.10 to Figure 5.13 show the volume/capacity maps for the preferred land-use scenario. These show that a lot of the road network is performing relatively well considering the level of growth applied, with the exception of the eastern orbital route from the M4 junction to the Maynooth Environs (Moygaddy) and the MEC northern school campus. In comparison with the four land use scenarios tested previously with Maynooth Environs (Moygaddy), the preferred scenario volume/capacity maps show less pressure on the town centre, radial approaches and orbital road; which shows the benefit of locating growth in areas with greater potential for sustainable travel as these areas have lower car trip rates.

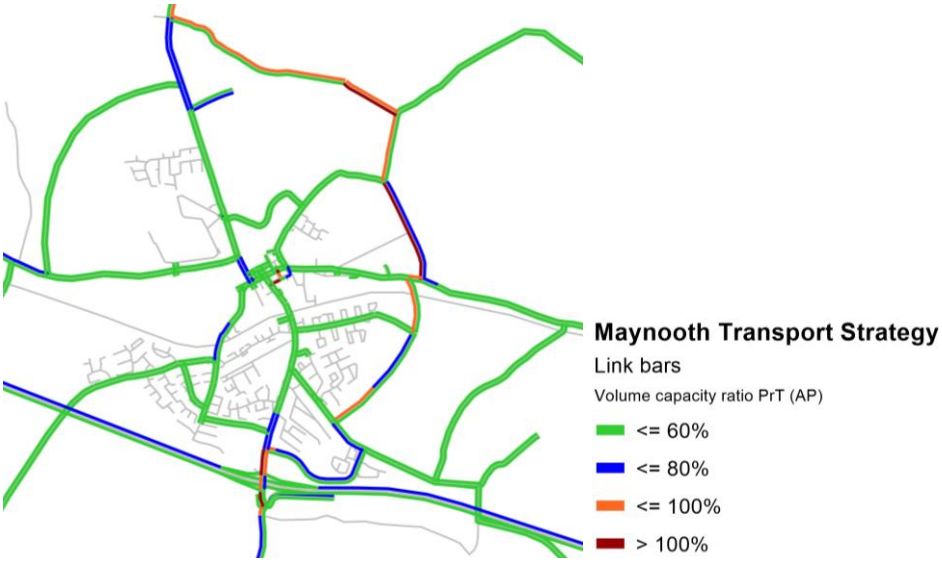

Figure 5.10 Preferred Scenario DS Network: 2028 AM V/C

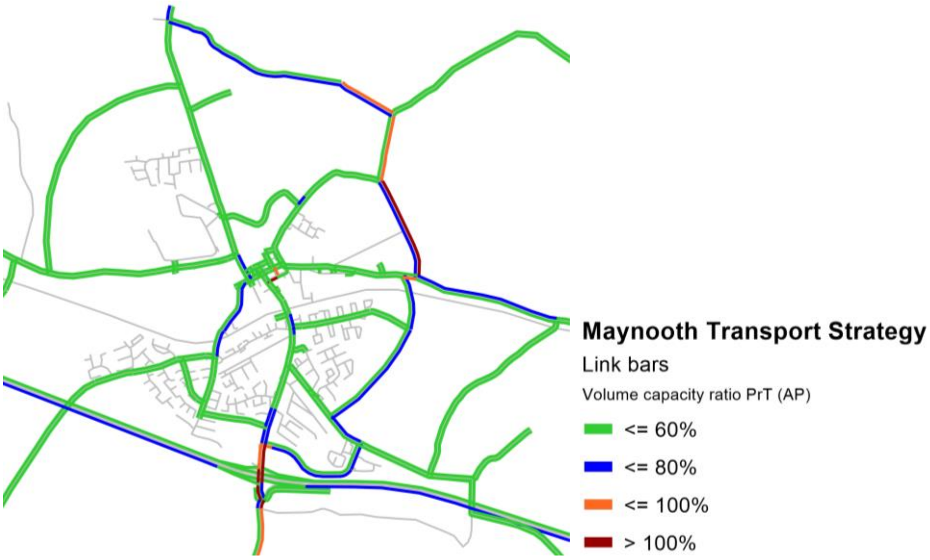

Figure 5.11 Preferred Scenario DS Network: 2028 PM V/C

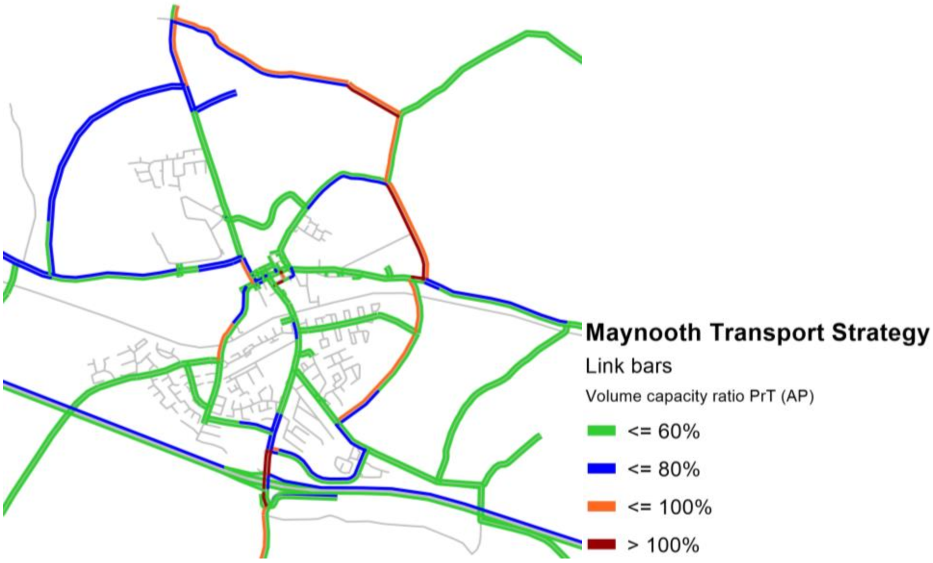

Figure 5.12 Preferred Scenario DS Network: 2038 AM V/C

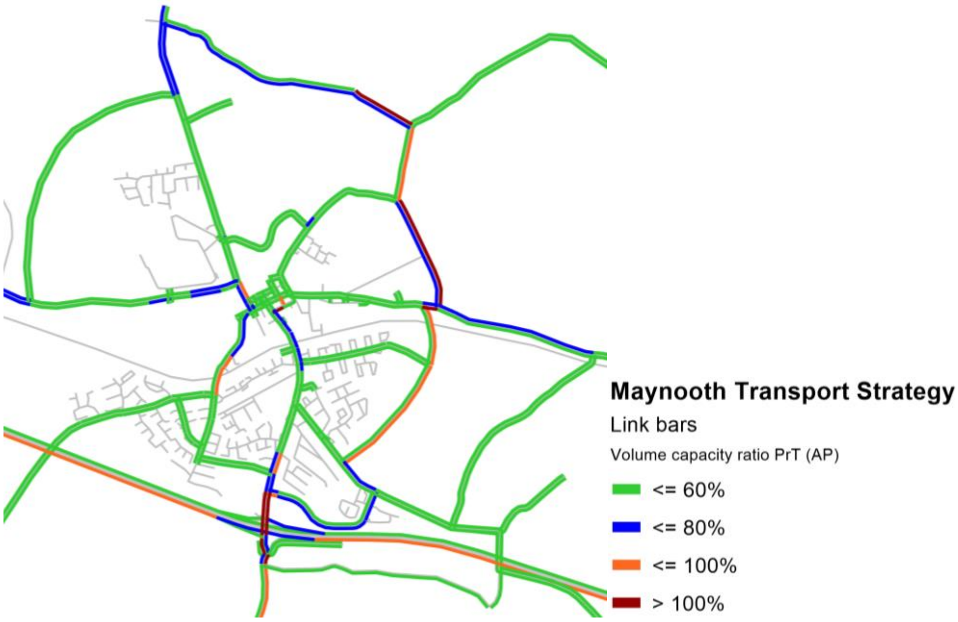

Figure 5.13 Preferred Scenario DS Network: 2038 PM V/C

5.2.2.2 Preferred Scenario: Network Statistics

Table 5.7 and Table 5.8 show the network statistics for the preferred land-use scenario in comparison with the base model. In the original four land use scenarios (including the Maynooth Environs (Moygaddy)), the total network delay in 2038 was between 5,000-6,000 hours compared to less than 5,000 hours in the preferred scenario.

This is due to trip rates which incorporate the land-use scoring, meaning that better sustainable travel areas will produce less vehicle (private car) trips in the model. As the preferred scenario has adopted a more compact development approach, with new buildings targeted in sites with better public transport access, this has benefited the overall road network by producing less car trips. However, it should be noted that the increase in vehicle delay is still significant and this reflects the near doubling in population within the town along with a major expansion in commercial activities.

Table 5.7 2038 AM Comparison of the Base and Preferred Scenario (LV + HV)

Scenario	Total Network Trips	Total Vehicle KM	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 AM Base	16,711	151,522	3,148	48.1
2028 AM Preferred	20,800	186,496	4,078	45.7
2038 AM Preferred	22,992	205,658	4,735	43.4

Table 5.8 2038 PM Comparison of Base and Preferred Scenario (LV + HV)

Scenario	Total Network Trips	Total Vehicle KM	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 PM Base	18,392	165,043	3,514	47.0
2028 PM Preferred	21,879	197,747	4,336	45.6
2038 PM Preferred	23,854	217,247	4,993	43.5

5.2.3 MCA to Confirm Preferred Land-Use Scenario

Table 5.9 scores the preferred land-use scenario relative to the previous four land-use scenario scores from Section 4.3.3. This table shows that the preferred scenario has a more positive impact than the previous four scenarios and represents an improvement across most categories. In respect to school growth, there is minimal difference between the preferred scenario and land use scenarios 1 (Concentric) or 2 (Northern) so the scores are the same.

An exception is commercial growth, where the preferred scenario scores worse than the four scenarios in 2028, with this reflecting the commercial growth allocated to the west prior to the implementation of the new train station and the requirement to build commercial development in the Maynooth Environs (Moygaddy).

Table 5.9 Standalone MCA for Preferred Land Use Scenario Compared with Original 4 Land Use Scenarios

Scenario	2028 Sustainable Travel Scoring			2038 Sustainable Travel Scoring			2028 VISUM	2038 VISUM	Alignment with Land-Use Objectives
	Population Growth	Commercial Growth	School Pupil Growth	Population Growth	Commercial Growth	School Pupil Growth	Network Statistics[10]	Network Statistics	
Preferred Land Use Scenario									
Scenario 1: Concentric Circle									
Scenario 2: Northern Growth									
Scenario 3: Eastern Growth									

[10] The network statistics for 2028 only have marginal differences which do not help to identify the preferred scenario. Therefore, these scenarios are rated minor positive/negative to reflect this.

Scenario 4: Western Growth									

5.3 Conclusion on the Preferred Scenario

The preferred scenario is an improvement in respect to the allocation of growth to areas which will promote sustainable travel, with the reduction in car trips as a result of allocating growth to areas which lower trips has a positive impact on the network statistics. However, despite these improvements, the level of growth proposed for Maynooth will present a capacity challenge to both the road network and public transport network. In order for the road network to function effectively, significant modal shift will be required to reduce the amount of people who drive and accommodate the level of growth proposed in Maynooth. In Section 6 several modal split sensitivity tests on the preferred scenario have been undertaken to identify the level of modal shift which should be targeting in Maynooth by 2038.

6. Modal Split Sensitivity Tests

The level of growth proposed for Maynooth will put significant pressure on the road network and substantial modal shift will need to take place to accommodate the additional travel demand and deliver an effective sustainable transport system. The Maynooth Local Area VISUM Model is a road-only model so it cannot predict model shift to sustainable modes or future modal split. Therefore, there is a risk that the future year models will overestimate car demand if a ‘business-as-usual’ approach to modal split is assumed. Overestimating car demand would be detrimental to Maynooth as it could lead to excessive capacity improvements, which would create induced demand and promote modal shift in the wrong direction from sustainable modes to car travel, exacerbating future traffic problems.

To avoid this situation, the future year models in Maynooth will assume a level of modal shift will take place in forthcoming years to add realism to the demand predictions while also providing a target for the reduction in car use to be achieved by the MEABTA measures. This section describes a series of Modal Split Sensitivity Test (MSST) scenarios conducted using the preferred land-use scenario to assess the impact of varying levels of modal shift on the road network in 2038. On the basis of these results, a modal shift assumption of -5%, -10% or -15% will be adopted for the future year models in 2028 and 2038.

6.1 Modal Split Sensitivity Test Assumptions

6.1.1 Introduction to Modal Shift in Maynooth

Modal shift involves people changing from private motor vehicles like cars or motorcycles to sustainable transport modes such as walking, cycling or public transport. When new sustainable travel infrastructure is introduced to an area there is an expectation that modal shift will occur as a result, but in reality, modal choices are more complicated and a permanent shift in travel behaviour is hard to achieve. People make modal choices on the basis of personal preferences (e.g. an environmental preference against car use), cost considerations (e.g. fuel or fare price), journey characteristics (e.g. speed or reliability), transport infrastructure (e.g. local train station), life stage (e.g. trip chaining with children), employment location as well as a range of other important factors. Simply making one mode of travel more convenient will not necessarily produce modal shift in the intended fashion, a good example of this is the Luas Green line which was very successful when implemented but it primarily attracted former bus passengers rather than car users.

In the wider context of travel in Ireland, it is reasonable to assume that a certain amount of modal shift will occur if fuel prices, and the cost of living continues to rise and price sensitive travel users change their behaviour to minimise expenses. In addition to this, shifting attitudes regarding the environmental and health impacts associated with car use will lead to a certain amount of revaluation of travel choices and give a higher preference towards sustainable modes. These two factors should create a scenario where the population is more receptive to the concept of modal shift, but the provision of sustainable infrastructure and the development of compact, mixed use urban forms is necessary to create an environment where non-car options are a viable alternative.

In this regard, the National Planning Framework (NPF) changes to planning policy should begin to deliver results through compact development over the next two decades, especially when combined with the extensive plans to improve public transport and active travel infrastructure in the National Transport Authority's Draft Transport Strategy for the Greater Dublin Area (GDA) 2022-2042. These wider regional or national trends will affect the modal split in GDA region, with a certain amount of this impact trickling down to Maynooth, but at a local level the measures proposed by the MEABTA and the Joint LAP will play a more significant role in promoting sustainable travel and producing modal shift for internal trips within the town.

6.1.2 Defining Modal Shift Scenarios

As outlined in the previous section, predicting future modal shift is complex due to the number of factors involved in determining modal choice. A useful guide of National Transport Authority (NTA) expectations for future modal shift in the region is contained in the GDA Transport Strategy which predicts that regional car modal split will fall from 58% in 2016 to 49% in 2042 after the new sustainable travel infrastructure has been delivered (Figure 6.1).

Figure 6.1 GDA Strategy Modal Split in 2042

This represents a -9% reduction in car modal split with these trips distributed to sustainable modes of personal travel through modal shift. In comparison with this prediction, current work modal split in Maynooth is higher than the GDA at 66% in 2016 and a -9% reduction in car use would only reduce car modal split to 57% in Maynooth with a majority of people still driving to work. To achieve a similar level of car modal split as 49% in the GDA, the car mode share in Maynooth would have to fall by -17% over the next twenty years which would be a huge challenge to achieve, especially when considered with the high level of growth planned for Maynooth.

In the Modal Split Sensitivity Tests (MSSTs), we need to assume a future level of modal shift for Maynooth across a range of scenarios from pessimistic to optimistic when compared to the NTA GDA Transport Strategy future modal split expectations. The scenario assumptions are outlined below along with their alignment with policy:

- **-5% Car Modal Split MSST**: This is the pessimistic scenario which assumes that a lower level of modal shift will occur than the -9% expected in the NTA GDA Transport Strategy.
- **-10% Car Modal Split MSST**: This is the scenario most in line with the -9% modal shift expected by the NTA GDA Transport Strategy.

- **-15% Car Modal Split MSST**: This is the optimistic scenario which assumes a higher -15% reduction in car use than the -9% expected in the NTA GDA Transport Strategy.

Even if the optimistic MSST scenario is achieved, the transport model is likely to show that the transport problems in Maynooth are still significant due to the level of growth proposed which will create a major increase in transport demand. The Maynooth and Environs ABTA is trying to create the best possible conditions to encourage modal shift, through the detailed land-use planning process conducted in this report which has refined the preferred land-use scenario on the basis of sustainable travel impacts, and the transport infrastructure measures which will be proposed in the strategy.

However, any significant level of modal shift will require the enforcement of planning policies to promote compact growth as envisioned in the preferred land-use scenario and substantial investment in sustainable travel infrastructure to be realised.

6.1.3 Demand Reduction Applied for MSST Scenarios

Section 6.1.2 established how the MSST scenarios will assess the impact of -5%, -10% and -15% reduction in car modal split on the preferred land-use scenario. This section explains the technical process adopted to reduce demand in the MSST scenarios accordingly.

6.1.3.1 Impact of Working from Home on Demand

Transport Infrastructure Ireland research determined that the long-term impact of post-Covid behavioural change in respect to an increasing proportion of people working from home would reduce overall personal travel demand on road by -5%. To capture this aspect, the MSST scenarios incorporate a -5% reduction in Light Vehicle (LV) demand across all zones (internal and external) in the trip matrix.

6.1.3.2 Impact of Modal Shift on Demand

The VISUM Maynooth model is road-only so it does not contain non-car personal trips. Within the internal logic of the model, the VISUM LV Matrix represents 100% of personal trips in the modelled area but in reality, the proportion is lower because only 66% of work trips by residents of Maynooth take place by private motor vehicles. This means that a -5% reduction in car modal split will have a larger percentage reduction on LV demand than -5% in the model because the proportions are different. To identify the right proportion of LV demand reduction to apply, the percentage of modal shift needs to be factored[11] up to represent its impact on total car trips.

[11] In Census 2016 there were 4,005 work trips made by car out of a total 6,111 work commutes by Maynooth residents. This meant that car trips represented 65.5% of total trips by Maynooth residents. To create a situation where car trips represent 100% of trips, to align with the road-only LV trip matrix, the existing car-based work trips would have to be factored up by 52.6%. This percentage can be used to understand that the proportional impact of a -5% reduction in car modal split would have an -8% reduction in LV trip demand in the transport model.

Table 6.1 shows the proportional impact of a reduction in car modal split in each MSST on LV demand in the transport model trip matrix.

Table 6.1 Impact of Reduction in Car Modal Split on LV Vehicle Demand

MSST Scenario	Reduction in % Car Modal Split	% Reduction to Apply to LV Demand in Matrix from Impact of Modal Shift
MSST 1: 5% Modal Shift from Car	-5%	-8%
MSST 2: 10% Modal Shift from Car	-10%	-15%
MSST 3: 15% Modal Shift from Car	-15%	-23%

These percentage reductions were applied to the LV trip matrix for the internal transport model zones near Maynooth in each MSST. The model zones where the percentage reduction was applied are defined in Figure 6.2, these zones represent the existing built-up area of Maynooth or future development zones, which are the areas likely to be most influenced by the Joint LAP and MEABTA measures.

Figure 6.2 Model Zones where MSST LV Demand Reduction Applied for Modal Shift

6.1.3.3 Exclusion of HGVs from Demand Reduction

The demand adjustments from working from home and modal shift will not affect the number of heavy goods vehicles on the road network. The vast majority of freight carried in Ireland travels by road and it is highly unlikely that substantial modal shift to rail freight will take place in the years leading up to 2038. Therefore the Heavy Vehicle (HV) trip matrix demand is not reduced in the MSST scenarios.

6.2 Modal Split Sensitivity Test VISUM Results

The MSST scenarios were only run in 2038 as it was anticipated that significant modal shift will primarily occur during the 2028-2038 period rather than in the next six years leading up to 2028 due to the lack of infrastructure changes likely to occur due to the planning/design phase. The MSST scenarios use the same DM road network and DS road infrastructure as the preferred land-use scenario.

6.2.1 Volume/Capacity Comparison

Figure 6.3 shows a comparison of the volume/capacity maps in the preferred scenario and the 3 MSST scenarios in the 2038 AM peak. Figure 6.4 shows a similar comparison in the 2038 PM peak. These maps show the cumulative impact of -5%, -10% and -15% reduction in car mode share on traffic demand throughout the network. Unsurprisingly, MSST 3 has the greatest impact with the best volume/capacity results, but it should be noted how challenging a -15% reduction in car use would be to achieve.

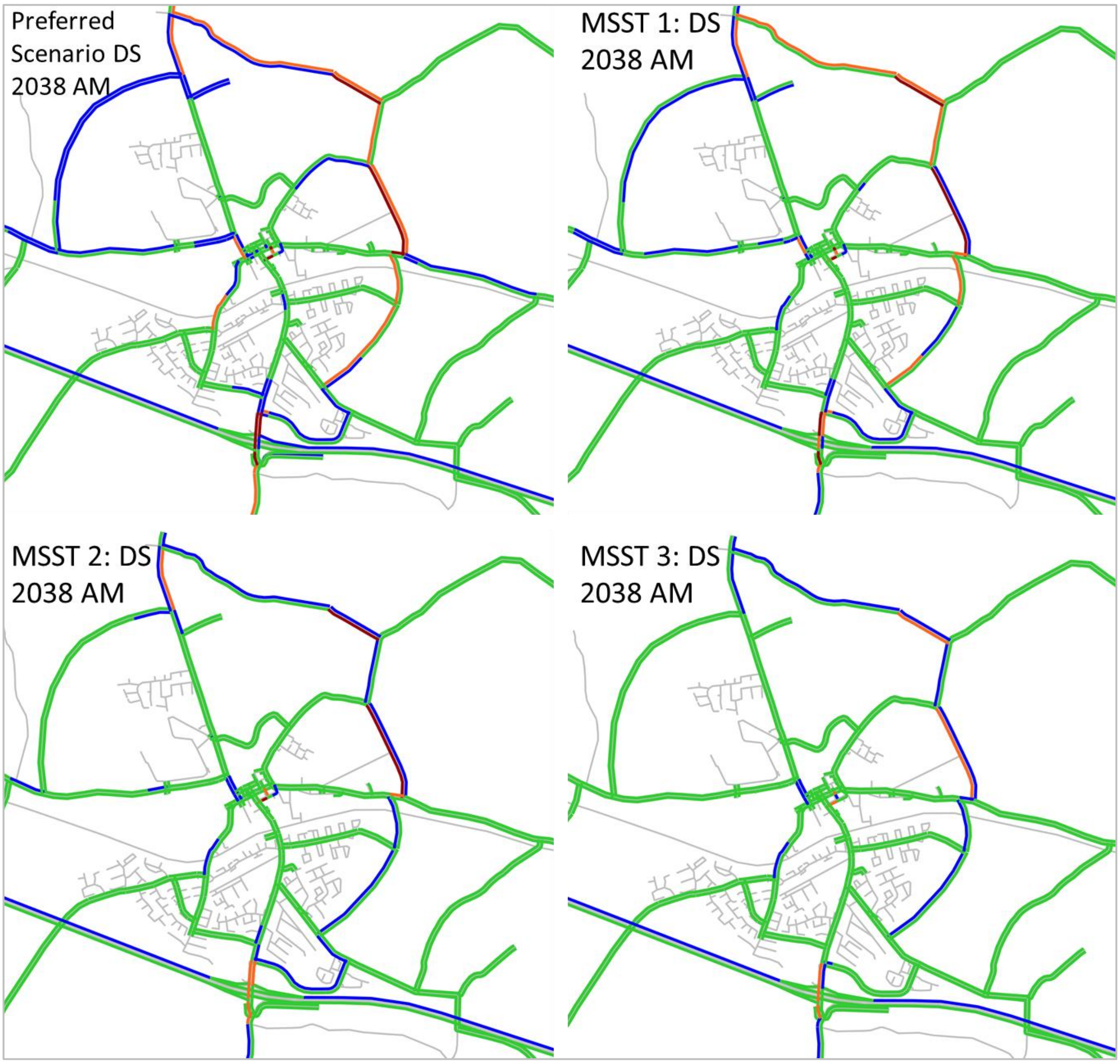

Figure 6.3 Comparison of Preferred and MSST Scenarios: 2038 AM DS Volume/Capacity

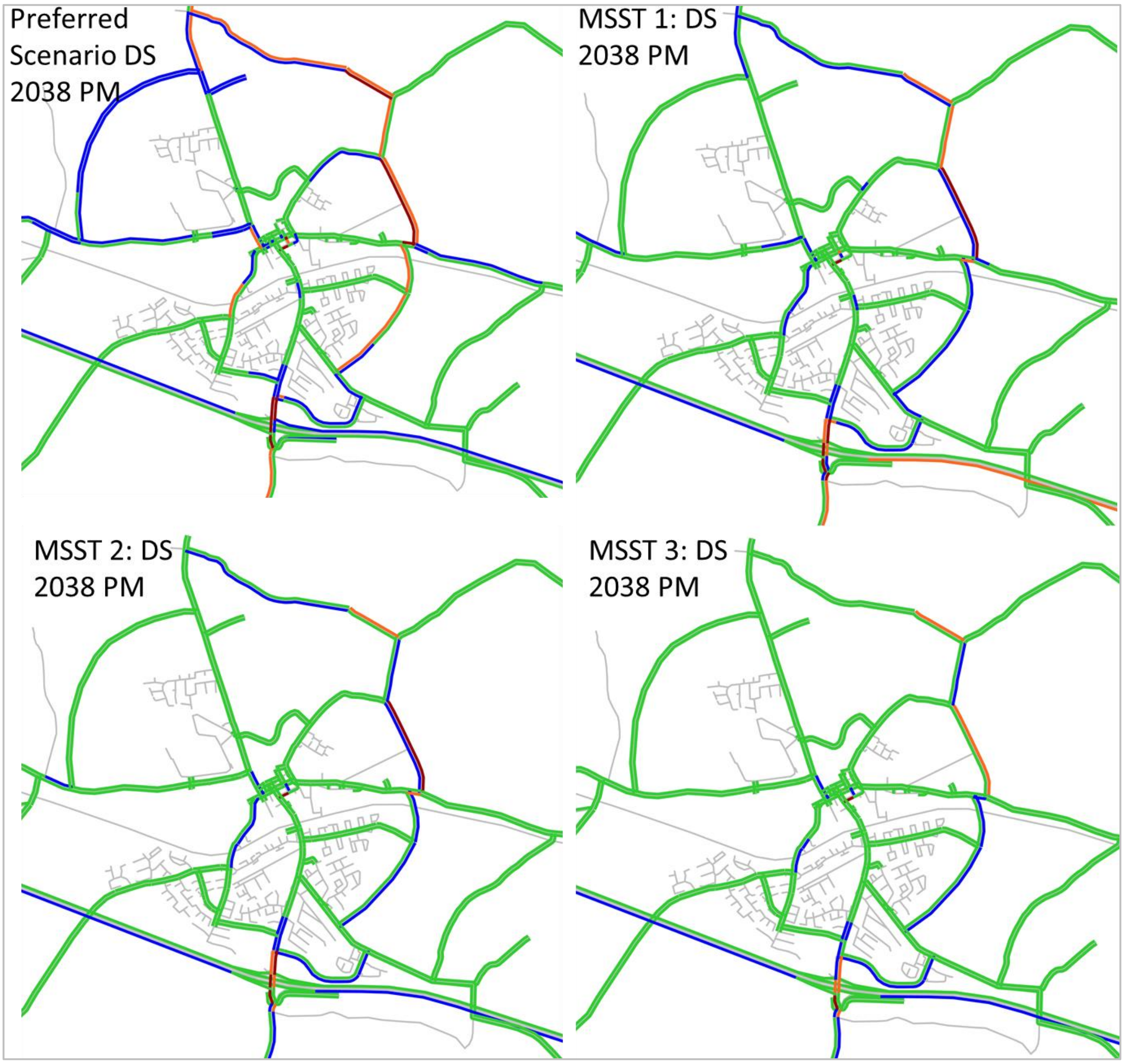

Figure 6.4 Comparison of Preferred and MSST Scenarios: 2038 PM DS Volume/Capacity

6.2.2 Network Statistics Comparison

Table 6.2 and Table 6.3 present the network statistics for the 3 MSST scenarios in 2038 in comparison with the base 2019 model and preferred land-use scenario, which both use existing modal split assumptions. In these tables, it can be observed that the reduction in LV trips from modal shift has a significant impact on the network statistics with reductions in vehicle KM travelled and total travel time delay as well as improvements in average vehicle speed.

Compared to the base model in 2019, the level of additional growth still causes a decline in road network conditions (greater delay, longer KM travelled, slower speeds), but the MSST scenarios demonstrate the importance of modal shift to manage the increase in car demand and deliver an effective future road network.

Table 6.2 2038 AM Comparison of 2038 Preferred Scenario and MSST Scenarios (LV + HV)

Model	Total Network Trips	Total Vehicle KM	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 AM Base	16,711	151,522	3,148	48.1
2038 AM Preferred LU Scenario	22,992	205,658	4,735	43.4
MSST 1: AM 2038	21,022	190,010	4,175	45.5
MSST 2: AM 2038	20,223	184,750	3,968	46.6
MSST 3: AM 2038	19,321	178,705	3,745	47.7

Table 6.3 2038 PM Comparison of 2038 Preferred Scenario and MSST Scenarios (LV + HV)

Model	Total Network Trips	Total Vehicle KM	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
2019 PM Base	18,392	165,043	3,514	47.0
2038 PM Preferred LU Scenario	23,854	217,247	4,993	43.5
MSST 1: PM 2038	21,854	201,176	4,427	45.4
MSST 2: PM 2038	21,077	196,033	4,233	46.3
MSST 3: PM 2038	20,189	190,185	4,020	47.3

6.3 Modal Shift Assumption for Future Year Models

6.3.1 Modal Shift Challenges

The results have shown that the modal shift in the MSST scenarios is critical to accommodate the level of growth proposed in Maynooth and manage traffic on the road network. Unsurprisingly, the greater levels of modal shift in MSST 3 (-15% car mode share) lead to the most positive outlook in respect to road network management, while also being aligned with policy goals to promote sustainable travel. However, it is important to remember how challenging modal shift is to achieve, especially at 15%:

- **Modal shift issue with new residents**: 16,800 extra people will live in Maynooth by 2038 (when compared to the 2019 base year) and we will need to create conditions where 34.5% of new residents can travel to work without the private car for the modal split to remain stationary. For 15% modal shift to occur, 49.5% of new residents will have to be non-car commuters, essentially 1 in 2 new residents. This is a very high percentage, which would rely on a high proportion of local employment allowing for trips by active modes, along with public transport connectivity to employment areas. Considering the relatively weak industrial/employment base in Maynooth, this will be challenging to achieve by active modes and there will be reliance on public transport to provide access to regional jobs.

- **Modal shift among existing residents**: 65.5% of existing residents drive to work, this means that they have made residential location decisions without regard to whether their workplace is accessible via sustainable travel. While the infrastructure for active modes and public transport will improve, if the workplace is not accessible via these modes then existing residents will not shift their mode of transport.

6.3.2 Level of Modal Shift Assumed in Maynooth

Given these challenges, the future year transport scenarios need to be realistic and conservative in their expectations around modal shift. While ideally larger modal shift such as the optimistic -15% car modal split in MSST 3 scenario would be preferrable, there is a risk involved in assuming an unrealistically high level of modal shift as this could underestimate the impact of future growth on the transport network. Therefore, the MEABTA assumes a -10% car modal split (MSST 2) by 2038, which is aligned with the modal shift assumptions in the NTA GDA Transport Strategy, which can also act as a target for the MEABTA and LAP to achieve. The -10% reduction in car modal split for work is intended as a conservative minimum target, which should be realistic to achieve by 2038, but the intention of the MEABTA is to aim for even greater modal shift, if possible, over this time period.

In this regard, it is acknowledged that the Climate Action Plan (CAP) aims to achieve a -20% modal shift from car use by 2030 as a national target. In a theoretical town where there is near total car dependency and no viable car alternatives, the introduction of major public transport and active travel measures in an ABTA would have a major impact with a greater chance of achieving higher modal shift. However, Maynooth is a mature town with established travel behaviour patterns where viable car alternatives have existed for a long time. This means the implementation of the MEABTA measures won’t have the same shock factor as introducing sustainable travel infrastructure for the first time. Modal shift in Maynooth will be a gradual process of convincing existing car users to change their behaviour using carrot and stick methods (e.g. better public transport provision combined with town centre traffic restrictions) while also ensuring that new residents move into areas where sustainable travel models are prioritised e.g. low car parking developments.

In the future year transport models for the Maynooth ABTA, a -10% reduction in car use is assumed by 2038. The transport modelling process is most valuable in anticipating the ‘worst’ case scenario in respect to travel demand and the impact on the network, therefore no modal shift is assumed in the 2028 model. Yet, the MEABTA would intend to promote modal shift prior to 2028 if possible, subject to planning, design and implementation of the measures taking place. In the longer term 2038 scenario, significant modal shift is anticipated with the opening of the new Maynooth West train station, the MEABTA measures, the DART+ expansion and the creation low or no-car developments to accommodate growth. The modal split assumptions will be implemented in the future year models as described in Table 6.4.

Table 6.4 Modal Shift Assumptions in Future Year Models

Model Year	Assumption
2028	-5% LV demand in all zones to reflect impact of working from home
2038	-5% LV demand in all zones to reflect impact of working from home
	-15% LV demand in Maynooth zones to reflect impact of -10% car work modal shift by 2028

A.1 Maynooth VISUM Model Zone Maps

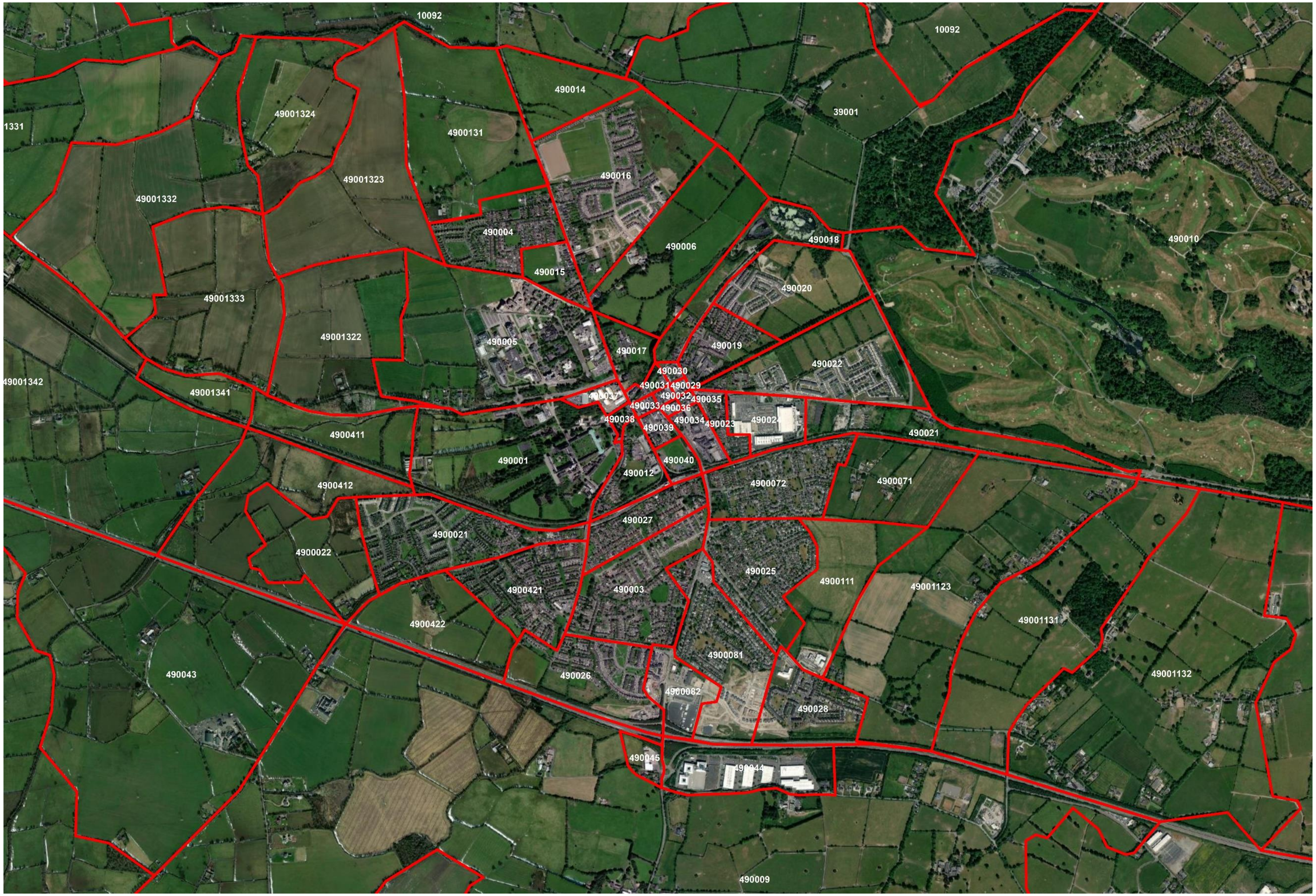

Figure 6.5 Maynooth and Environs VISUM Zones (Study Area Extent)

Figure 6.6 Maynooth VISUM Zones (Town Centre Extent)

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Appendix C: Combined VISUM Model Development/Traffic Modelling Report

Maynooth & Environs ABTA

VISUM Traffic Modelling Report

Kildare County Council

August 2023

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1 Introduction

1.1 Introduction

AECOM was commissioned by Kildare County Council to provide assistance in the preparation of an Area Based Transport Assessment for Maynooth Town and environs. AECOM's role was to develop an understanding of the transport issues in Maynooth Town and make recommendations on a strategic implementation plan of improvement measures and interventions in relation to walking, cycling, public transport, car parking and traffic movements.

To aid this cause, Kildare County Council have commissioned AECOM to develop a strategic VISUM model to inform the Council on the impact of their network improvements and planning proposals. This report outlines the methodology used to develop the traffic model, a description of the road options, the results of the option assessment and the impact of the recommended combined roads strategy.

1.2 Report Structure

This report has the following structure:

- Chapter 2: Base Year Traffic Modelling;
- Chapter 3: Future Year Matrix Development;
- Chapter 4: Assessment of Road Options; and
- Chapter 5: Impact of Combined Roads Strategy.

2 Base Year Traffic Modelling

A VISUM model for Maynooth was created as part of the Eastern Ring Road project, which had a base year of 2016. This report uses a ‘light touch update’ of this VISUM model to update the base year to 2019. The changes to the model involved in the light touch update are outlined in this section.

2.1 Road Network and Zones - 2016

The Maynooth base year network and model zones which were developed for Eastern Ring Road project in 2016 are shown in Figure 2.1.

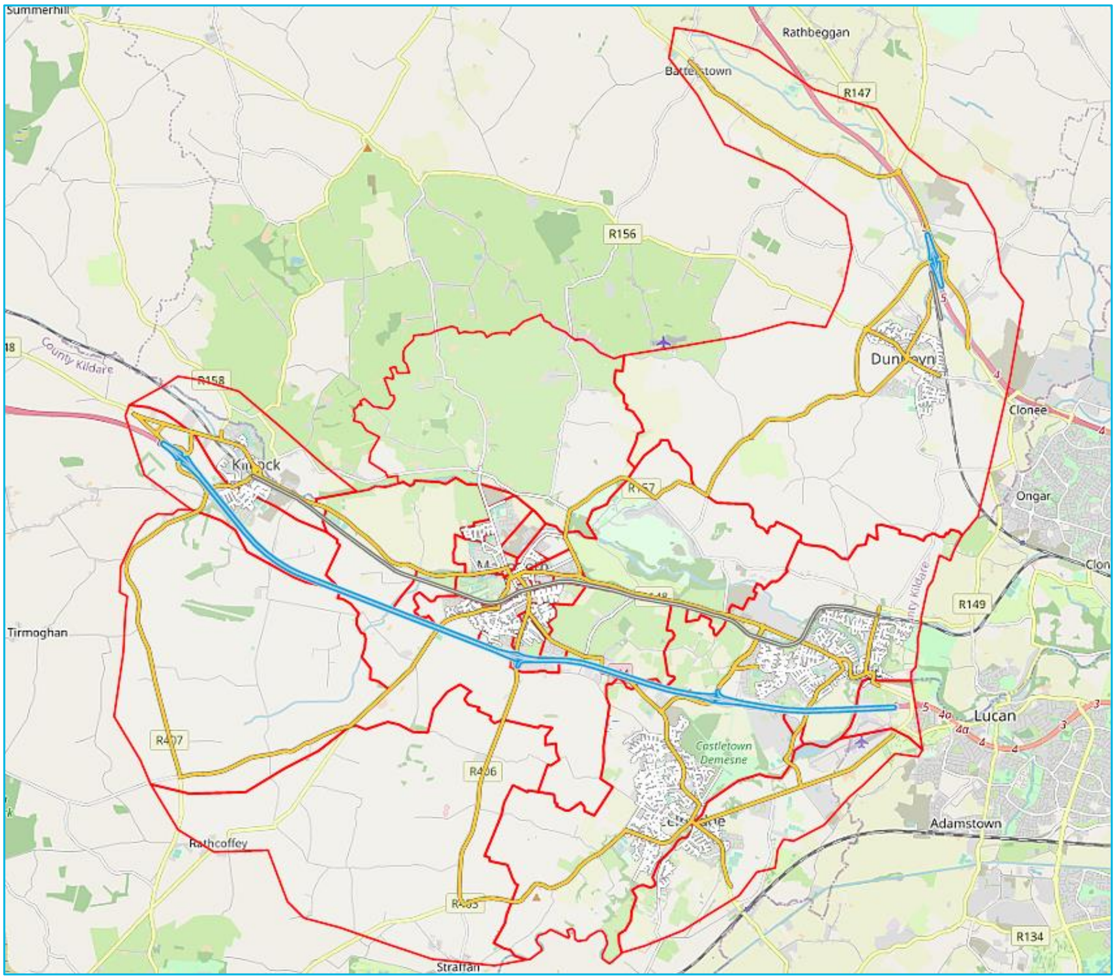

Figure 2.1 Base Year VISUM Network - Maynooth 2016

2.2 Base Year Light Touch Update - 2019

The base year for the Maynooth and Environs ABTA is 2019, this required a light touch update from the original 2016 base year. The 2016 model has been updated in terms of missing links, zones, connectors, and travel demand to reflect the situation in the new base year 2019.

2.2.1 Updating Links in 2019 Base Network

The following sections provide a summary of the missing links that are updated in the 2019 base year model.

1. Ballygoran Road

Ballygoran Road, which is located to the south of M4 was missing in the 2016 network and has been added in the base year model. The link is updated with a capacity of 800PCUs and speed of 30kph. Updated link is highlighted in the Figure 2.2 below.

Figure 2.2 Ballygoran Road

2. Griffith Rath Housing Estate Roads

All the roads of Griffith Rath housing estate have been updated in base year model network. A future Do-Minimum Road (Straffan Link Road) will run through the housing estate and connects to the south of Griffin Rath Manor. Figure 2.3 below highlights the updated Griffith Rath estate roads.

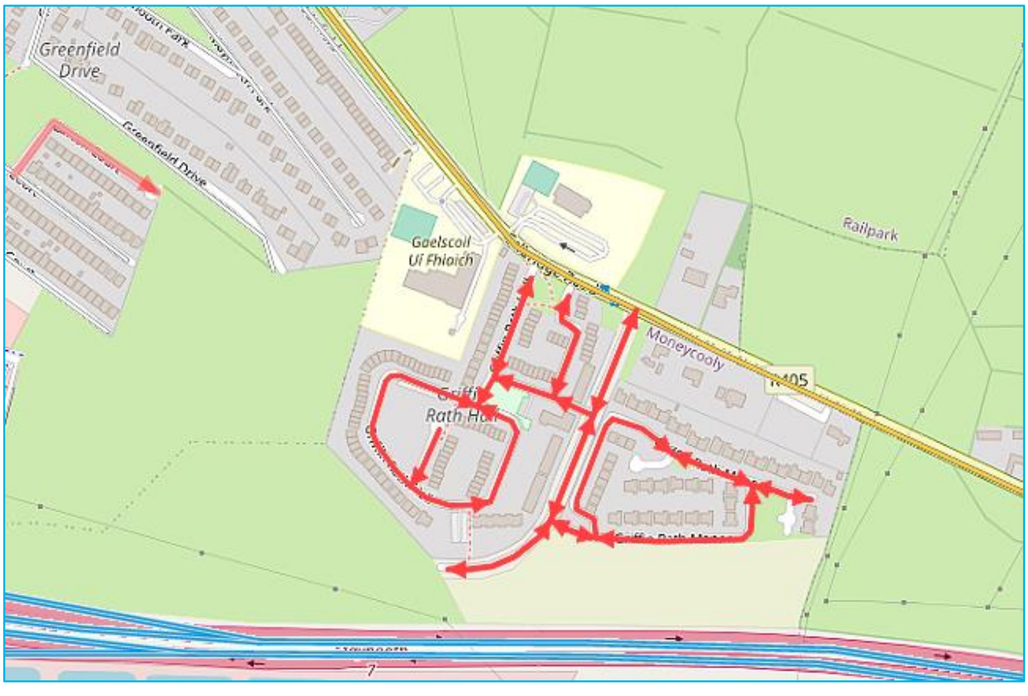

Figure 2.3 Griffith Rath Housing Estate Roads

3. Closed the road connection for Carton Avenue

The road connection for Carton Avenue which was open in the 2016 network has been closed as shown in Figure 2.4 in the updated 2019 base year network as it is a private lane.

Figure 2.4 Road Closure of Connecting Carton Avenue

2.2.2 Updating Zoning System

There was a total of 56 zones (including 9 external zones) in the 2016 model before updating the zoning system in the 2019 base year model. Considering future year land use growth and the future road network, the main zones near Maynooth town centre were split into sub zones thereby increasing the number of zones to 65, which includes 9 external zones. This allowed for more accurate modelling of future traffic demand. The main zones which were split and the corresponding sub zones in the updated 2019 base model are listed in Table 2.1. The other internal and external zones are unaltered.

Table 2.1 Zones Split – Updated Model

Main Zone	Split Zones			
1009	10092	30091		
49002	490021	490022		
49008	490081	490082		
490011	4900111	4900112	4900113	
490013	4900131	4900132	4900133	4900134
490042	4900421	4900422		

The updated zoning system is shown in Figure 2.5.

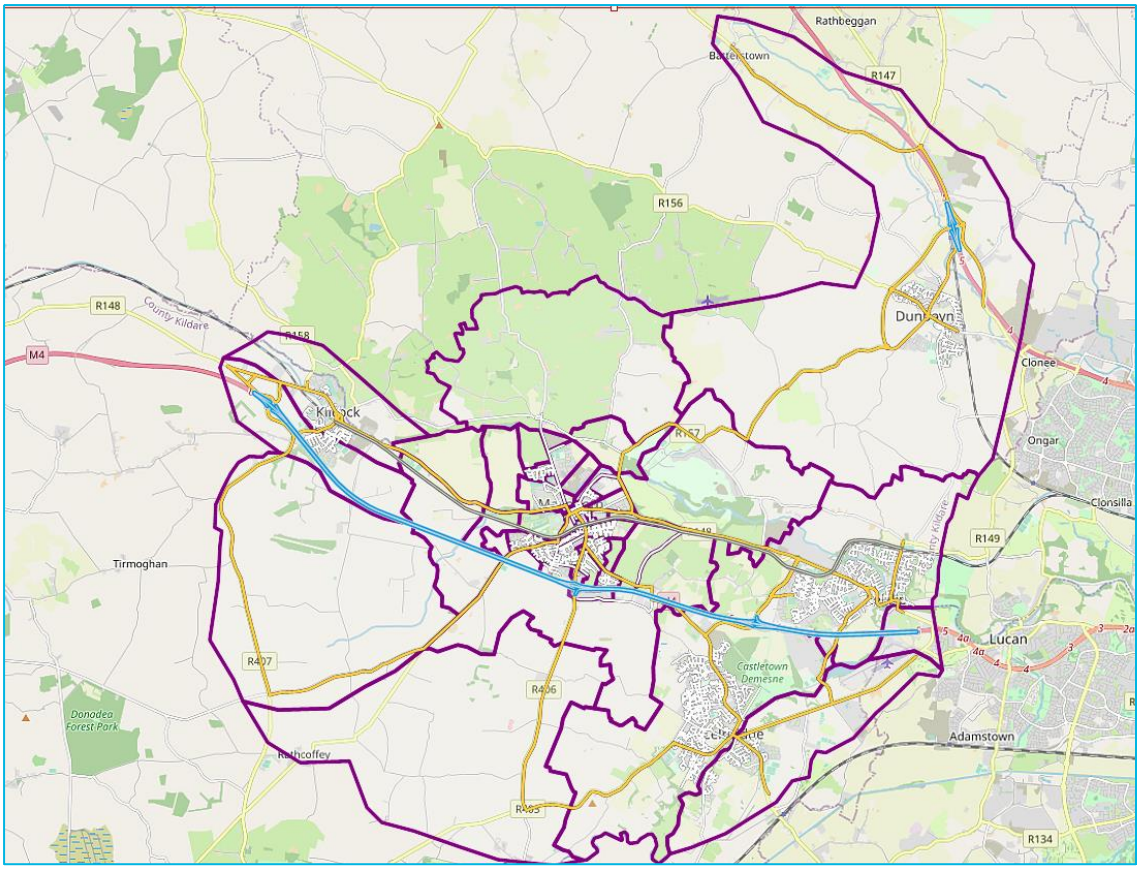

Figure 2.5 Updated Zoning System – 2019

2.2.3 Connectors Update

Based on the new zone system formed, the zone connectors were also updated ensuring proper distribution of demand assigned.

2.2.4 Travel Demand update

After updating the zone structure, the demand in the 2016 model is adjusted based on the proportions calculated for each split zone. Then the LV and HV demand have been uplifted to the 2019 base year levels based on the growth factors presented in Table 2.2. The growth factors were developed from Traffic Monitoring Unit (TMU) data collected from the M4 mainline between 2016 and 2019.

Table 2.2 Factors for Uplifting Travel Demand from 2016 to 2019

Vehicle Type	AM Growth Factor	PM Growth Factor
LV	-5.3%	+1.7%
HV	+11.8%	+1.6%

After updating the network, zones, connectors and demand, the assignment runs have been carried out for the base year models using the Equilibrium Lohse method for both AM and PM Peaks.

2.2.5 Network Statistics

The VISUM models are fixed demand models, which demonstrate the re-routing of traffic associated with changes to the network (e.g. increased capacity, greater congestion, etc). The key outputs from the network statistics like total vehicle kilometres, total travel time and average network speed are extracted and presented in Table 2.3 for the 2019 base year model.

Table 2.3 : Network Statistics – Base Year

Peak	Total Network Trips	Total Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
AM	16,711	147,570	2,745	53.76
PM	18,392	161,360	3,046	52.98

3 Future Year Matrix Development

This chapter details the development of the future year vehicular trip matrices used to inform the assessment of road options for the Maynooth Transport Strategy. Matrices were developed for the years 2028 and 2038 using the demand matrices from the base year (2019) VISUM model.

The zone structure defined in the 2019 base year model, as shown in Figure 2.5 has been retained in the future year scenarios as well. As with the base year (2019) model development, separate demand matrices were developed to represent the AM peak (08:00-09:00) and the PM peak (17:00-18:00) hours and these were further classified by Light (LV) and Heavy vehicle (HV) user classes.

3.1 Final Preferred Land-Use Scenario

The land-use modelling process identified the final preferred land-use scenario to use for future growth in the forecast years 2028 and 2038. In the final preferred land use scenario, growth for different land uses such as Residential, Commercial, Schools and University, Retail, Industrial and Hotel were added to the internal zones within Maynooth Study area for future years based on information from Kildare County Council Planning Department. The details of the land use growth used for both the forecast years is presented in Table 3.1.

Table 3.1 Preferred Land Use Scenario Details

Land Use Details	Growth In Land Use	
	2019-2028	2019-2038
Residential (No of Units)	3,645	6,897
Primary school (No of Pupil)	900	1,808
Secondary school (No of Pupil)	2,296	2,939
University (No of Students)	9,000	13,000
Office (GFA)	66,740	95,700
Industrial (GFA)	155,450	203,750
Retail (GFA)	500	2,500
Hotel (No of Bedrooms)	150	300

The population targets for each of these scenarios were provided by KCC in the form of a planning sheet, which projected the additional number of persons for each zone of the traffic Model. In total, for 2028 and 2038, the town's residential units are projected to increase by 3,645 and 6,897 respectively (from the 2019 baseline scenario).

3.2 Trip Forecasting

For LVs, the trip rates from TRICS [1] were used to develop future origins and destinations for zones with new land uses proposed within Maynooth Study area for 2028 and 2038. The base year internal zonal trip ends were uplifted by adding the additional land use in the 2028 and 2038 to develop the forecast year trip ends.

For the estimation of vehicular trips to/from external zones, link-based central growth rates provided in Table 5.3 of "*Project Appraisal Guidelines for National Roads Unit 5.3 – Travel Demand Projections"* were used to derive external traffic growth factors for the years 2028 and 2038. These growth factors as presented in Table 3.2 and Table 3.3, were multiplied with the base year trip ends of external zones to develop future year origin and destination trip ends for 2028 and 2038.

Table 3.2 2028 and 2038 – AM Peak External Zone Growth Factors

Maynooth Zones	2028 AM Central				2038 AM Central			
	2028 AM Vehicles		2028 AM Heavies		2038 AM Vehicles		2038 AM Heavies	
	O	D	O	D	O	D	O	D
1001	1.30	1.29	1.68	1.86	1.44	1.48	2.32	2.55
1002	1.33	1.24	1.91	1.67	1.58	1.38	2.66	2.34
1003	1.11	1.27	1.41	1.11	1.19	1.38	1.77	1.30
1004	1.29	1.15	1.36	1.30	1.44	1.27	1.68	1.56
1005	1.35	1.07	1.85	1.39	1.62	1.11	2.50	1.80
1006	1.25	1.13	1.34	1.30	1.40	1.23	1.60	1.53
1007	1.18	1.00	1.45	1.15	1.26	1.07	1.80	1.38
1008	1.12	1.16	1.51	1.35	1.21	1.27	1.85	1.68
10092	1.01	1.01	1.02	1.02	1.02	1.02	1.04	1.04

[1] TRICS® Training & Development Forum

Table 3.3 2028 and 2038 – PM Peak External Zone Growth Factors

Maynooth Zones	2028 PM Central				2038 PM Central			
	2028 PM Vehicles		2028 PM Heavies		2038 PM Vehicles		2038 PM Heavies	
	O	D	O	D	O	D	O	D
1001	1.35	1.30	1.87	1.65	1.55	1.44	2.59	2.44
1002	1.28	1.47	1.66	1.84	1.41	1.78	2.55	2.60
1003	1.27	1.10	1.10	1.46	1.39	1.17	1.29	1.80
1004	1.11	1.33	1.30	1.37	1.21	1.50	1.54	1.69
1005	1.12	1.43	1.56	1.56	1.20	1.73	1.88	1.98
1006	1.11	1.24	1.30	1.31	1.21	1.38	1.53	1.57
1007	1.00	1.25	1.15	1.35	1.05	1.35	1.38	1.66
1008	1.19	1.02	1.33	1.46	1.30	1.10	1.64	1.75
10092	1.01	1.01	1.02	1.02	1.02	1.02	1.04	1.04

The HV trip rates sourced from TRICS for different commercial land uses for calculating HV demand is presented in Table 3.4.

Table 3.4 2028 and 2038 – HV Trip Rates

OGV Trip Rate					
TRICS Land Use	Rate	AM Peak (08:00-09:00)		PM Peak (17:00-18:00)	
		Arrivals	Departures	Arrivals	Departures
Office	GFA (per 100 sq. m)	0.003	0.0035	0.002	0.003
Retail / convenience Store	GFA (per 100 sq. m)	0.163	0.081	0.041	0.041
Industrial Unit	GFA (per 100 sq. m)	0.0145	0.0145	0.008	0.0075

Using these trip rates, additional HV trip ends from the additional land uses were calculated for future years and have been added to base year HV trip ends.

3.3 Allocation & Distribution of Future Growth

With zone totals determined, the distribution of the origin and destination totals was carried out using the Furnessing distribution method, which is based on the reasonable assumption that in the forecast year, the pattern of trip making will remain substantially identical to those in the Base year, with the trip volumes increasing in line with the growth of both the origin and destination.

For proper distribution of trip ends, all the O-D cells with zero demand in the base year matrices were seeded with a very small number (0.01) so that they get populated with appropriate future year trips. Otherwise, the cells remain zero irrespective of the factor applied.

The final demand matrices were obtained by projecting the base year matrices using doubly constrained projection in VISUM with the mean value of future year origin and destination trip ends used as matrix total for the iterative calculation.

3.4 Modal Split Sensitivity Tests (MSST)

After developing the matrices for the Preferred land use scenario, three modal split sensitivity tests were carried out using the following assumptions:

- For all these scenarios, the demand calculated for the Preferred land use scenario is used with additional changes.
- The demand sensitivity tests were carried for both 2028 and 2038 scenarios.
- A 5% reduction in LV demand in all zones is assumed to reflect impact of working from home. This reduction has been applied in both 2028 and 2038 demands.
- Further three demand sensitivity scenarios were considered in 2038 to reflect mode shift from car. However, this reduction in demand has been applied for only for Maynooth internal zones as presented in Table 3.5.
- There is no reduction in HV demand in any scenario as they are not affected by modal split.

Table 3.5 2038 MSST Scenarios

MSST Scenario	Reduction in % Car Modal Split	% Reduction to Apply to LV Demand in Matrix from Impact of Modal Shift
MSST 1: 5% Modal Shift from Car to Other Modes	-5%	-8%
MSST 2: 10% Modal Shift from Car to Other Modes	-10%	-15%
MSST 3: 15% Modal Shift from Car to Other Modes	-15%	-23%

The future year trip ends for 2038 estimated for Preferred scenario and three MSST scenarios based on the above procedure is presented in Table 3.6.

Table 3.6 Future year trip ends-2038

Model Year	AM Peak		PM Peak	
	Light Vehicle	Heavy Vehicle	Light Vehicle	Heavy Vehicle
Preferred Scenario	21,368	1,626	22,384	1,469
MSST 1	19,393	1,626	20,377	1,469
MSST 2	18,599	1,626	19,600	1,469
MSST 3	17,692	1,626	18,712	1,469

Ultimately, MSST 2 (10% reduction in car modal split) scenario demand has been decided and adopted to carry out future year modelling for options in the forecast year 2038.

4 Option Assessment

4.1 Do Minimum Road Network

The roads strategy assumes that in addition to the base year model network links update, following committed roads schemes will be completed in the future and they form the Do-Minimum (DM) road network, which is described below:

- Lyreen Avenue connecting Moyglare Road and Dunboyne Road.
- Straffan Link Road connecting Straffan Road with Griffith Rath Housing Estates.

The DM Road network is shown in Figure 4.1.

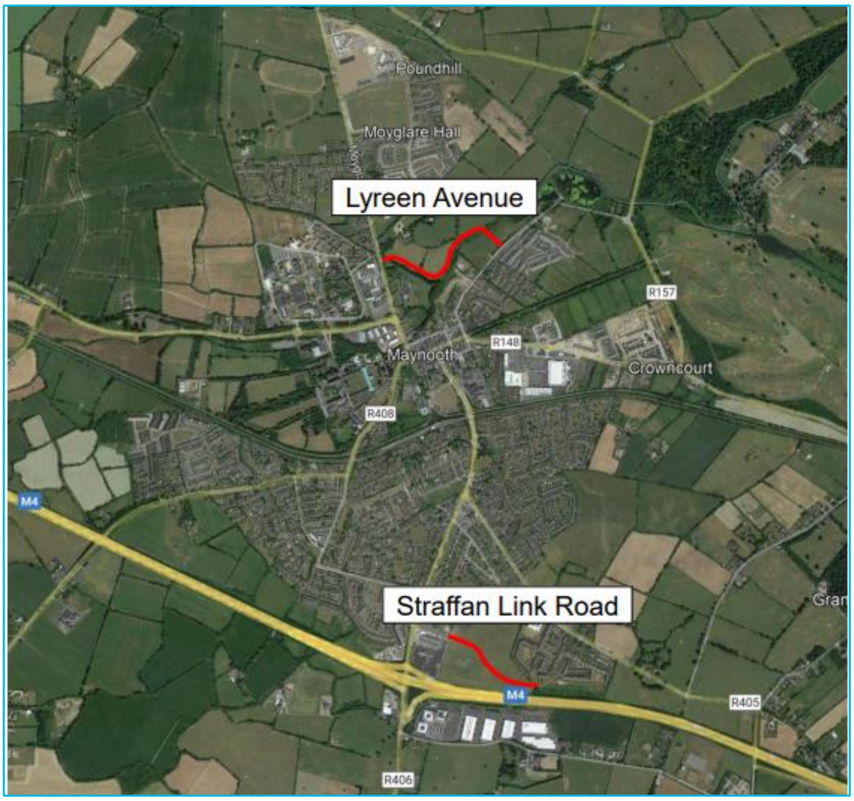

Figure 4.1 Do-Minimum Road Network

4.2 Road Options Description

A number of road options were created to improve traffic conditions across Maynooth Town. The majority of these options are tested in the VISUM transport model to assess their impact on the road network in Maynooth and inform the option assessment process.

4.2.1 Options 1A-1C: Maynooth Outer Orbital Road (MOOR)

In this option, southern/Western bypass is connecting the Moyglare Road with Straffan Road. This road is coded as a Single Carriageway Road with 1350 PCUs/hour capacity and a 70kph speed to provide continuous priority. This bypass will facilitate bus priority/ active travel infrastructure in the town centre. It is modelled as three different segments linked to the development in the west and these are coded as three options in the model - Option 1A, 1B, and 1C. Option 1A connects Straffan Road to Rathcoffey Road, Option 1B connects Rathcoffey road to Kilcock Road and Option 1C connects Kilcock Road to Moyglare Road. Option 1 is shown in Figure 4.2.

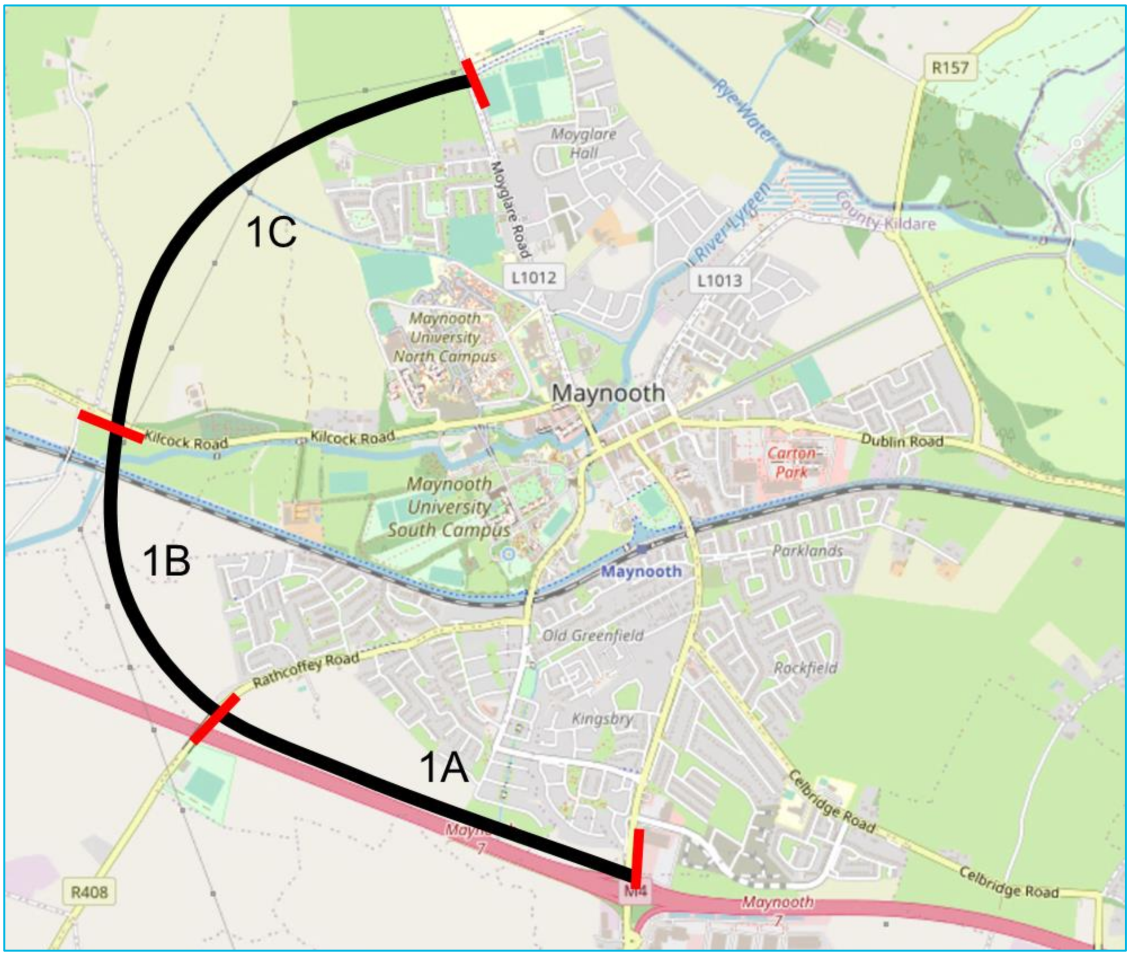

Figure 4.2 Option 1- MOOR (1A/1B/1C)

4.2.2 Options 2A-2B: Second M4 Junction / Upgrade to the existing M4 Junction

In Option 2A, a new M4 junction is proposed west of the existing junction while converting the existing junction into an overbridge. The second junction will split demand and is expected to reduce capacity issues while also providing a junction which prioritises buses.

Option 2B considers increasing capacities of the slip roads of the existing M4 junction from 1600 to 3200 pcus/hour with a speed of 80kph to cater for the extra demand. Option 2 A or B locations are shown in Figure 4.3 below.

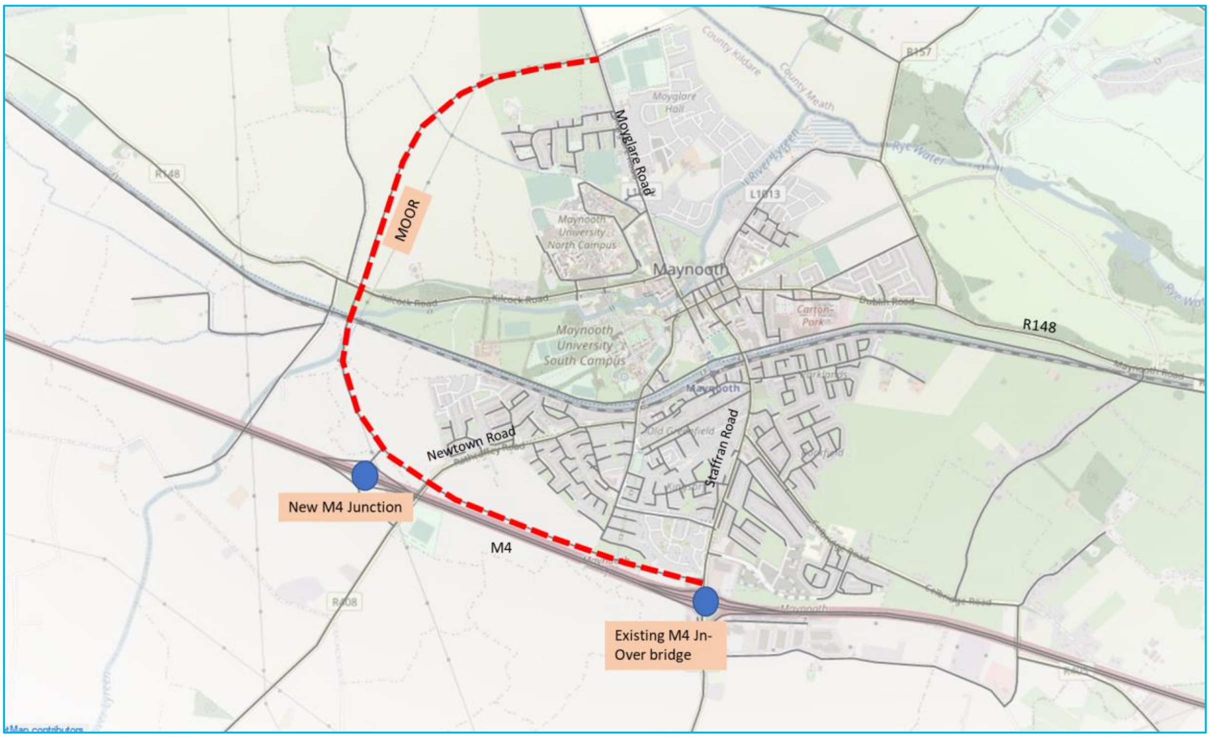

Figure 4.3 Option 2A-2B

4.2.3 Option 3: Maynooth Eastern Ring Road

In this option, an Maynooth Eastern Ring Road (MERR) is provided connecting the Straffan Link Road with the Dublin Road to create an eastern bypass of the town centre, as shown in Figure 4.4.

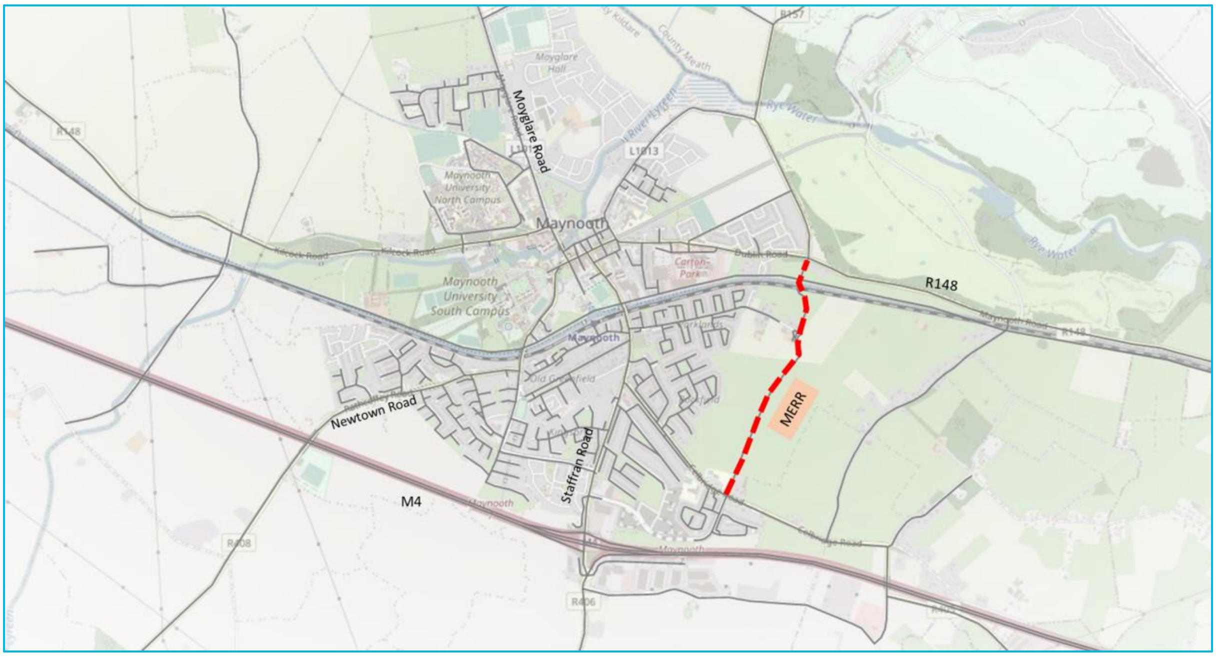

Figure 4.4 Option 3 – MERR

4.2.4 Option 5: North-Eastern Orbital Linking Moygaddy with Maynooth

In this option, which connects the Moygaddy site, a distributor road has been provided. In order to avoid a safety and congestion issue in the Moyglare Hall estate, filtered permeability is provided at the north of the housing estate to stop it becoming a rat-run as shown in Figure 4.5.

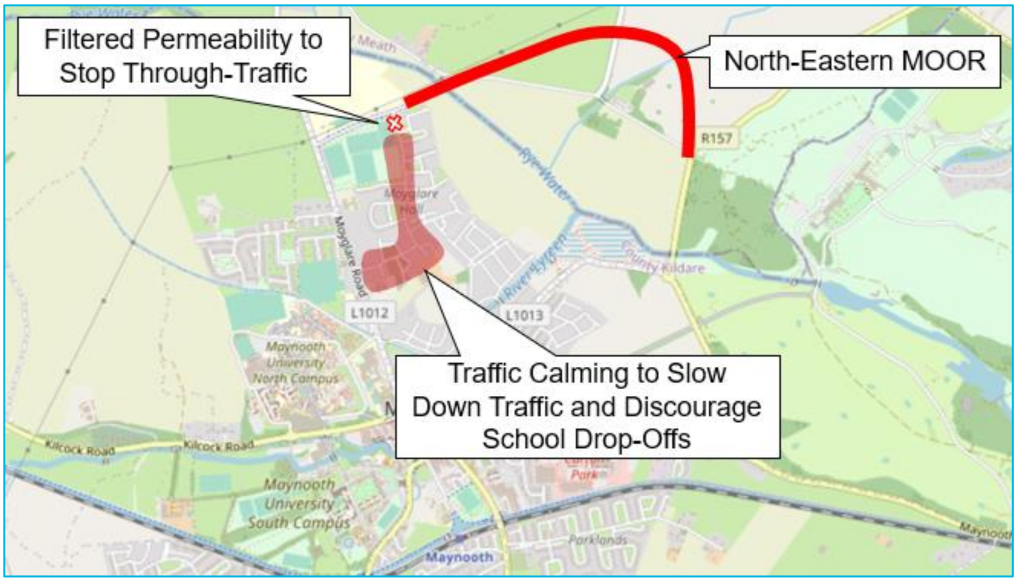

Figure 4.5 Option 5- North Distributor Road

4.2.5 Option 6: Alternative Moygaddy Links

This option presents a new radial multi modal corridor directly to Moygaddy from central Maynooth. This option avoids putting a large number of vehicles outside the MEC school complex. Radial routes are preferrable for sustainable travel modes because they involve shorter distances as they are more direct and the existing roads are upgraded to cater the traffic demand as shown in Figure 4.6.

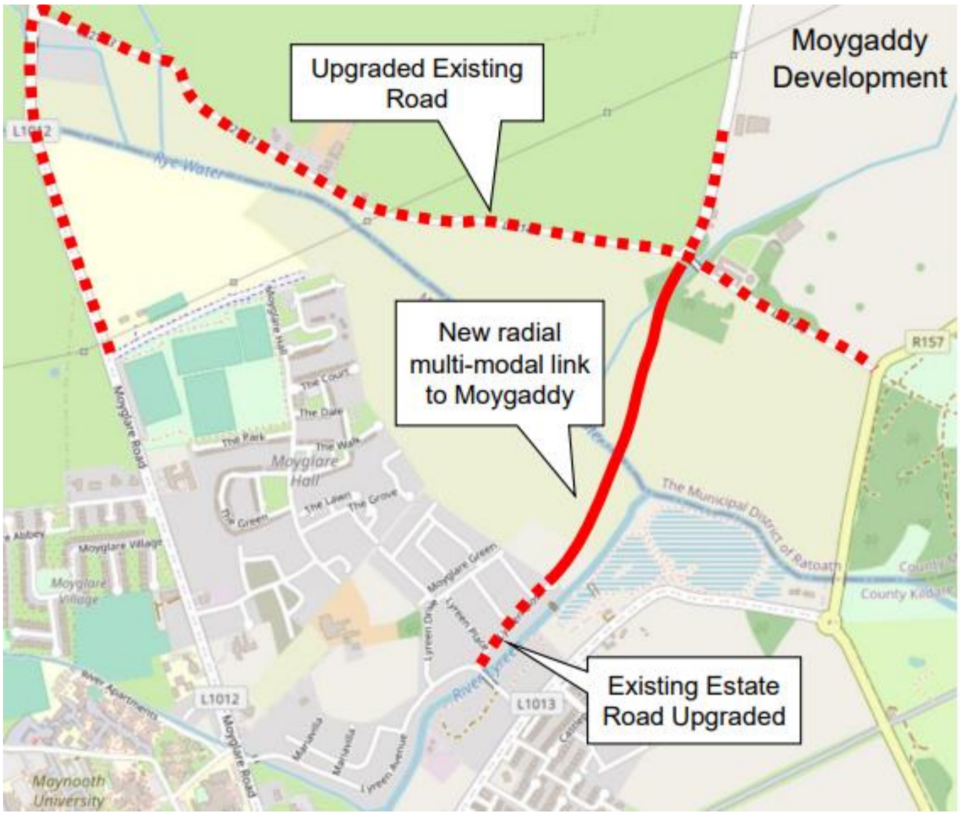

Figure 4.6 Option 6- Alternative Moygaddy Links

4.2.6 Option 8: Southern Access to Leinster Street

This option is aligned with a parking option and creates a largely pedestrianised route from the train station to town centre and reduces the traffic volumes on Main Street via a southern access from Parsons Street. Capacity at the R408/ R418 junction in the town centre has been increased by turning it into a T-Junction. The new access road is connected to the planned development road from Parsons Street. Retractable bollards are used on Leinster Street to facilitate continuous access by emergency vehicles as shown in Figure 4.7.

Figure 4.7 Option 8- Southern Access to Leinster Street

4.2.7 Option 10: Close Eastern NUIM Entrance

In this option, existing vehicle access to the university is closed and turned into a walk/cycle entrance and potentially a bus gate with retractable bollards. This will reduce cross town centre traffic queuing on Moyglare Road. Option 1 MOOR is required for this option, as shown in Figure 4.8, to provide alternative access to the university.

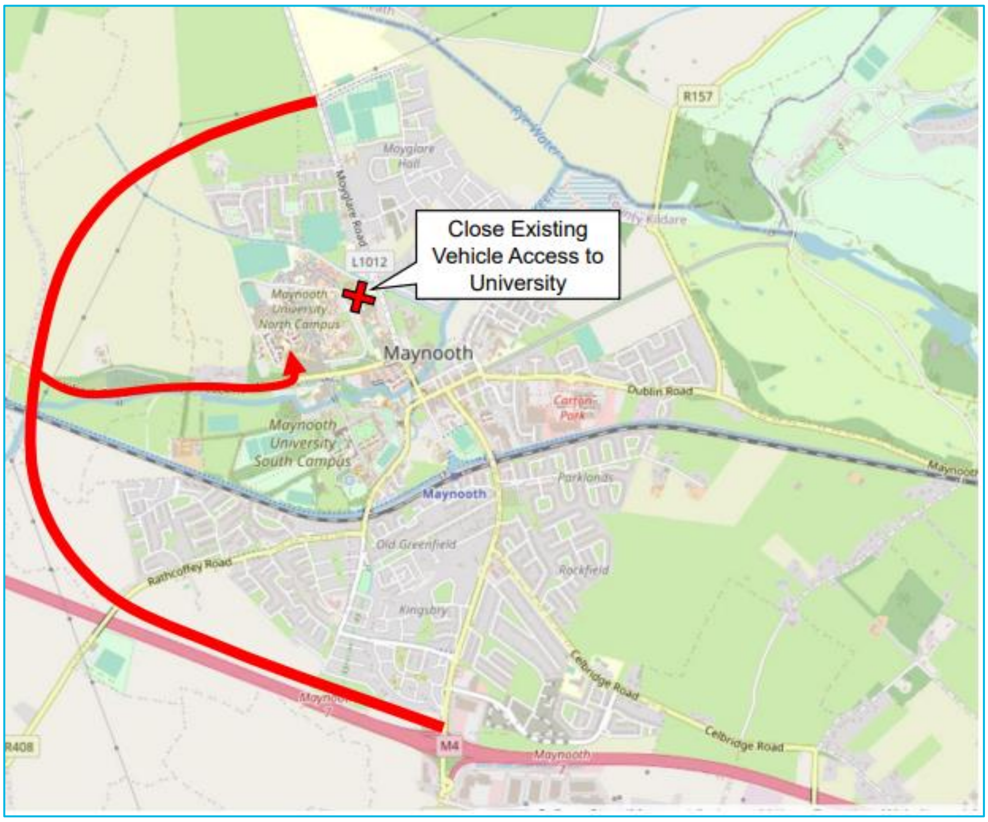

Figure 4.8 Option 10- Close Eastern NUIM Entrance

4.3 Road Option Scenarios Assessment

This section describes the results of the strategic transport modelling (VISUM) assessment of the potential options. Some scenarios were tested with individual options whereas, some scenarios were tested with the combination of two or more options. **The MSST 2 scenario demand has been used for carrying out assignments**.

In this section, difference plots from the VISUM modelling are presented for each Do-Something (DS) option and a summary of network statistics across all options is provided. A difference plot shows the change in traffic volumes when the option is implemented, in comparison with the Do-Minimum Scenario. In the difference plots, **green** indicates a reduction in traffic on the link as a result of implementing the option while **red** represents an increase in traffic on the link.

4.3.1 Scenario - 1A

Option 1A was compared against this DM Scenario in 2038 for the AM peak and the flow difference plot is shown in Figure 4.9. With the existence of the southern orbital Road, the difference plot shows that all traffic moving on the R407 has transferred onto the R408 because of shorter distance reaching town centre.

4.3.2 Scenario -1B

Option 1B was compared against the Do-Minimum scenario for 2038 for the AM peak and the difference plot is shown in Figure 4.10. The difference plot highlights that the introduction of the 1B section in the west has reduced traffic volumes on the R148 and in the north of the Maynooth, by facilitating traffic movements between the west and south of the town without the need to travel through central areas.

4.3.3 Scenario - 1C

Option 1C was compared against the Do-Minimum scenario for 2038 for the AM peak and the difference plot is shown in Figure 4.11. The difference plot indicates that the introduction of the 1C section in the north has reduced traffic volumes on the R148 to the west of Maynooth, Moyglare Road and in the northern sections of Maynooth. There has been slight decrease in flows on the M4.

4.3.4 Combined Option 1 (1A/1B/1C)

Combined Option 1(1A/1B/1C) was compared with Do-minimum 2038 scenario for the AM Peak and the plot is shown in Figure 4.12. The most notable difference that was observed is that the majority of the traffic was reassigned to the new orbital road thereby decreasing volumes on almost all of the links within Maynooth town. There has been a slight increase in vehicular movements on the R408 and R148 towards the south and west of Maynooth.

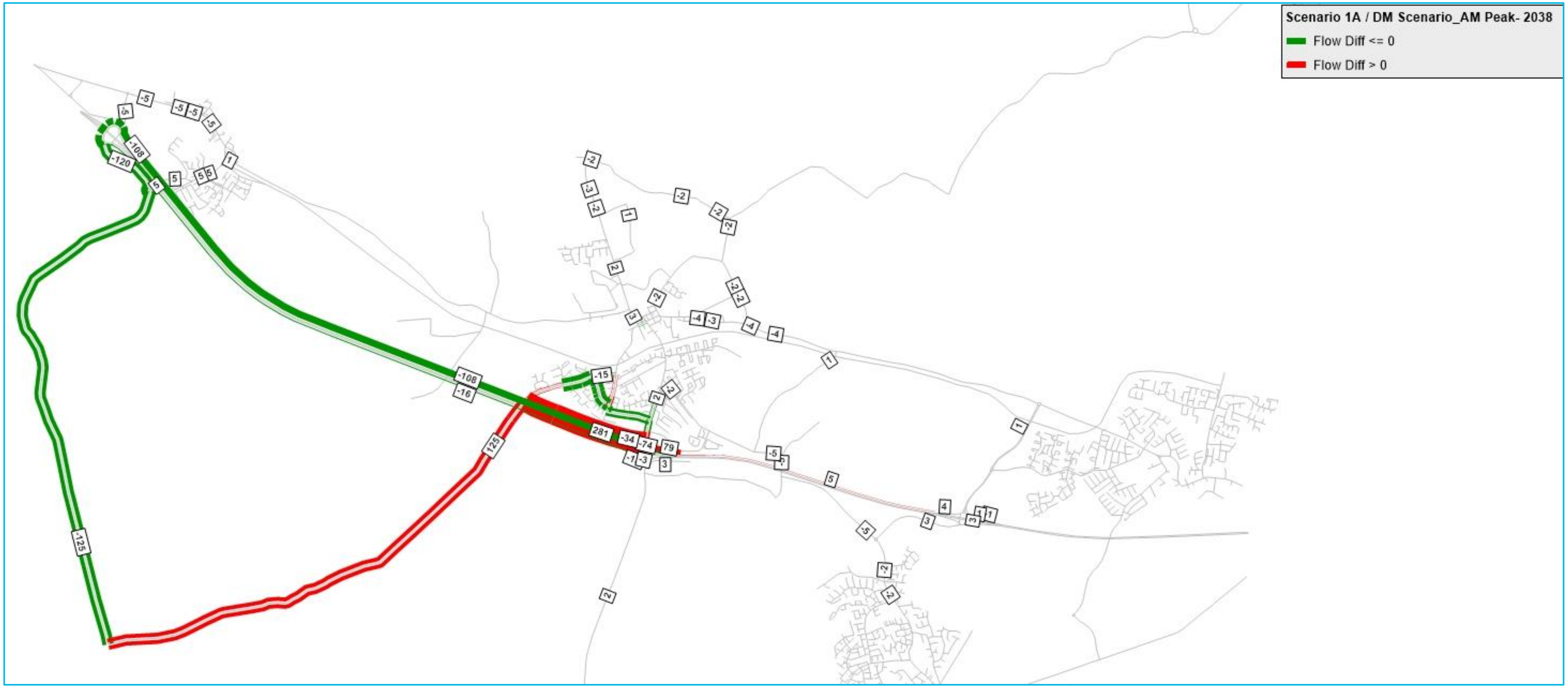

Figure 4.9 Flow Comparison (Scenario 1A Vs DM Scenario) – 2038 – AM Peak

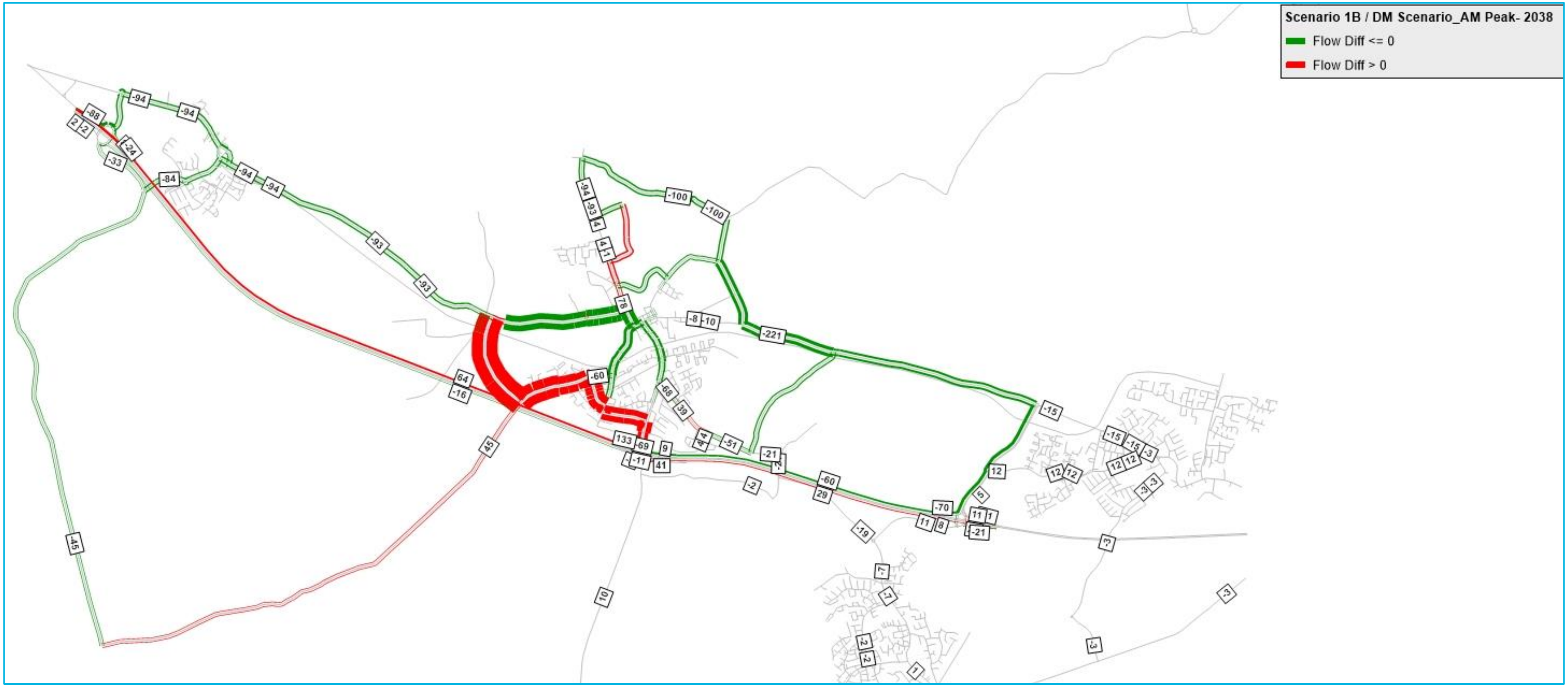

Figure 4.10 Flow Comparison (Scenario 1B Vs DM)– 2038 – AM Peak

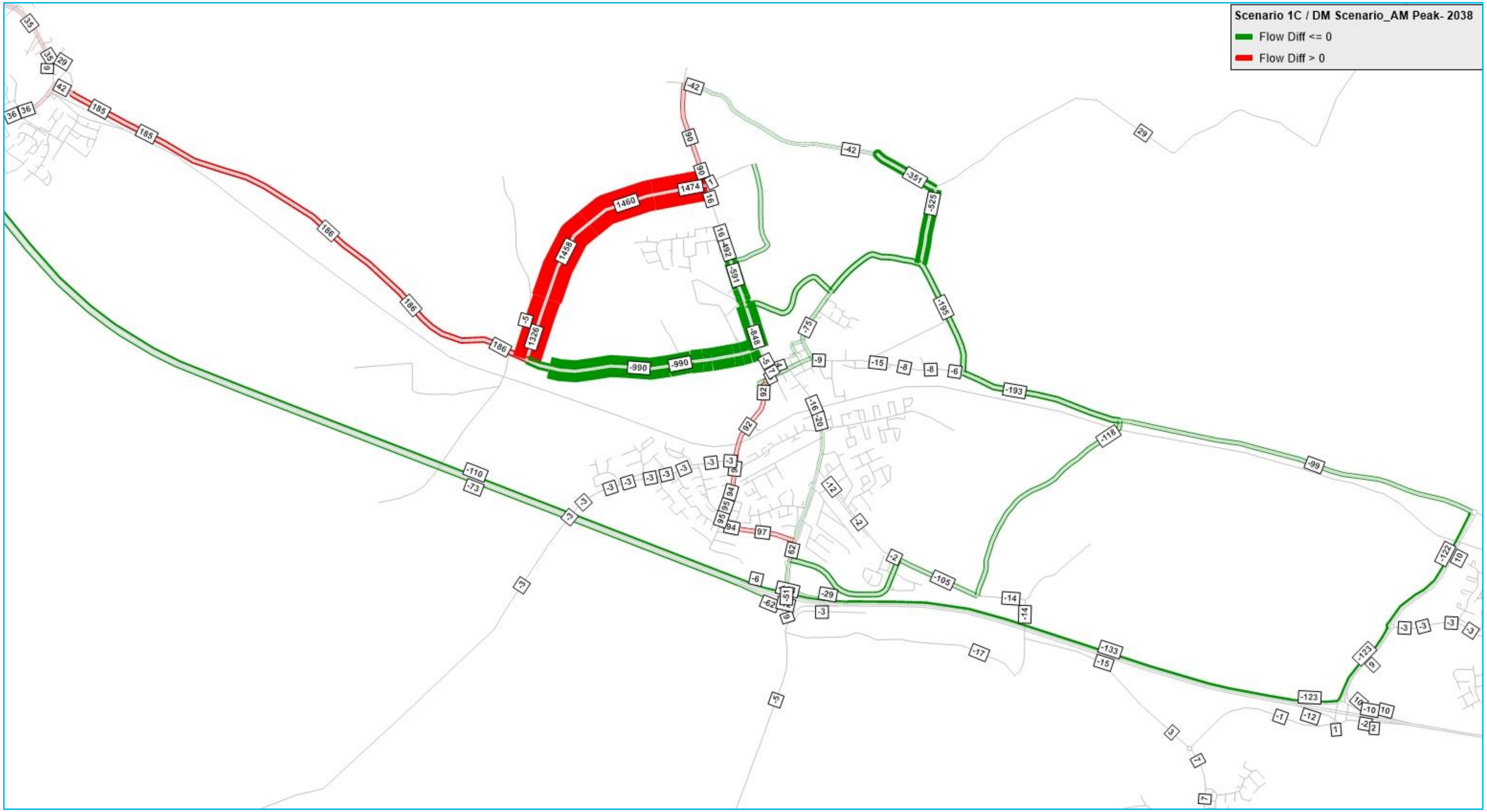

Figure 4.11 Flow Comparison (Scenario 1C Vs DM) – 2038 – AM Peak

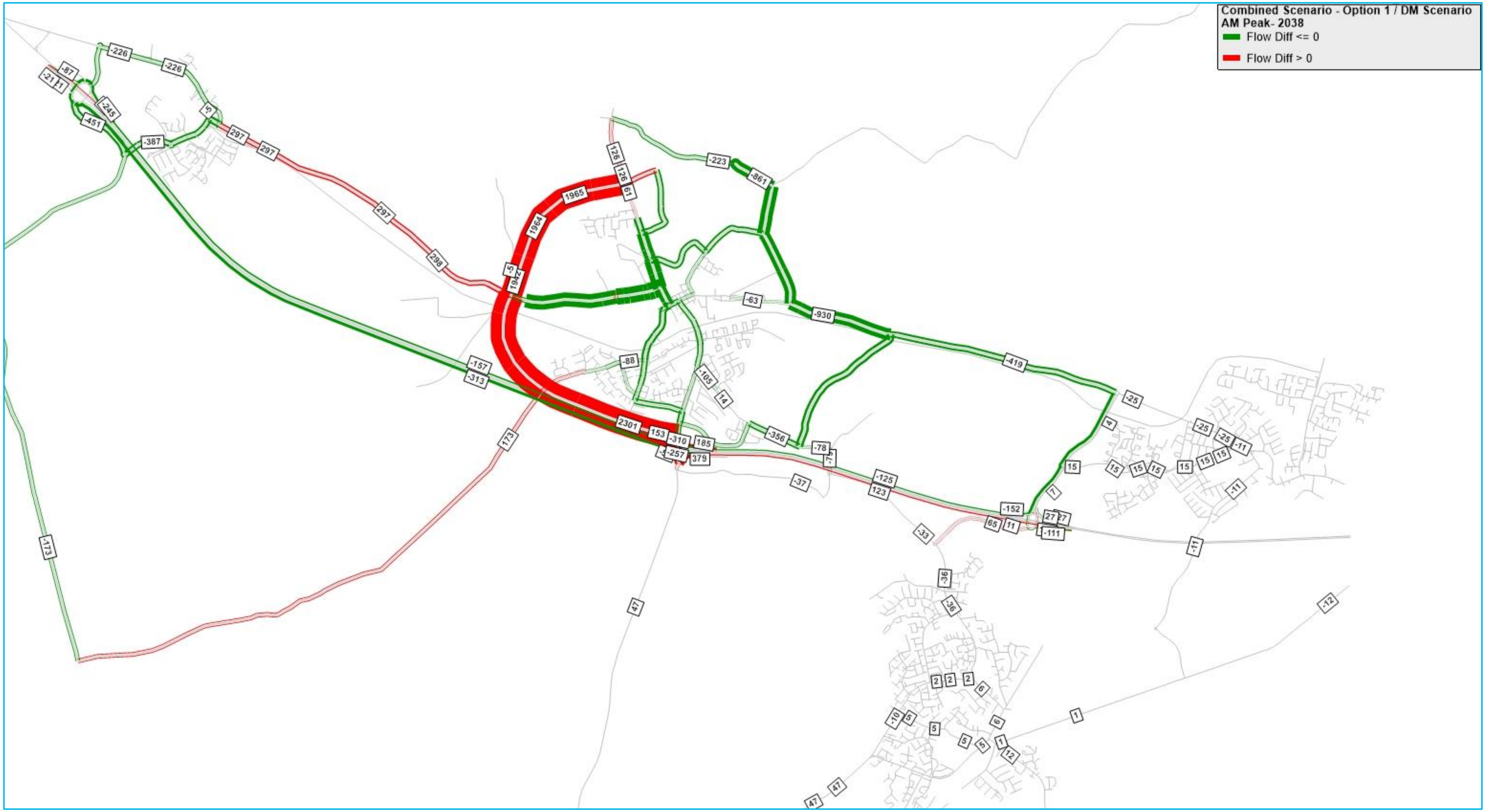

Figure 4.12 Flow Comparison (Combined Option 1 Vs DM) 2038 – AM Peak

4.3.5 Scenario - 2A

Scenario 2A is a combination of Option 2 (MOOR in place along with upgrade of Existing M4 junction), Option 3 (MERR) and Option 5 (North-Eastern Orbital Road to Moygaddy). These options almost form a ring around Maynooth town. It was compared against the Do-Minimum scenario for 2038 in the AM peak with the flow difference plot shown in Figure 4.13. There has been substantial reduction in vehicular movements inside Maynooth town and also on major corridors like the R148 and Moyglare road.

4.3.6 Scenario - 2B

Scenario 2B is a combined scenario with Option 2 (MOOR along with new M4 junction and making the existing M4 junction to overbridge closing the slip roads), Option 5 (North Moygaddy Distributor Road) and Option 3 (Eastern Distributor Road). It was compared against the Do-Minimum scenario for 2038 in the AM peak with the flow difference plot shown in Figure 4.14.

4.3.7 Scenario - 2A -Alt1

Scenario 2A -Alt1 is a modification of Scenario 2A, (Upgrade existing M4 Junction and MOOR is not included) and also Option 3 (MERR). It was compared against the Do-Minimum scenario for 2038 in the AM peak with the flow difference plot shown in Figure 4.15 There is slight increase in traffic on the M4 from the west using the MERR corridor to reach north of Maynooth. There is also a substantial reduction in traffic on the adjacent roads of the MERR and R148.

4.3.8 Scenario - 2A -Alt2

Option 2A -Alt2 is also a modification of Scenario 2A, only Option2 (upgrade of the existing M4 Junction) is considered. The scenario is compared against the Do-Minimum scenario for 2038 in the AM peak with the flow difference plot shown in Figure 4.16. From the figure it is observed that there is no major difference in traffic flows even though the existing M4 junction is upgraded.

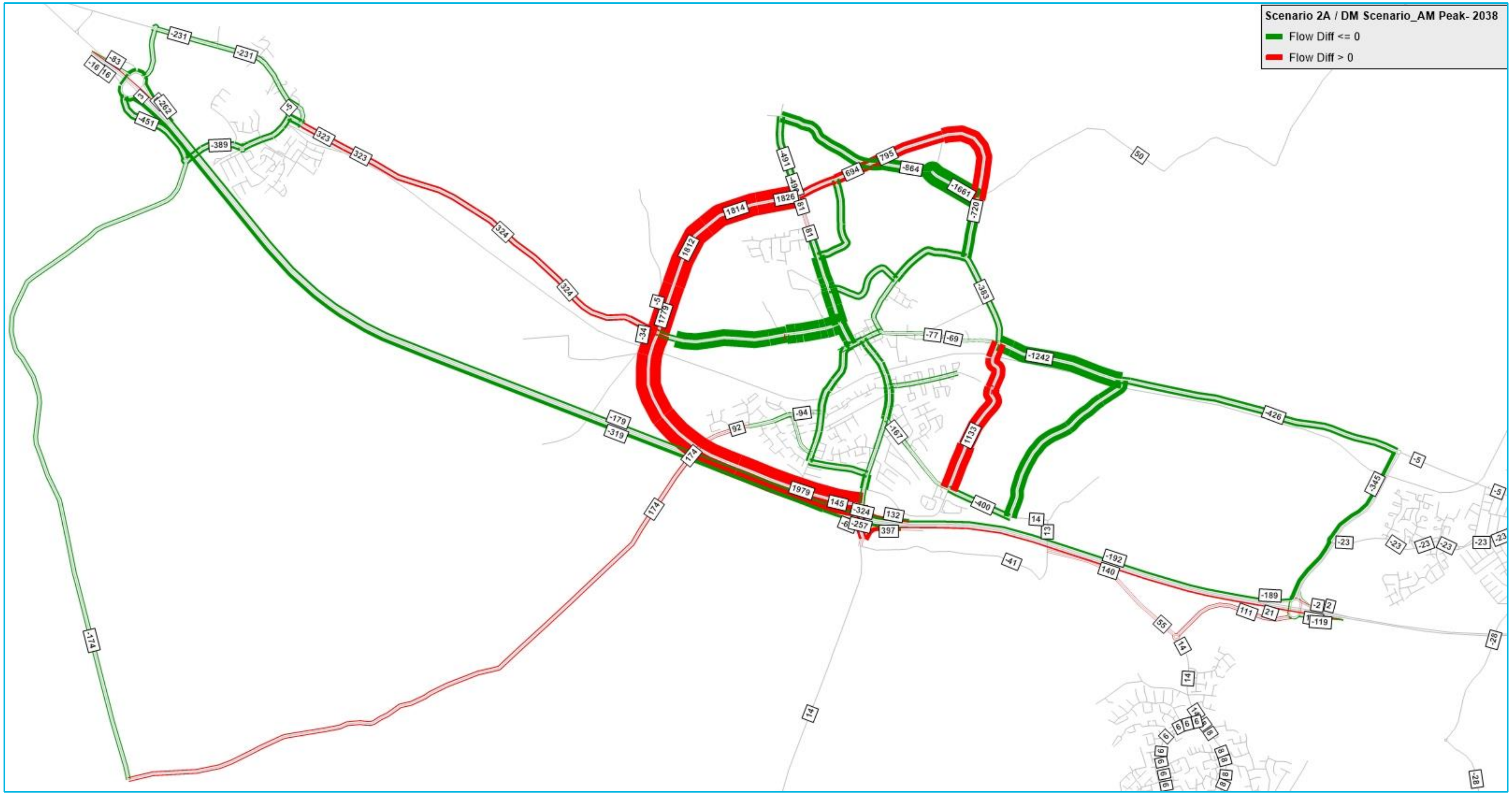

Figure 4.13 Flow Comparison (Scenario 2A Vs DM)– 2038 – AM Peak

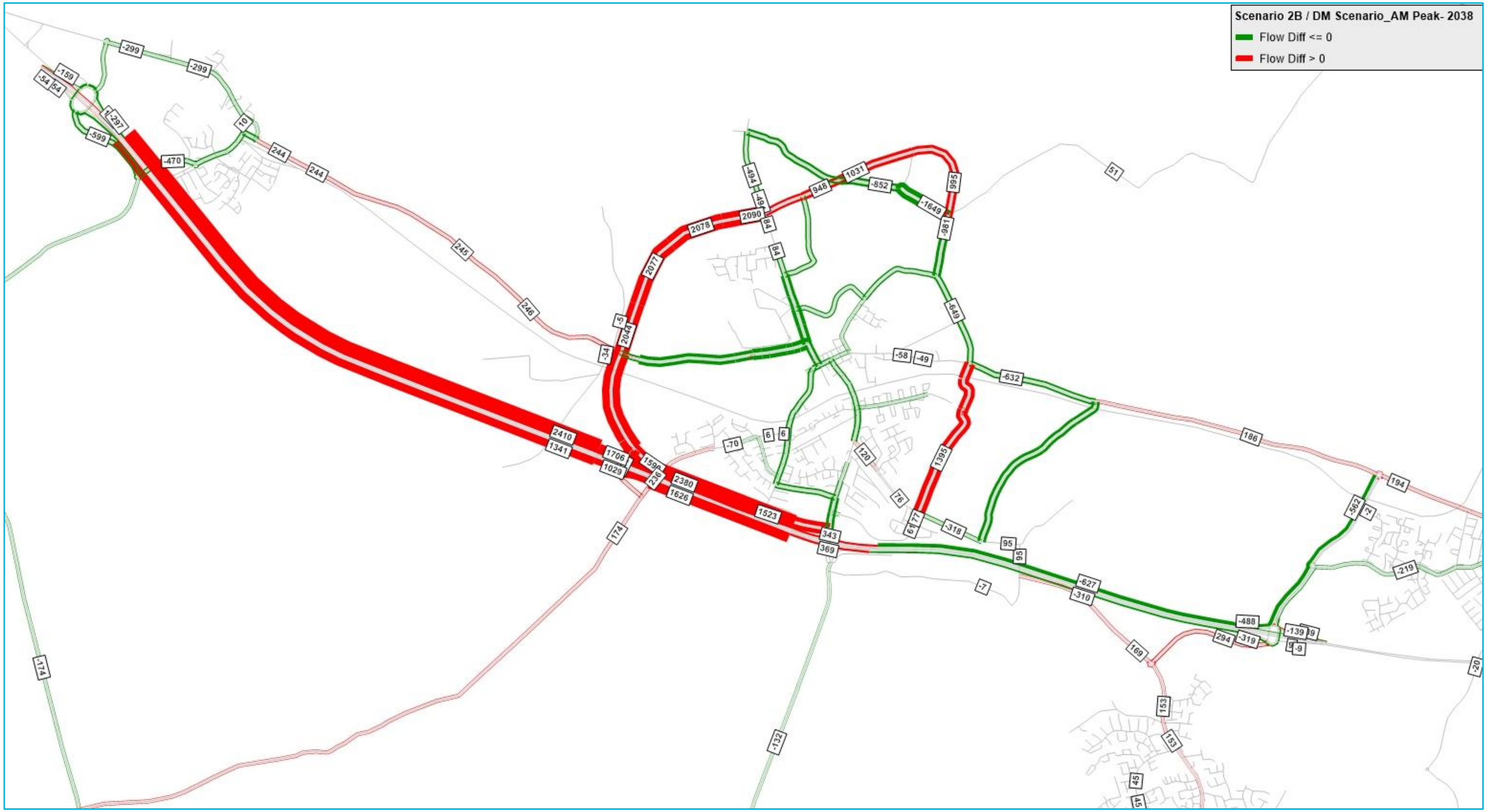

Figure 4.14 Flow Comparison (Scenario 2B Vs DM)– 2038– AM Peak

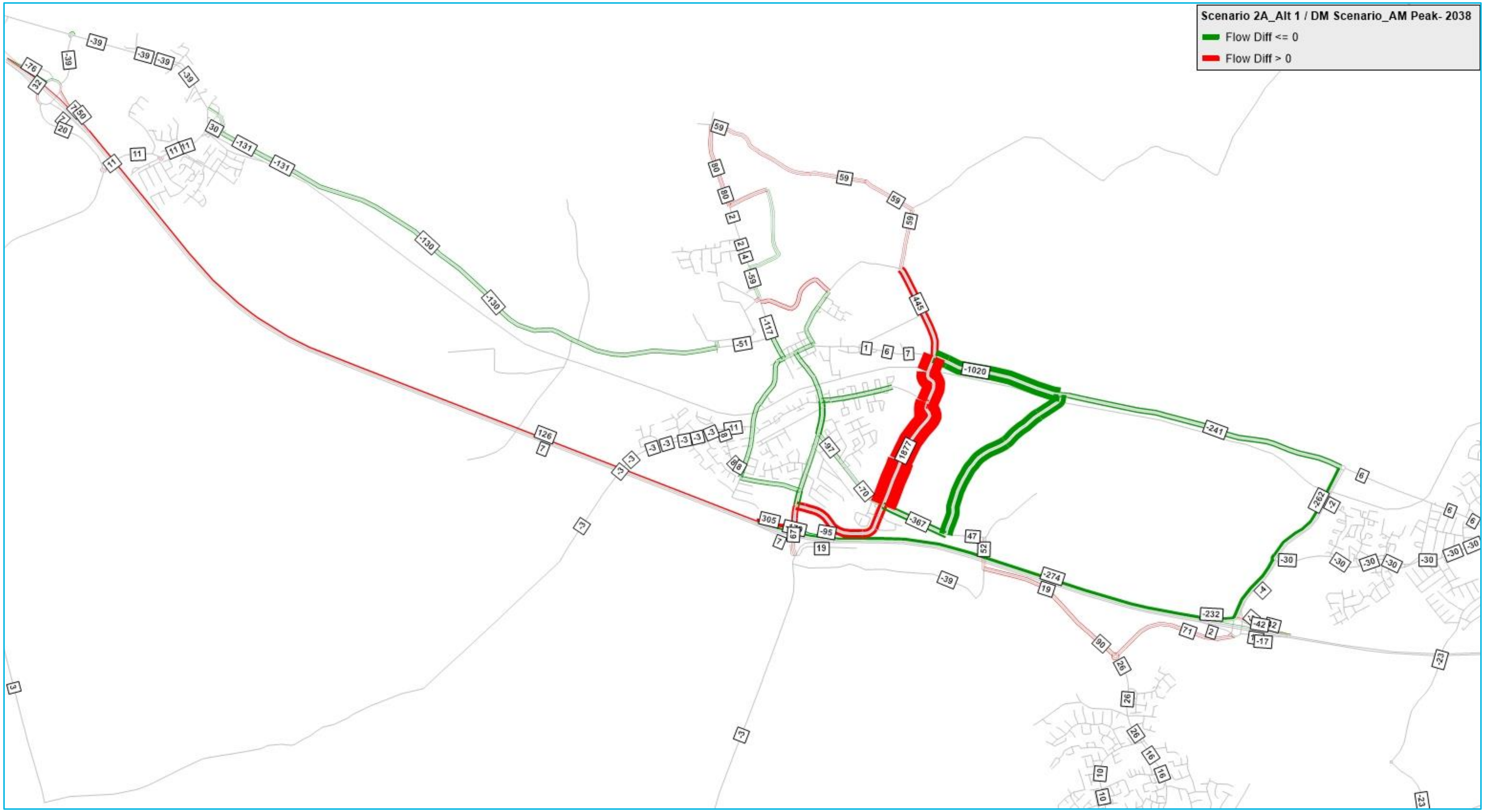

Figure 4.15 Flow Comparison (Scenario 2A_Alt1 Vs DM)– 2038 – AM Peak

Figure 4.16 Flow Comparison (Scenario 2A_Alt 2 Vs DM)– 2038 – AM Peak

4.3.9 Scenario 3

This scenario contains only Option 3 (MERR) and it was compared against the Do-Minimum scenario for 2038 in the AM peak with the flow difference plot shown in Figure 4.17 There has been a considerable reduction in traffic from the adjacent roads.

4.3.10 Scenario 5

This scenario has only Option 5 (Northern Moygaddy Distributor Road) and it was compared against the Do-Minimum scenario for 2038 in the AM peak with the flow difference plot shown in Figure 4.18.

4.3.11 Scenario 6

This scenario has Option 6 (Alternative links to Moygaddy Road that were upgraded) and it was compared against the Do-Minimum scenario for 2038 in the AM peak with the flow difference plot shown in Figure 4.19. It is observed from the figure that, on the upgraded links the traffic flows were increased.

4.3.12 Scenario 8

This scenario shows Option 8: southern street access to Leinster Street, compared against the Do-Minimum scenario for 2038 in the AM peak with the flow difference plot shown in Figure 4.20. Traffic reduces on Leinster Street with an increase on the new access road from Parsons Street.

4.3.13 Scenario 10

In this scenario, Combined Option 1(MOOR) is considered along with Option 10 (Eastern NUIM entrance closed) and compared against the Do-Minimum scenario for 2038 in the AM peak with the flow difference plot shown in Figure 4.21.

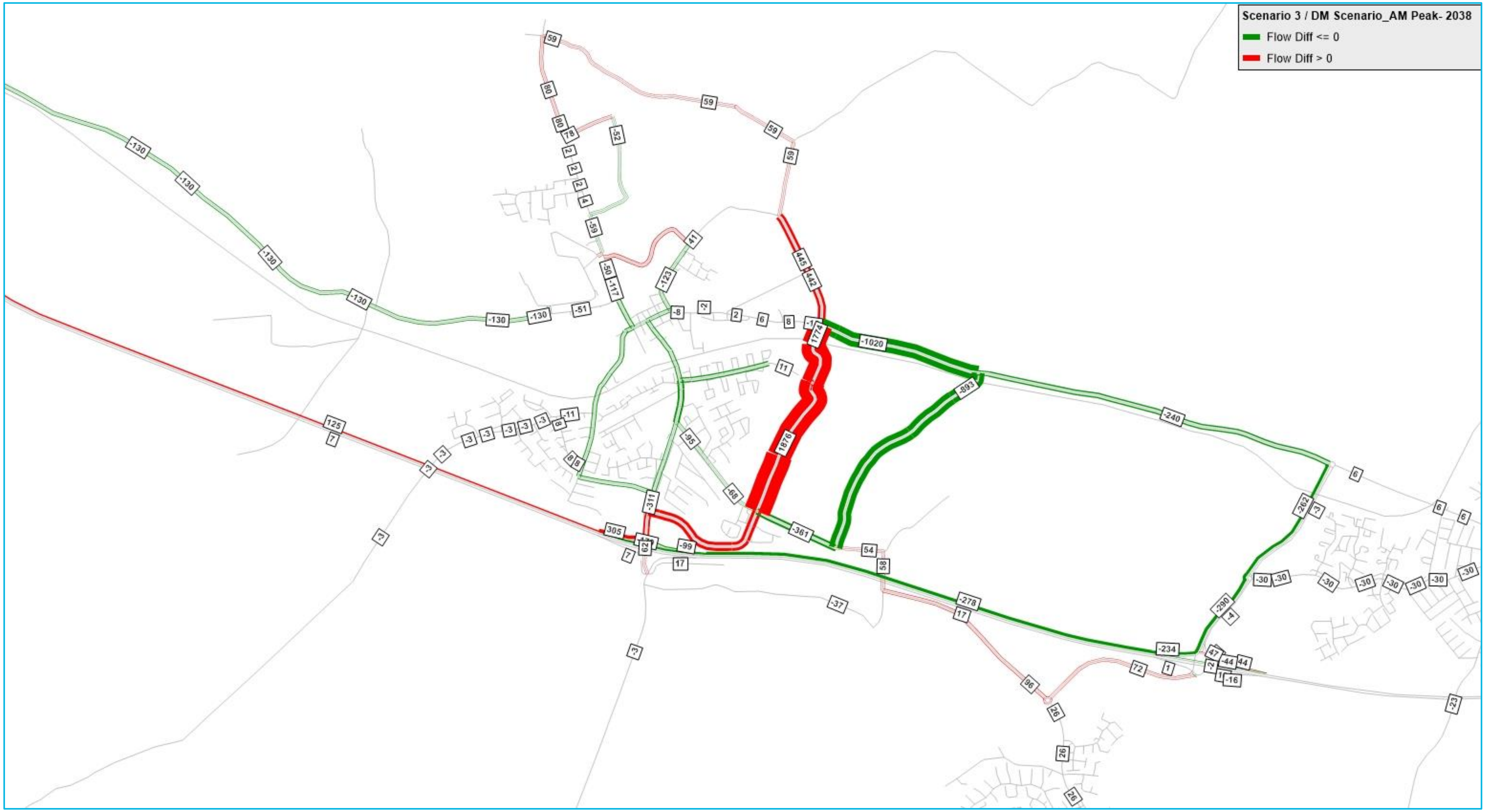

Figure 4.17 Flow Comparison (Scenario 3 Vs DM)– 2038 – AM Peak

Figure 4.18 Flow Comparison (Scenario 5 Vs DM)– 2038 – AM Peak

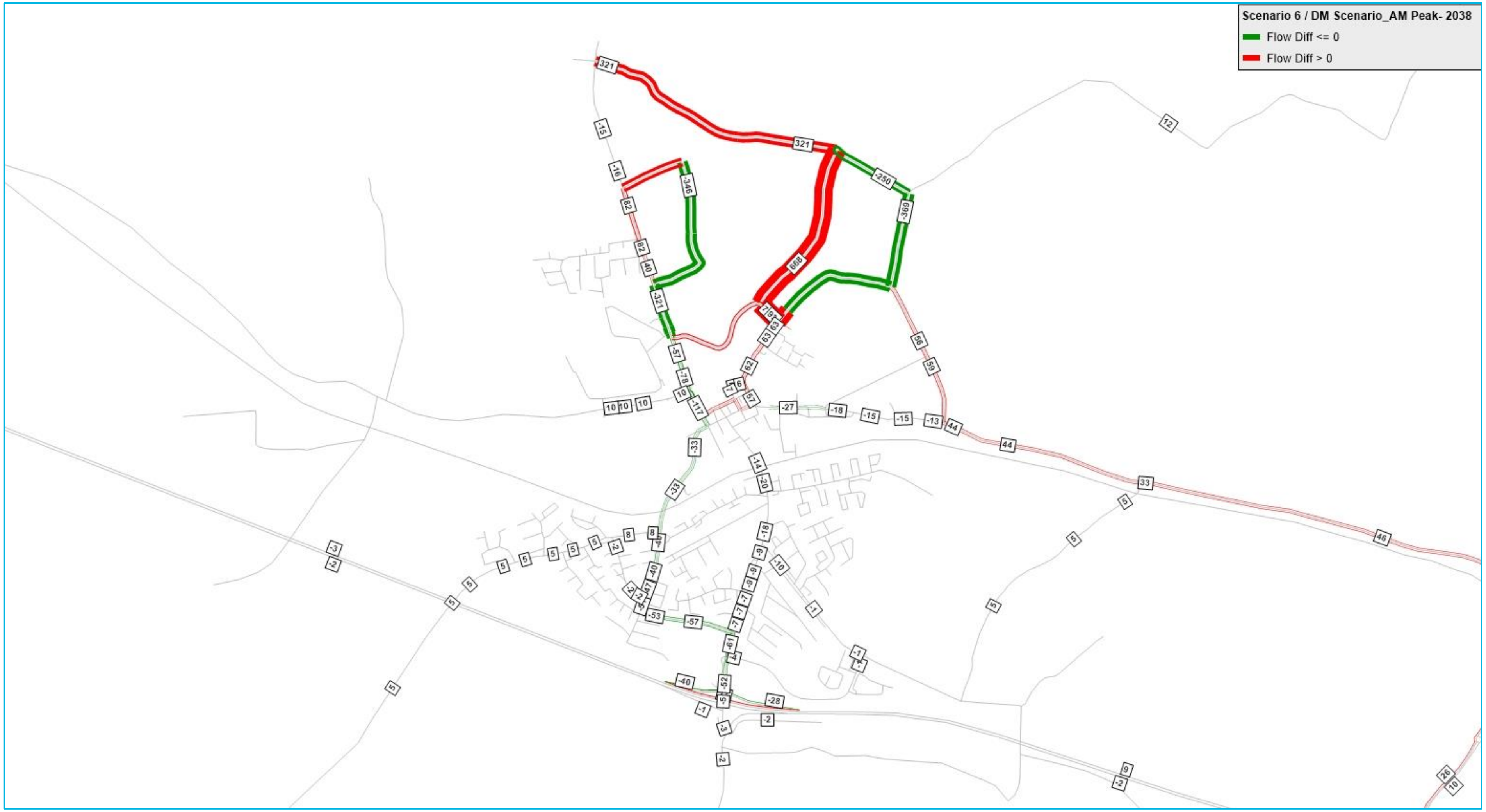

Figure 4.19 Flow Comparison (Scenario 6 Vs DM)– 2038 – AM Peak

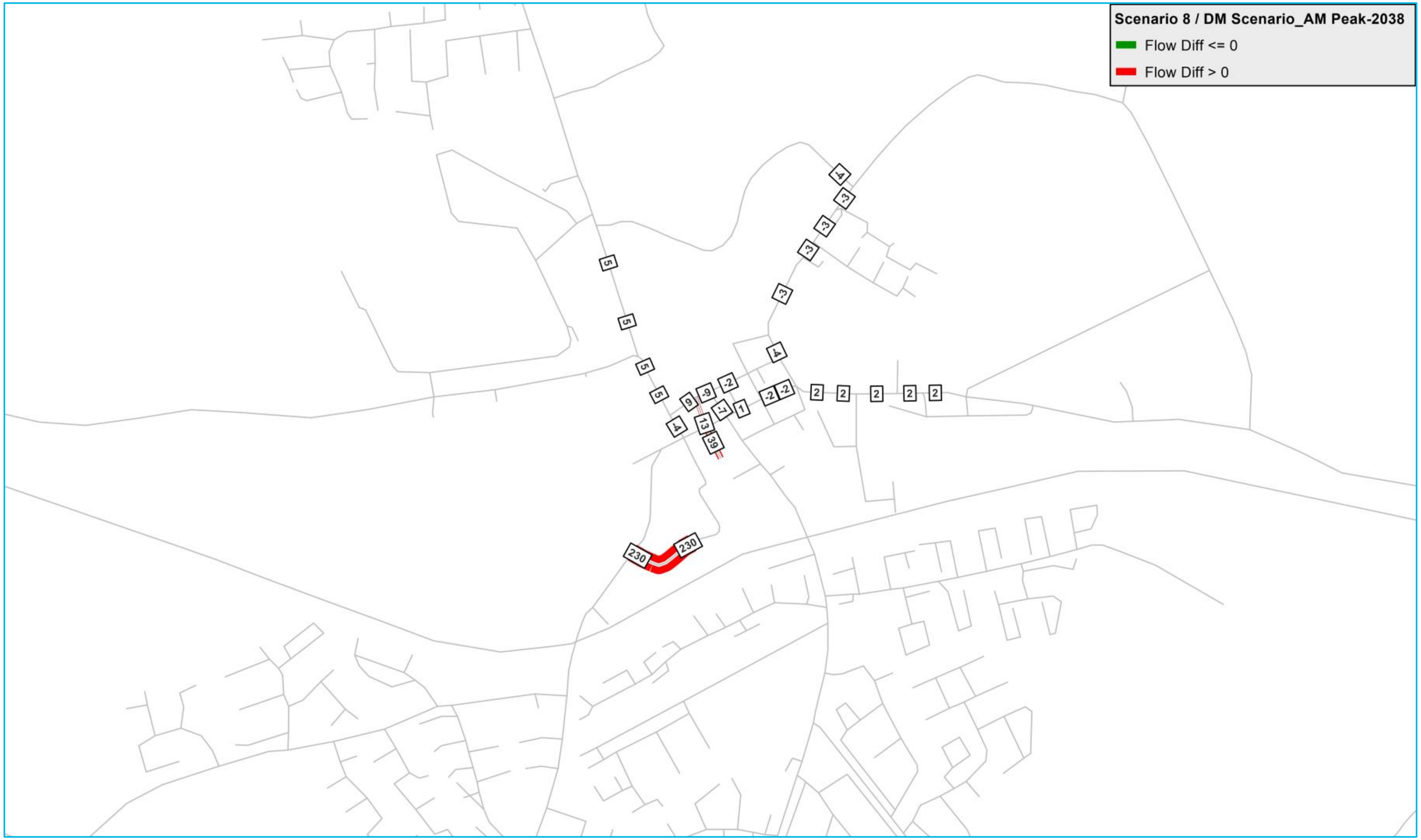

Figure 4.20 Flow Comparison (Scenario 8 Vs DM)– 2038 – AM Peak

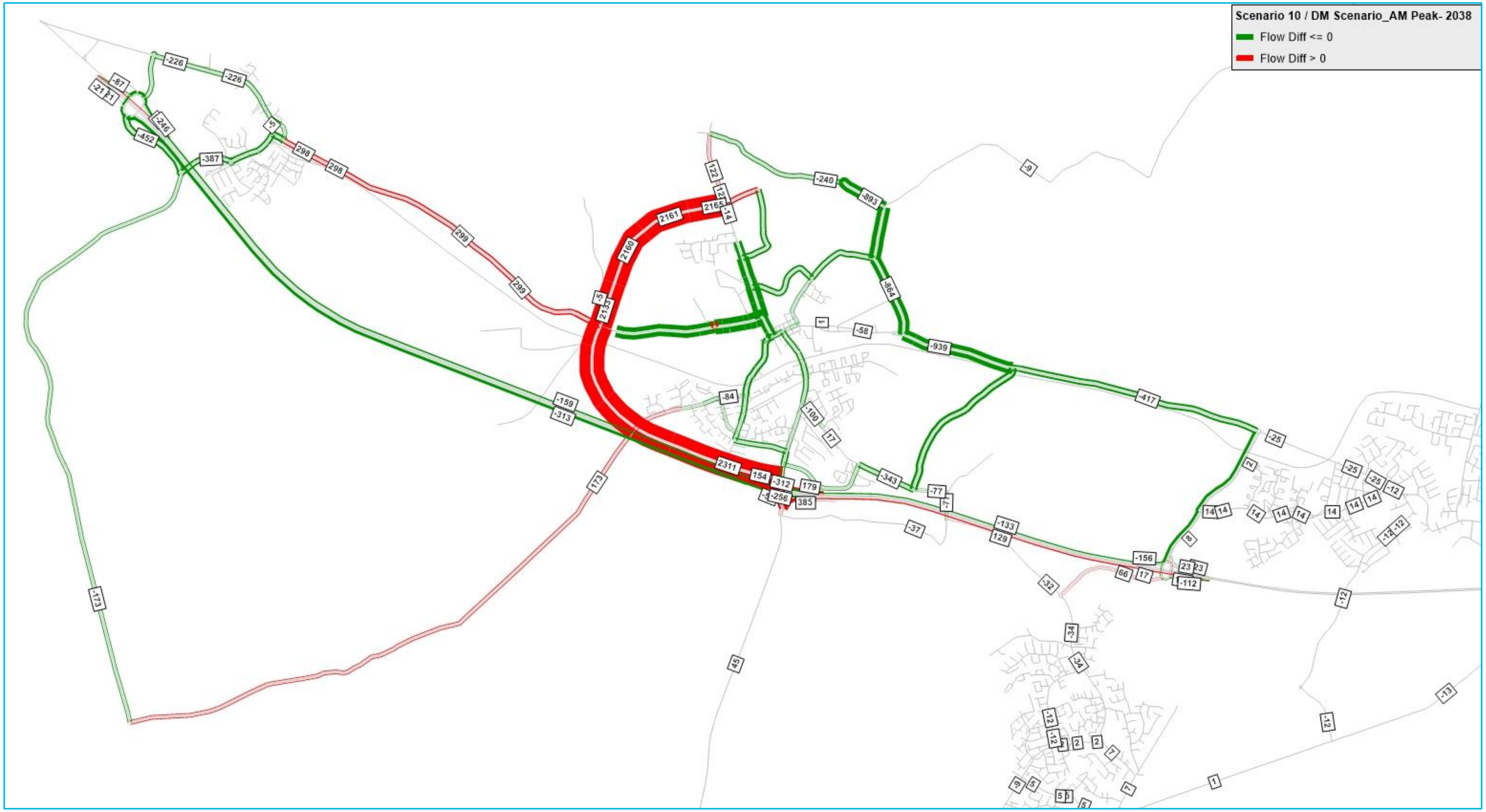

Figure 4.21 Flow comparison (Scenario 10 Vs DM)– 2038 – AM Peak

4.3.14 VISUM Network Statistics

Table 4.1 provides a summary of the network statistics for all the scenarios considered for 2038 across the AM and PM peaks. The most beneficial option presented in the network statistics is Scenario 2A as this is the only option which involves upgrading the existing M4 junction along with the MOOR, MERR and Moygaddy Link Road. The scenario results show that this scenario produces a reduction in vehicle distance and delay, with a slight increase in average network speed.

Compared to Scenario 2A, Scenario 2B (with new M4 Junction in place with MOOR, MERR and Moygaddy Link Road), results in a small decrease in vehicle kilometres but there has been a slight increase in vehicular delay resulting in a slight decrease in average network speeds.

Combined Option 1 shows the best results after Scenarios 2A and 2B. For all of the remaining options, the average network speeds are far less when compared to Scenario 2A/2B and Combined Option 1.

Table 4.2 provides a summary of analysis showing the percentage two-way reduction in traffic flow on Mill Street (shopping centre), Straffan Road (Square), Parsons St (Garda station) and Main Street (AIB) for different options. Generally, traffic flows reduce across all options in comparison with the Do Minimum scenario. The analysis shows similar pattern with Scenario 2A and Scenario 2B shows the best results.

Table 4.1 Network Statistics for the DM and DS Scenarios in 2038

SNo:	Model	Scenario name	Total Network Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
AM Peak					
1	Do-Minimum	Do Minimum Network	187,636	4,457	42.10
2	Scenario 1A	Maynooth Outer Orbital Road (MOOR): Straffan Road to Rathcoffey Road	186,760	4,439	42.07
3	Scenario 1B	MOOR: Rathcoffey Road-Kilcock Road	186,620	4,291	43.49
4	Scenario 1C	MOOR: Kilcock Road-Moyglare Road	184,455	4,132	44.64
5	Combined Option 1	Full MOOR Route	182,627	3,707	49.27
6	Scenario 2A	Upgrade Existing M4 Junction (With MOOR, Moygaddy link and MERR in place)	179,919	3,524	51.05
7	Scenario 2B	Provide one new M4 junction and convert existing M4 junction to an overbridge (With MOOR, Moygaddy link and MERR in place)	179,844	3,560	50.51
8	Scenario 2A_Alt 1	Existing M4 Junction Upgrade (No MOOR, No Moygaddy orbital)	185,756	4,243	43.77
9	Scenario 2A_Alt 2	Existing M4 Junction Upgrade (No MOOR, No Moygaddy orbital, No MERR, only DM network)	187,619	4,454	42.13
10	Scenario 3	Maynooth Eastern Ring Road (MERR)	185,745	4,248	43.73
11	Scenario 5	North-Eastern MOOR to Moygaddy	186,671	4,330	43.11

SNo:	Model	Scenario name	Total Network Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
12	Scenario 6	Moygaddy Radial Link and Local Road Upgrades	188,230	4,338	43.39
13	Scenario 8	New Southern Access to Leinster Street from Parsons Street	187,665	4,459	42.09
14	Scenario 10	Close Eastern Maynooth University Entrance to Motor Vehicle Traffic (with 1A-1C in place as alternative route)	183,074	3,722	49.18
PM Peak					
1	Do-Minimum	Do Minimum Network	196,980	4,619	42.64
2	Scenario 1A	Maynooth Outer Orbital Road (MOOR): Straffan Road to Rathcoffey Road	195,457	4,600	42.49
3	Scenario 1B	MOOR: Rathcoffey Road-Kilcock Road	195,903	4,440	44.12
4	Scenario 1C	MOOR: Kilcock Road-Moyglare Road	195,570	4,409	44.36
5	Combined Option 1	Full MOOR Route	192,642	4,039	47.69
6	Scenario 2A	Upgrade Existing M4 Junction (With MOOR, Moygaddy link and MERR in place)	190,242	3,857	49.33
7	Scenario 2B	Provide one new M4 junction and convert existing M4 junction to an overbridge (With MOOR, Moygaddy link and MERR in place)	191,263	3,914	48.87
8	Scenario - 2A_Alt 1	Existing M4 Junction Upgrade (No MOOR, No Moygaddy orbital)	195,889	4,414	44.38
9	Scenario 2A_Alt 2	Existing M4 Junction Upgrade (No MOOR, No Moygaddy orbital, No MERR, only DM network)	196,944	4,614	42.68

SNo:	Model	Scenario name	Total Network Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
10	Scenario 3	Maynooth Eastern Ring Road (MERR)	195,887	4,418	44.34
11	Scenario 5	North-Eastern MOOR to Moygaddy	196,335	4,559	43.07
12	Scenario 6	Moygaddy Radial Link and Local Road Upgrades	197,178	4,545	43.38
13	Scenario 8	New Southern Access to Leinster Street from Parsons Street	196,997	4,621	42.63
14	Scenario 10	Close Eastern Maynooth University Entrance to Motor Vehicle Traffic (with 1A-1C in place as alternative route)	193,127	4,054	47.64

Table 4.2 Percentage Reduction in Traffic flow in DS Scenarios in 2038

SNo:	Model	Scenario name	Mill Street	Straffan road	Parsons Street	Main Street
AM Peak						
1	Scenario 1A	Maynooth Outer Orbital Road (MOOR): Straffan Road to Rathcoffey Road	0.2%	-0.4%	-0.2%	-1.1%
2	Scenario 1B	MOOR: Rathcoffey Road-Kilcock Road	-23.4%	-15.7%	-22.0%	-14.3%
3	Scenario 1C	MOOR: Kilcock Road-Moyglare Road	-0.4%	-2.7%	0.9%	-7.7%
4	Combined Option 1	Full MOOR Route	-57.9%	-37.9%	-55.8%	-30.9%
5	Scenario 2A	Upgrade Existing M4 Junction (With MOOR, Moygaddy link and MERR in place)	-62.3%	-54.5%	-65.4%	-43.5%

SNo:	Model	Scenario name	Mill Street	Straffan road	Parsons Street	Main Street
6	Scenario 2B	Provide one new M4 junction and convert existing M4 junction to an overbridge (With MOOR, Moygaddy link and MERR in place)	-60.3%	-55.8%	-68.9%	-47.3%
7	Scenario 2A_Alt 1	Existing M4 Junction Upgrade (No MOOR, No Moygaddy orbital)	-13.5%	-19.3%	-20.0%	-6.9%
8	Scenario 2A_Alt 2	Existing M4 Junction Upgrade (No MOOR, No Moygaddy orbital, No MERR, only DM network)	0.0%	0.0%	0.1%	0.1%
9	Scenario 3	Maynooth Eastern Ring Road (MERR)	-13.5%	-19.3%	-20.0%	-6.9%
10	Scenario 5	North-Eastern MOOR to Moygaddy	-10.9%	-1.9%	-5.9%	1.7%
11	Scenario 6	Moygaddy Radial Link and Local Road Upgrades	-8.4%	-1.2%	-4.0%	-2.5%
12	Scenario 8	New Southern Access to Leinster Street from Parsons Street	0.3%	0.0%	-0.1%	-1.0%
13	Scenario 10	Close Eastern Maynooth University Entrance to Motor Vehicle Traffic (with 1A-1C in place as alternative route)	-56.3%	-38.9%	-54.8%	-29.4%
PM Peak						
1	Scenario 1A	Maynooth Outer Orbital Road (MOOR): Straffan Road to Rathcoffey Road	0.4%	-0.4%	-0.6%	-0.8%
2	Scenario 1B	MOOR: Rathcoffey Road-Kilcock Road	-29.9%	-10.6%	-28.7%	-5.6%
3	Scenario 1C	MOOR: Kilcock Road-Moyglare Road	0.0%	-2.8%	-5.5%	2.1%
4	Combined Option 1	Full MOOR Route	-51.2%	-27.9%	-47.6%	-13.4%

SNo:	Model	Scenario name	Mill Street	Straffan road	Parsons Street	Main Street
5	Scenario 2A	Upgrade Existing M4 Junction (With MOOR, Moygaddy link and MERR in place)	-57.1%	-40.8%	-54.1%	-23.2%
6	Scenario 2B	Provide one new M4 junction and convert existing M4 junction to an overbridge (With MOOR, Moygaddy link and MERR in place)	-48.3%	-43.0%	-64.9%	-33.5%
7	Scenario - 2A_Alt 1	Existing M4 Junction Upgrade (No MOOR, No Moygaddy orbital)	-12.7%	-16.1%	-16.2%	-6.2%
8	Scenario 2A_Alt 2	Existing M4 Junction Upgrade (No MOOR, No Moygaddy orbital, No MERR, only DM network)	0.2%	0.0%	0.1%	0.2%
9	Scenario 3	Maynooth Eastern Ring Road (MERR)	-12.9%	-16.1%	-16.5%	-6.3%
10	Scenario 5	North-Eastern MOOR to Moygaddy	-2.5%	-0.6%	-3.1%	-0.9%
11	Scenario 6	Moygaddy Radial Link and Local Road Upgrades	-5.9%	-1.6%	-2.6%	-1.2%
12	Scenario 8	New Southern Access to Leinster Street from Parsons Street	0.2%	0.1%	-0.6%	5.4%
13	Scenario 10	Close Eastern Maynooth University Entrance to Motor Vehicle Traffic (with 1A-1C in place as alternative route)	-48.3%	-28.4%	-47.0%	-9.9%

5 Impact of Combined Road Strategy Scenario

5.1 Combined Road Strategy Scenario - 2028

After considering the impacts of Options and Scenarios tested, a combined road strategy scenario has been recommended. For the forecast year (FY) 2028, the combined road strategy consists of the following options:

- Option 2: Existing M4 junction upgrade with no MOOR
- Option 3: MERR
- Option 5: North-Eastern Orbital Linking Moygaddy with Maynooth
- Option 10: Southern Access to Leinster Street

The measures which form the combined strategy for 2028 FY are shown visually in Figure 5.1.

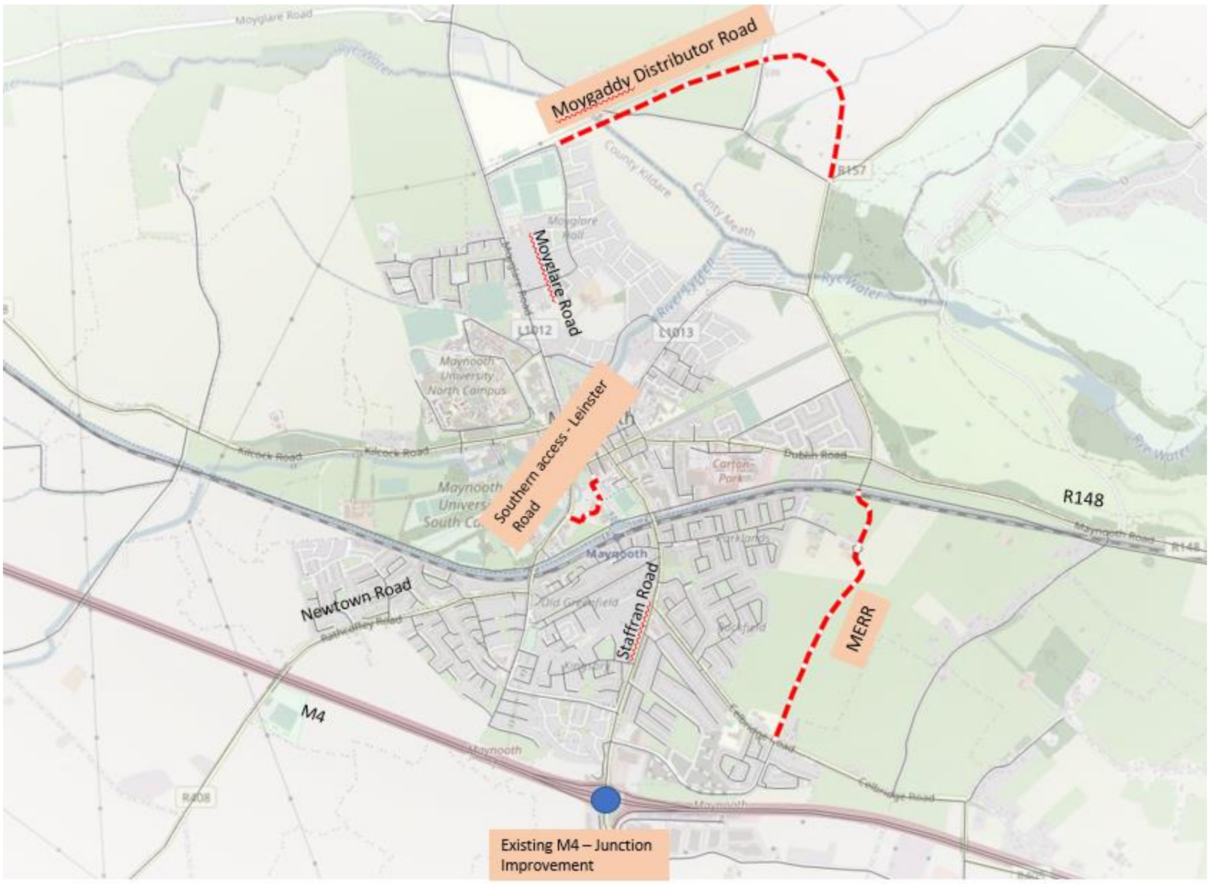

Figure 5.1 Combined Road Strategy Measures - 2028

Figure 5.2 shows the Maynooth Town combined Road Strategy Measures in combination with the Do-Minimum Road Network to provide an overview of the future changes to the road network in Maynooth for FY 2028.

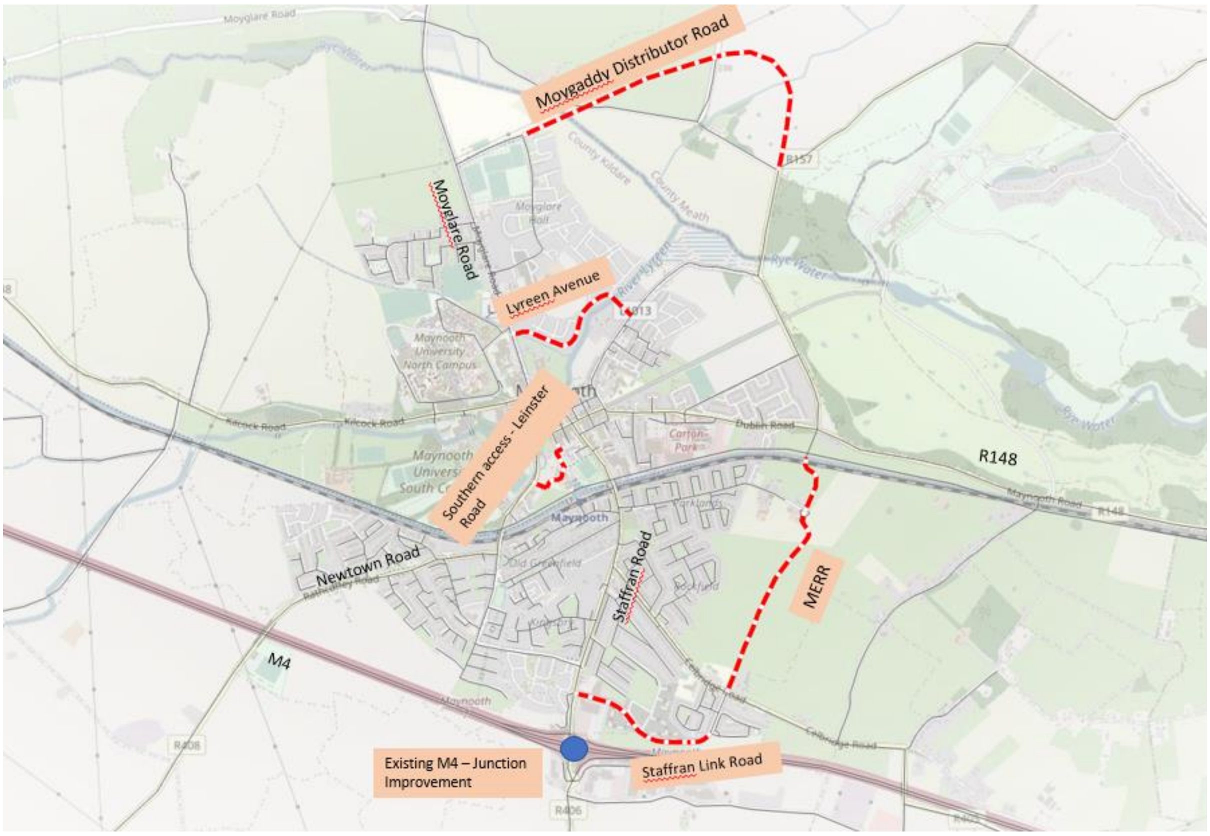

Figure 5.2 Future Road Network– Combined DM Network and Road Strategy Measures-2028

5.2 2028 VISUM Scenario

5.2.1 Network Statistics

The combined road strategy was compared against the DM 2028 scenario and the network statistics are presented in Table 5.1. It can be observed that the combined road strategy results in an increase in average vehicle speeds and a reduction in overall network delay.

Table 5.1 Network Statistics – Combined Roads Strategy - 2028

Peak	Option	Total Network Trips	Total Network Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
AM	DM- 2028	19,829	180,042	4,178	43.10
	Combined Road Strategy	19,829	176,743	3,794	46.59
PM	DM- 2028	20,849	189,608	4,385	43.24
	Combined Road Strategy	20,849	187,161	4,070	45.98

Table 5.2 below provides a summary of analysis showing percentage two-way reduction in traffic flow on Mill Street (shopping centre), Straffan Road (Square), Parsons St (Garda station) and Main Street (AIB) for the combined road strategy scenario.

Table 5.2 Percentage Reduction in Traffic Flow – Combined Roads Strategy - 2028

Peak	Option	Mill Street	Straffan road	Parsons Street	Main Street
AM	Combined Road Strategy	-28.6%	-25.4%	-31.6%	-8.7%
PM	Combined Road Strategy	-20.7%	-21.3%	-22.1%	-4.5%

5.2.2 Difference Plots

Difference plots comparing the combined roads strategy with the 2028 DM scenario are provided in Figure 5.3 for the AM peak and Figure 5.4 for the PM peak. In these plots, the red bars represent an increase in traffic, whilst the green bars represent a decrease in flow. The width of the bars indicates the magnitude of change in traffic flow.

The most notable difference is observed along two sections i.e. Moygaddy distributor Road and MERR to which the majority of the existing traffic gets reassigned.

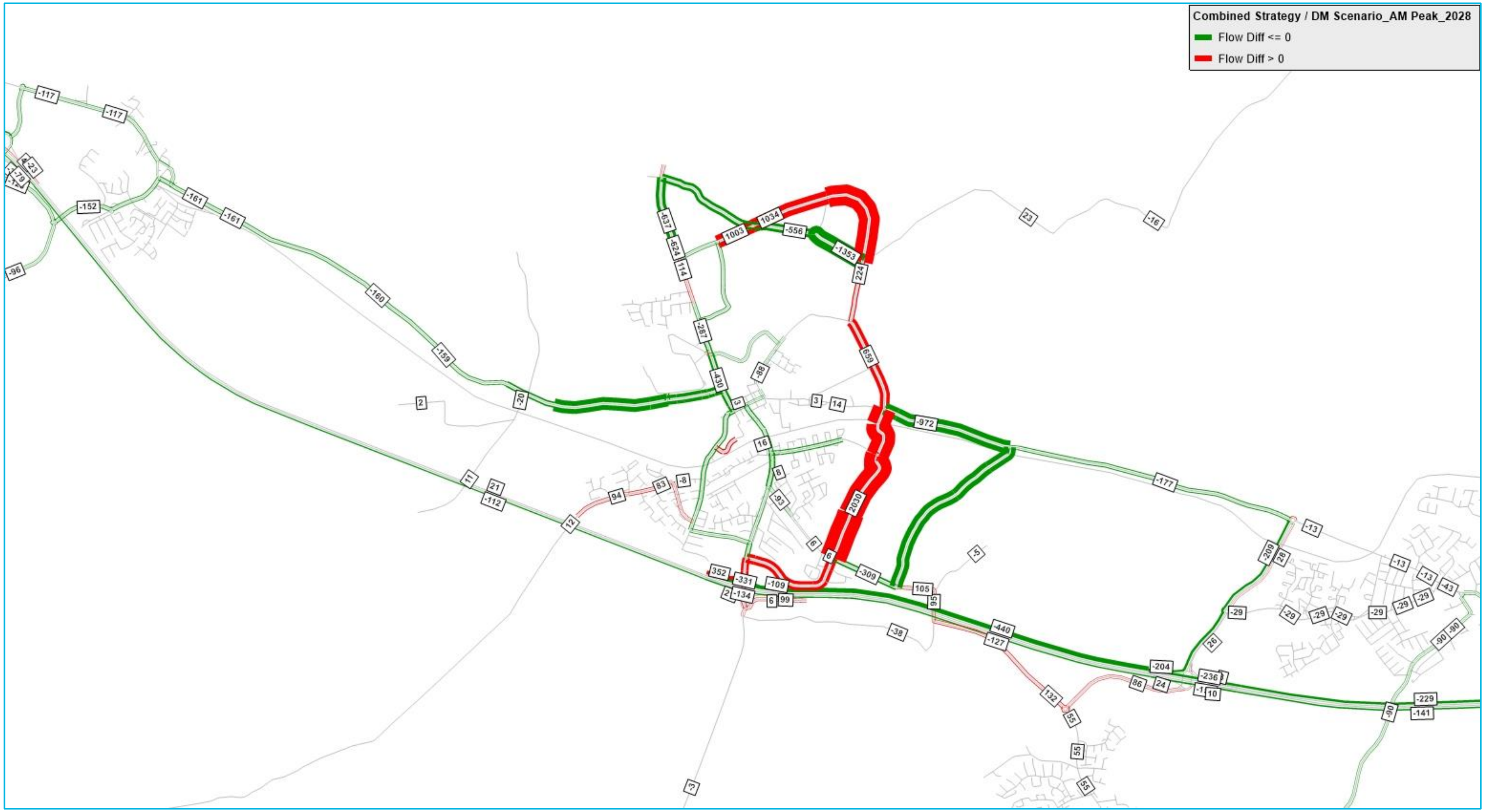

Figure 5.3 Combined Road Strategy vs DM Scenario 2028 – AM Peak

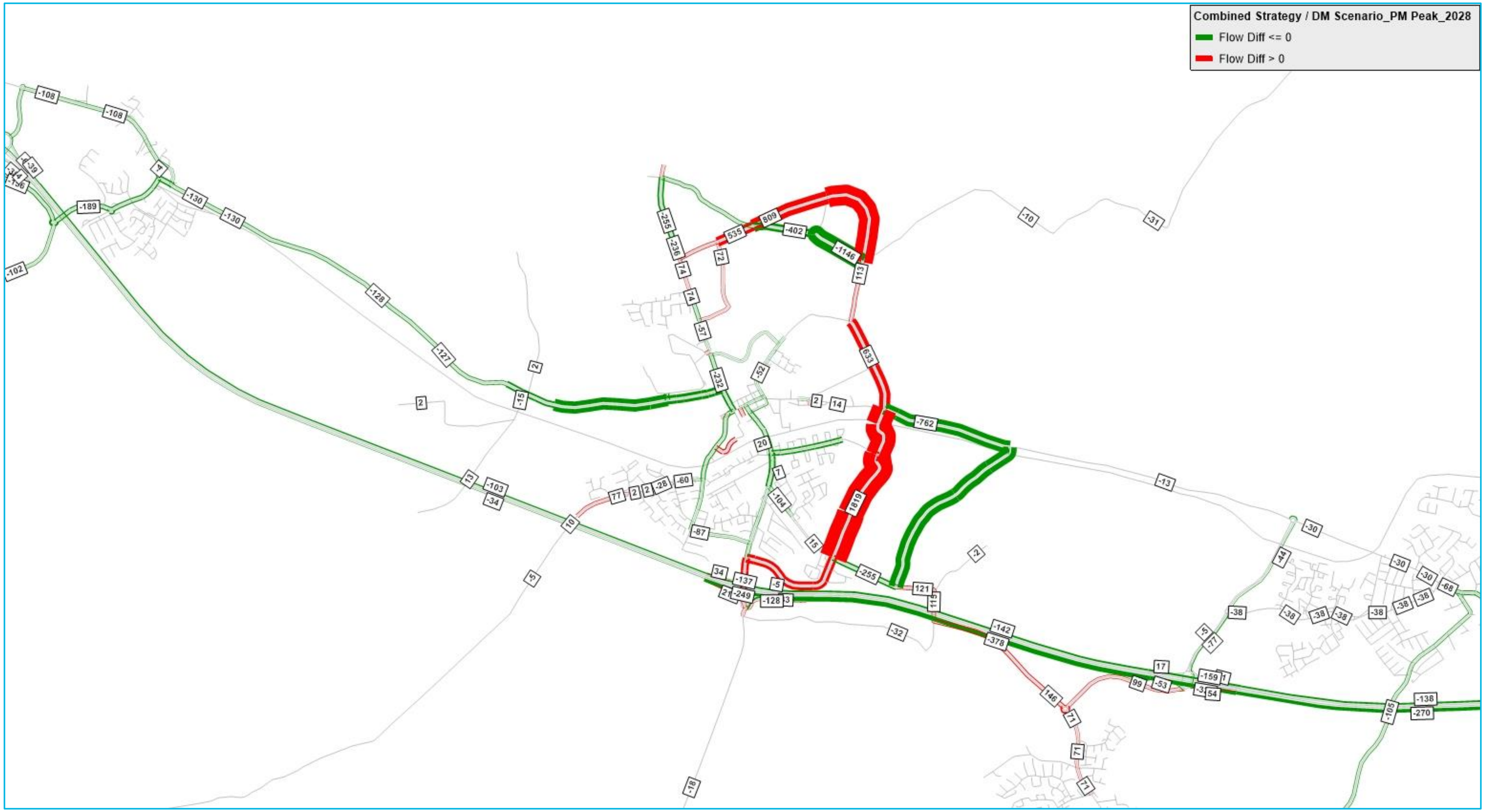

Figure 5.4 Combined Road Strategy vs DM Scenario 2028– PM Peak

5.2.3 Traffic Flow Plots

The peak hour traffic flow plots for the combined roads strategy were extracted from the VISUM model and are presented in Figure *5.5* and Figure *5.6*. In these plots, the width of the green bars indicates the magnitude of the traffic flow.

From the Figures, it can be observed that the highest east-west traffic flows are observed on M4 followed by the R418. With the introduction of the northern and eastern distributor roads the majority of the north-south bound traffic is diverted through these roads thereby reducing traffic in the Maynooth Town area.

Figure 5.5 Traffic Flow Plot Combined Road Strategy 2028 – AM Peak

Figure 5.6 Traffic Flow Plot Combined Road Strategy 2028 - PM Peak

5.2.4 Traffic Volume to Capacity Plots

The peak hour traffic volume to capacity plots were extracted for the Do minimum and the Combined Road strategy scenarios and are presented in Figure 5.7 to Figure 5.10. The modelled link level volume to capacity ratio is represented in colour bands. The introduction of road strategy measures in 2028 help in reducing congestion level in the Maynooth town centre compared to the Do minimum scenario. The M4 junction improvement also observed to be having a positive impact.

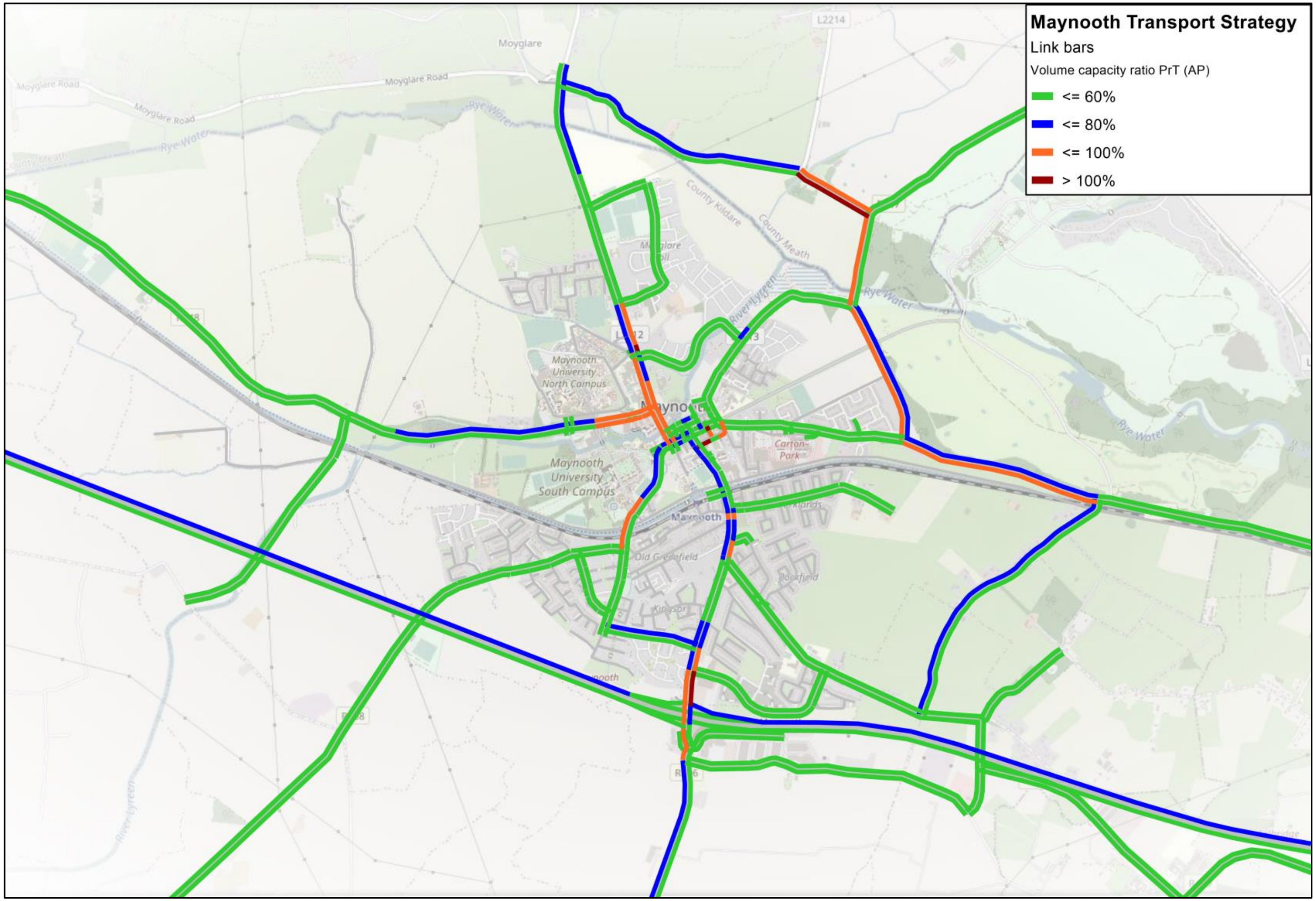

Figure 5.7 Volume to Capacity Plot Do Minimum 2028 - AM Peak

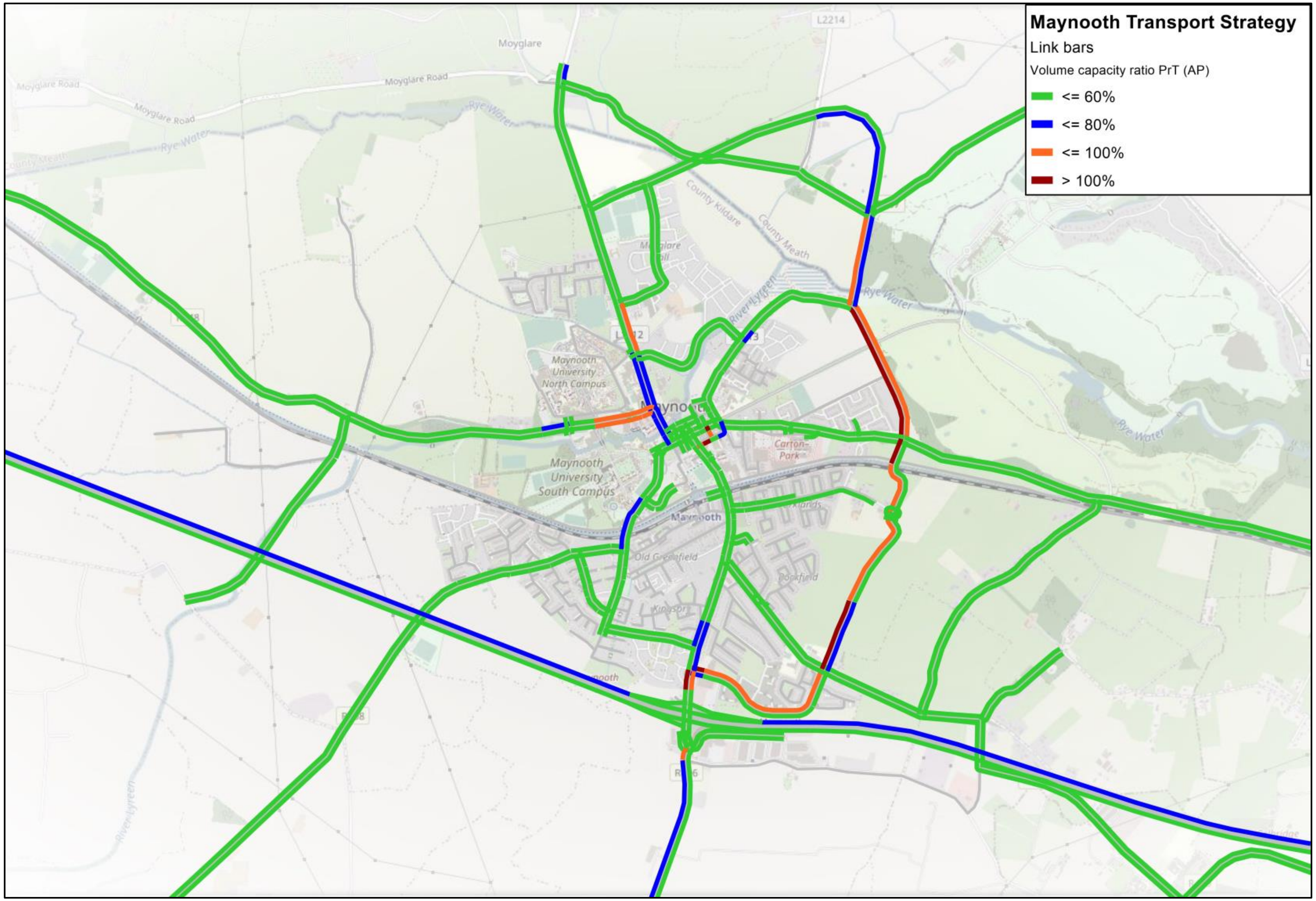

Figure 5.8 Volume to Capacity Plot Combined Road Strategy 2028 - AM Peak

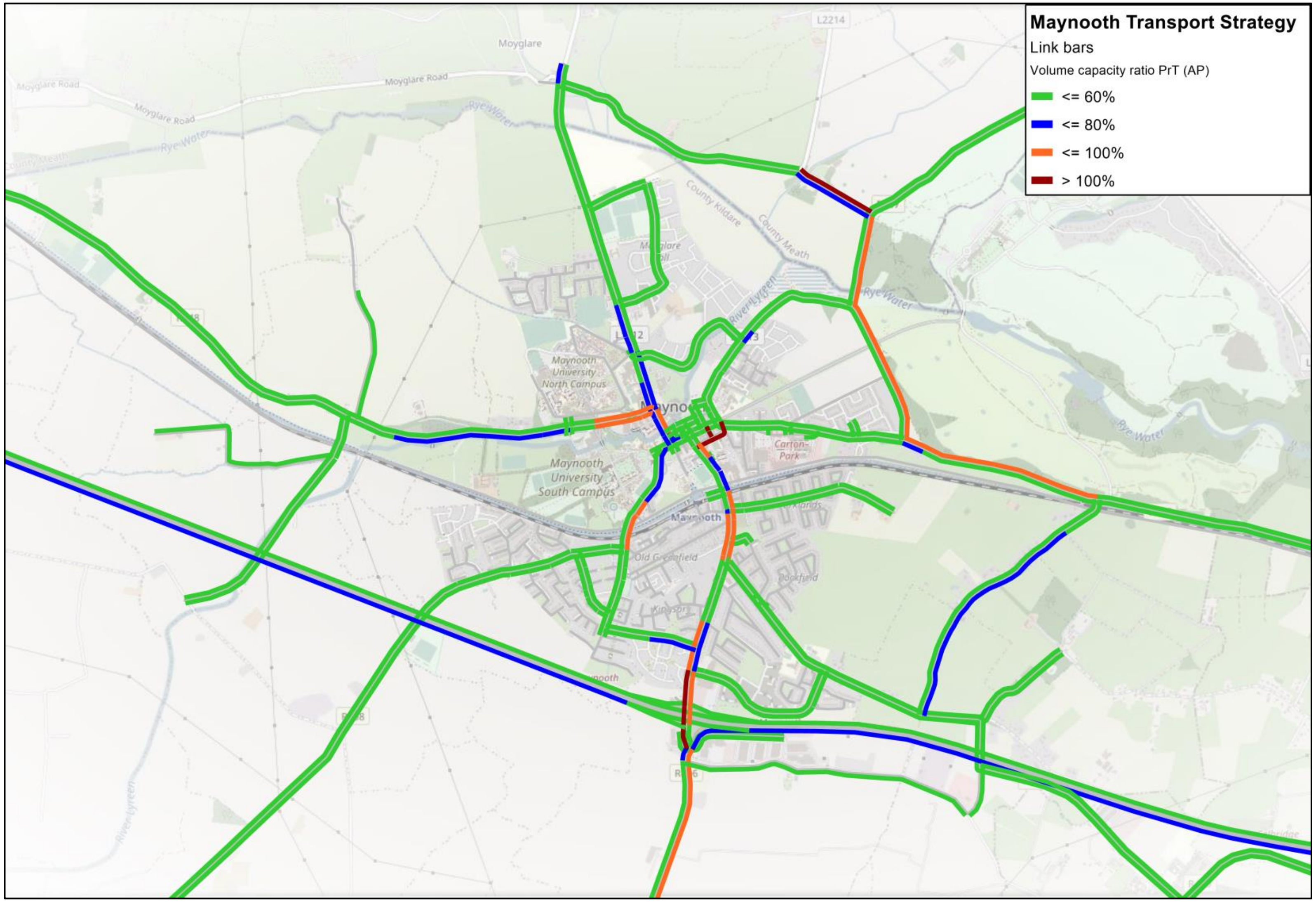

Figure 5.9 Volume to Capacity Plot Do Minimum 2028 - PM Peak

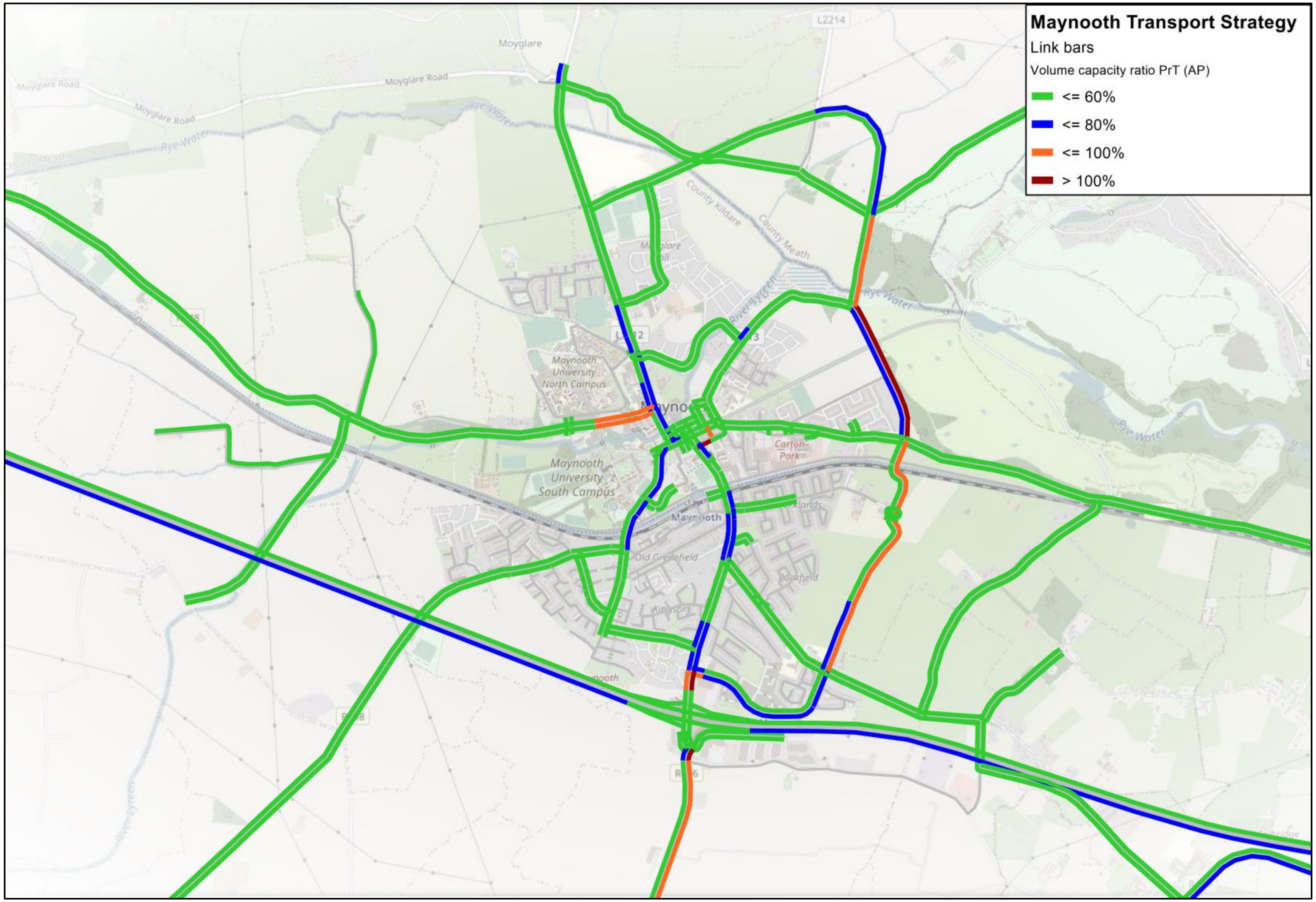

Figure 5.10 Volume to Capacity Plot Combined Road Strategy 2028 - PM Peak

5.3 Combined Road Strategy Scenario - 2038

For the forecast year 2038, the recommended combined road strategy consists of the following options:

- Option 1: MOOR sections 1A,1B and 1C
- Option 2: Existing M4 junction upgrade[2]
- Option 3: MERR
- Option 5: North-Eastern Orbital Linking Moygaddy with Maynooth
- Option 10: Southern Access to Leinster Street
- Option 12: Close Eastern NUIM Entrance

The measures which form the combined strategy for 2038 FY are shown visually in Figure 5.11.

[2] For the purposes of the MEABTA, Option 2A (upgrade of existing junction) is used as the preferred measure in the future 2038 strategy. This is the preferred junction location from a sustainable land-use-transport perspective for the MEABTA as it will allow for higher capacity flows and bus priority. Moving the junction roughly a kilometre to the west would encourage urban sprawl on a flood plain in the south-west, which the MEABTA has intentionally tried to avoid in the land-use assessment process. Leaving the junction in its existing location reduces the potential for urban sprawl and allows the junction to be integrated into the public transport network and the negative impacts on active travel to be mitigated for where possible. From a policy perspective, there is no 'preferred junction' location in Maynooth, but for the purpose of the MEABTA which has a very local scope, Option 2A is used to show the impact of greater junction capacity in the future and how growth will be accommodated. Which junction location is actually used in reality, will be determined by a separate study at a later date.

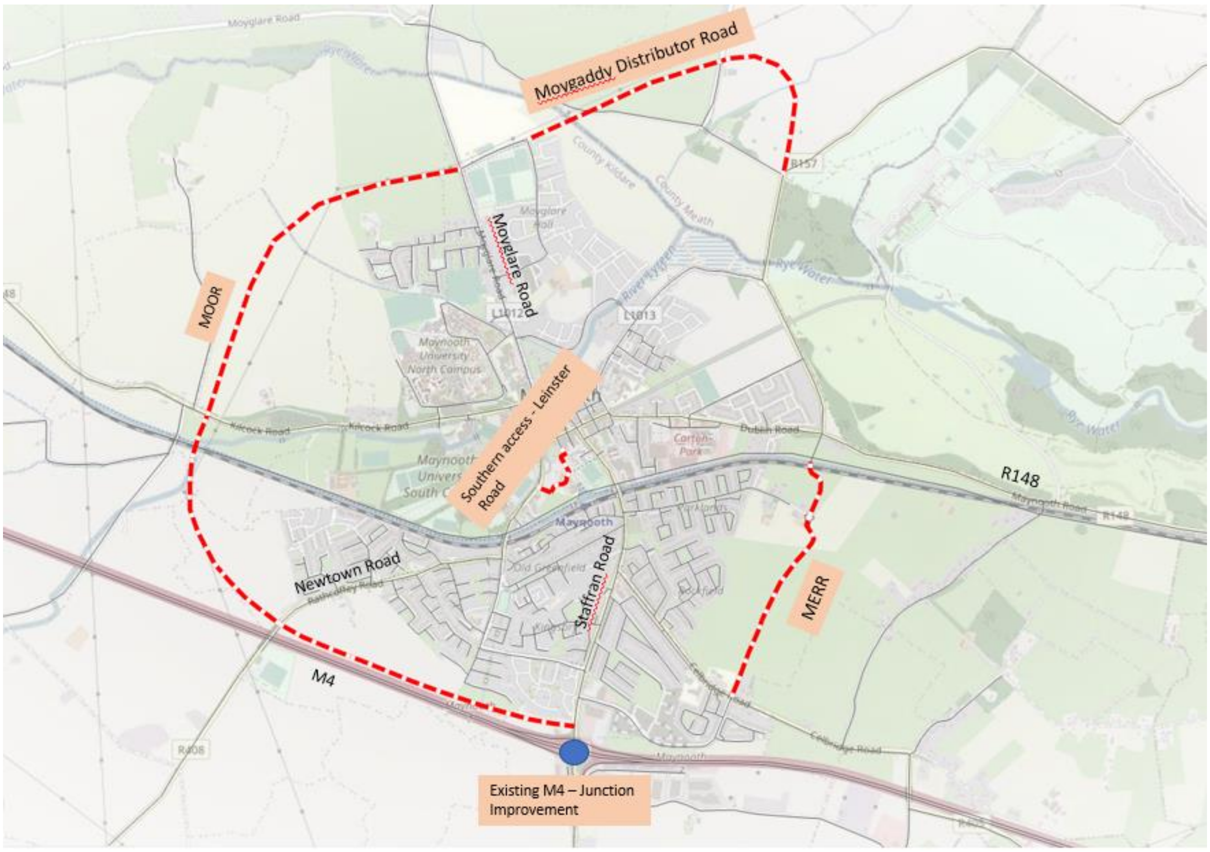

Figure 5.11 Road Strategy Measures- 2038

Figure *5.12* shows the Maynooth Town Road Strategy Measures in combination with the Do-Minimum Road Network to provide an overview of the future changes to the road network in the study area.

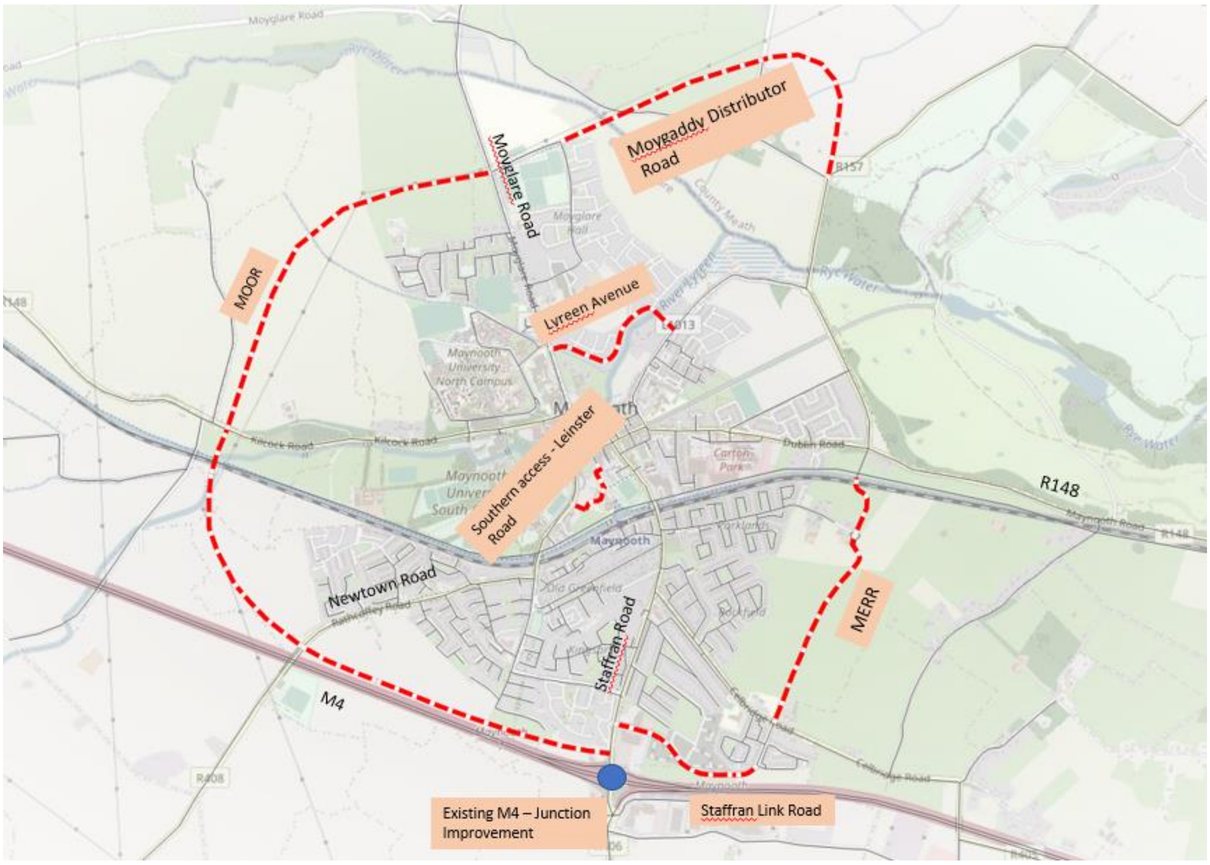

Figure 5.12 Future Road Network– Combined DM Network and Road Strategy Measures-2038

5.4 2038 VISUM Scenario

5.4.1 Network Statistics

The combined road strategy was compared against the DM 2038 scenario and the network statistics are presented in Table 5.3. It can be observed that the combined road strategy results in significantly higher average vehicle speeds and a reduction in overall network delay.

Table 5.3 Network Statistics – Combined Roads Strategy – 2038

Peak	Option	Total Network Trips	Total Network Vehicle km	Total Network Travel Time (hrs)	Average Network Vehicle Speed (kph)
AM	DM- 2038	20,225	187,636	4,457	42.10
	Combined Road Strategy	20,225	180,536	3,545	50.92
PM	DM- 2038	21,069	196,980	4,619	42.64
	Combined Road Strategy	21,069	190,802	3,875	49.23

Table 5.4 below provides a summary of analysis showing percentage two-way reduction in traffic flow on Mill Street (shopping centre), Straffan Road (Square), Parsons St (Garda station) and Main Street (AIB) for the combined road strategy scenario.

Table 5.4 Percentage Reduction in Traffic Flow – Combined Roads Strategy - 2038

Peak	Option	Mill Street	Straffan road	Parsons Street	Main Street
AM	Combined Road Strategy	-59.7%	-54.9%	-63.9%	-40.7%
PM	Combined Road Strategy	-53.8%	-40.6%	-52.7%	-14.8%

5.4.2 Difference Plots

Difference plots comparing the combined roads strategy with the 2038 DM scenario are provided in Figure 5.13Figure *5.13* for the AM peak and Figure 5.14 for the PM peak. Traffic flow has reduced significantly on the internal roads of Maynooth town with the introduction of the MOOR, Northern Moygaddy Orbital Road and MERR. In the east of the town, a significant volume of traffic has diverted onto the MERR thereby reducing traffic on adjacent roads and the R148.

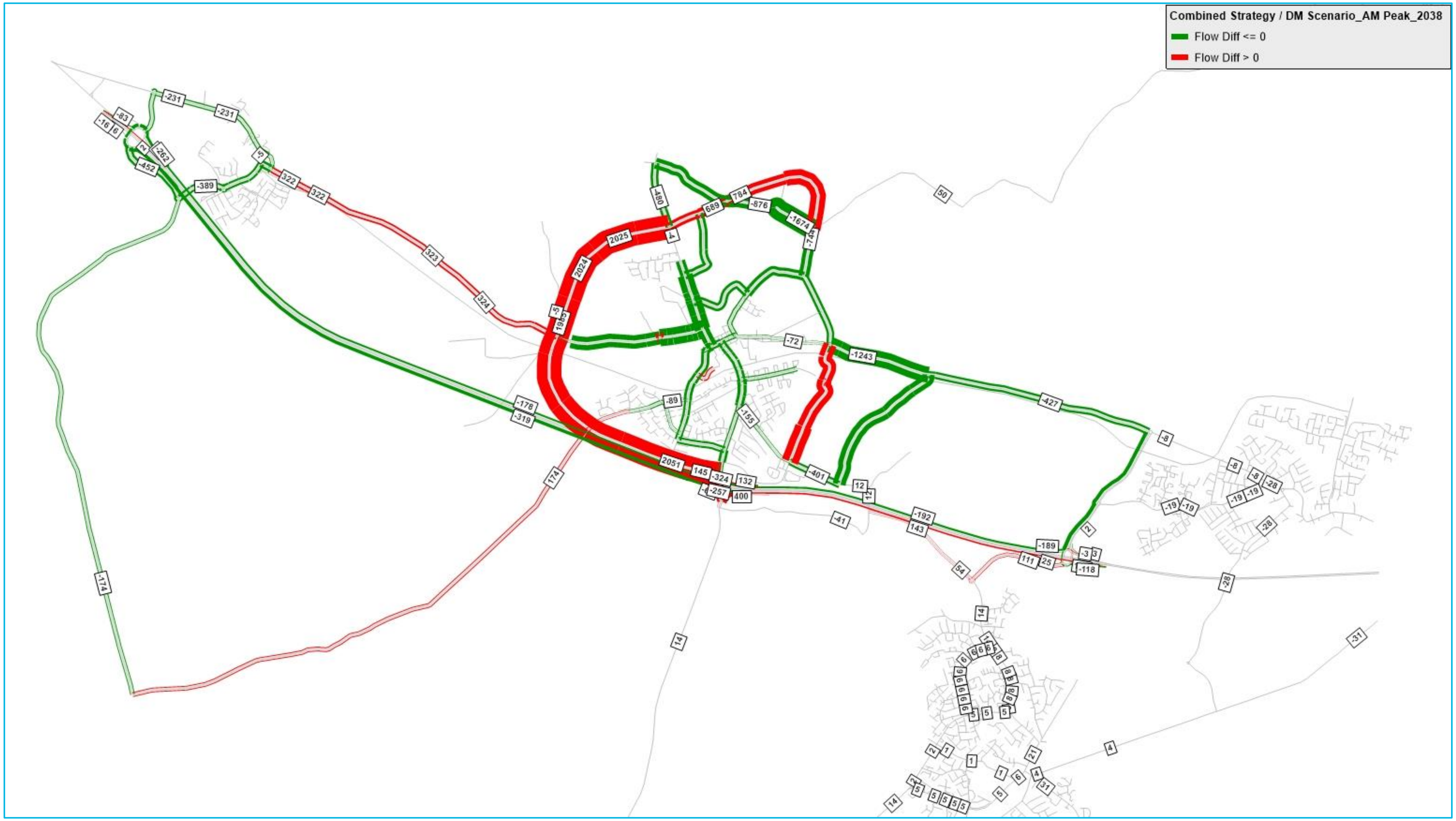

Figure 5.13 Flow comparison (Combined Road Strategy Vs DM)– 2038 – AM Peak

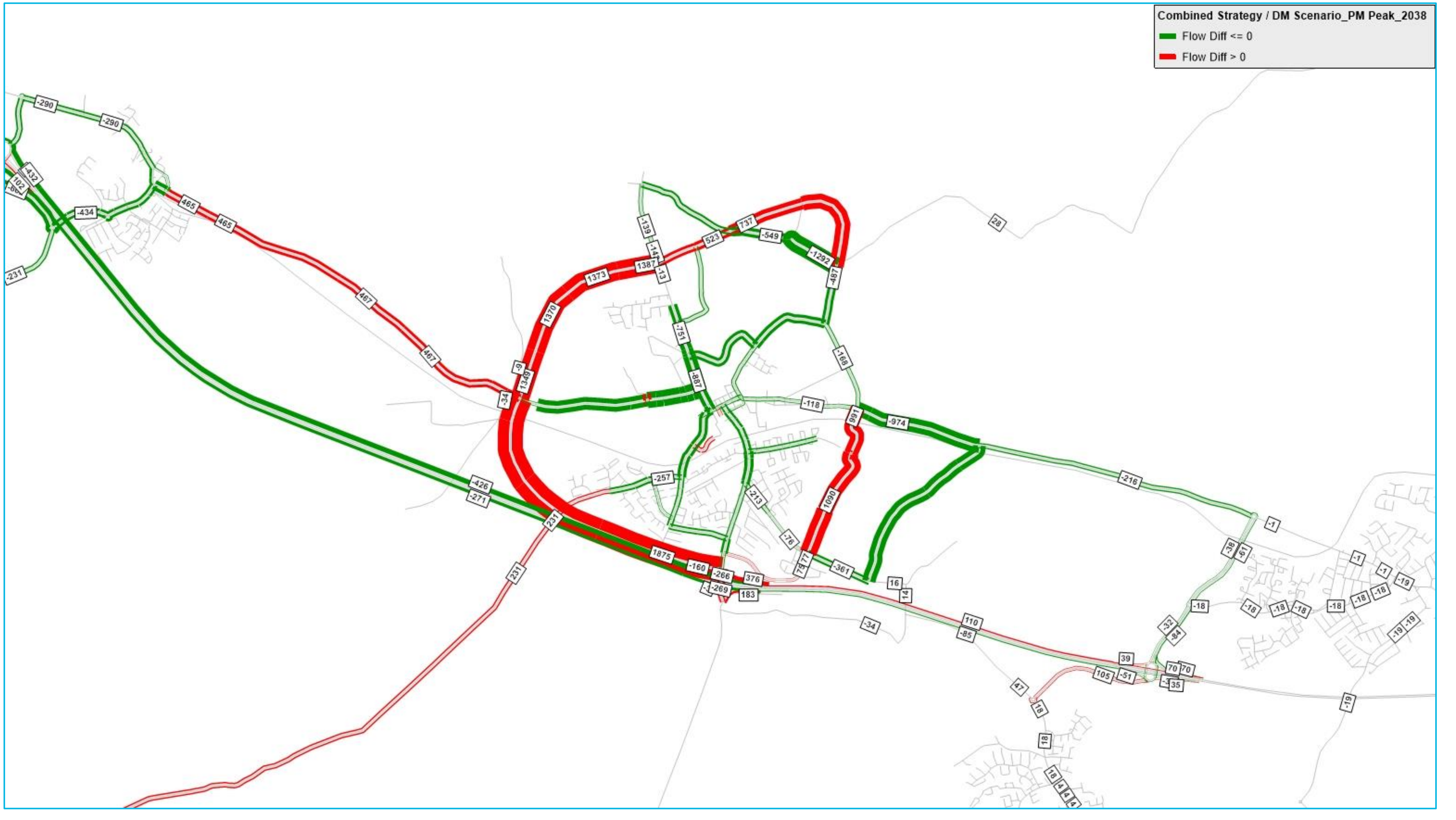

Figure 5.14 Flow comparison (Combined Road Strategy Vs DM)– 2038 – PM Peak

5.4.3 Traffic Flow Plots

Traffic flow plots presenting the traffic flow for the combined roads strategy for the 2038 DS scenario are provided in Figure *5.15* for the AM peak and Figure *5.16* for the PM peak. The figures show a similar theme to 2028 in some respects. The addition of the MOOR has created another north-south route to the west of the town in combination with the southern access to Leinster Street. The majority of the traffic is using the orbital roads to reach the other sides of town.

Figure 5.15 Traffic Flow Plot Combined Road Strategy 2038 - AM Peak

Figure 5.16 Traffic Flow Plot Combined Road Strategy 2038 – PM Peak

5.4.4 Traffic Volume to Capacity Plots

The peak hour traffic volume to capacity plots were extracted for the Do minimum and the Combined Road strategy scenarios and are presented in Figure *5.17* to Figure *5.20*. The modelled link level volume to capacity ratio is represented in colour bands. The introduction of road strategy measures in 2038 significantly improve the congestion level in the Maynooth town centre compared to the Do minimum scenario. The M4 junction improvement also observed to be having a positive impact.

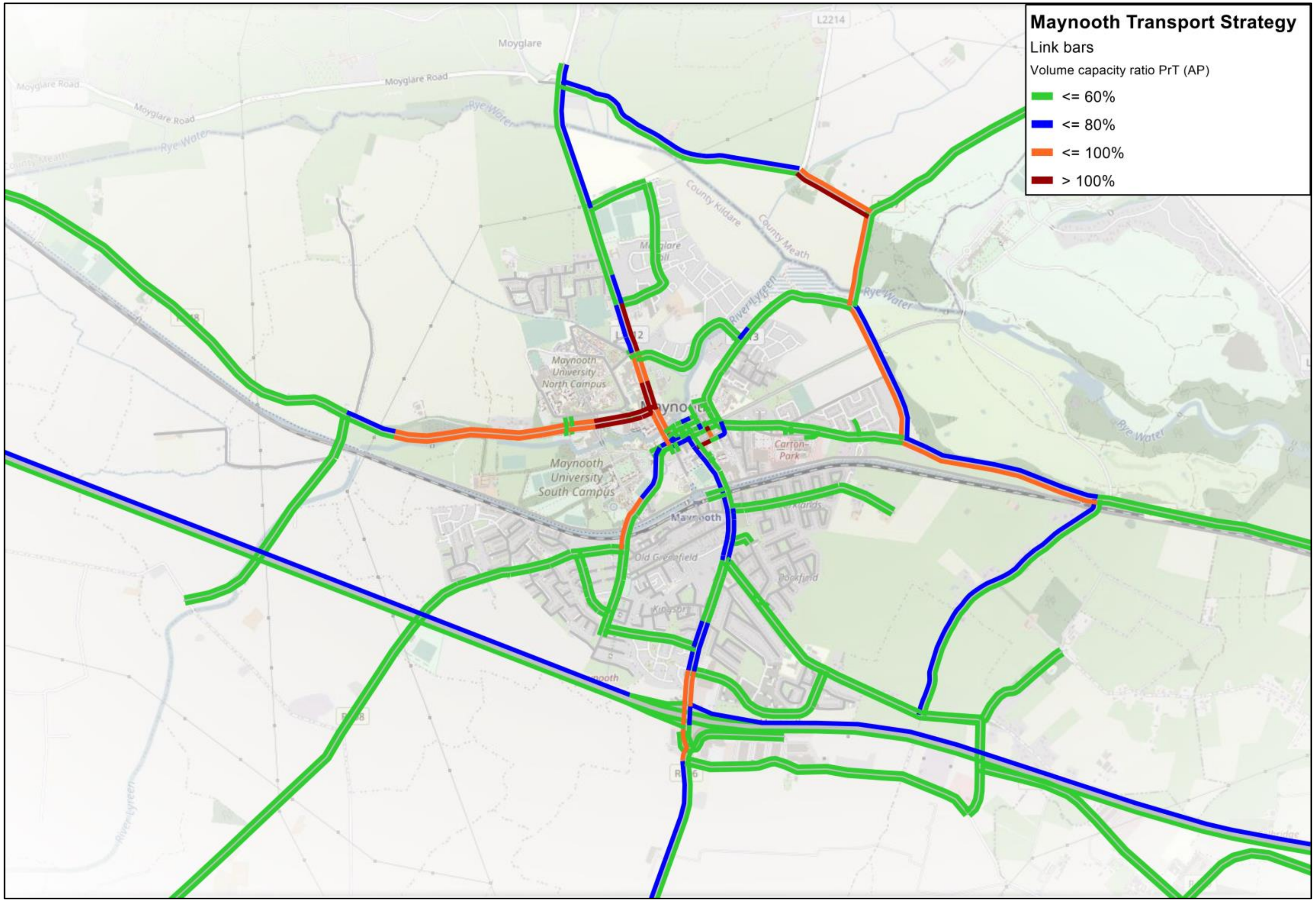

Figure 5.17 Volume to Capacity Plot Do Minimum 2038 - AM Peak

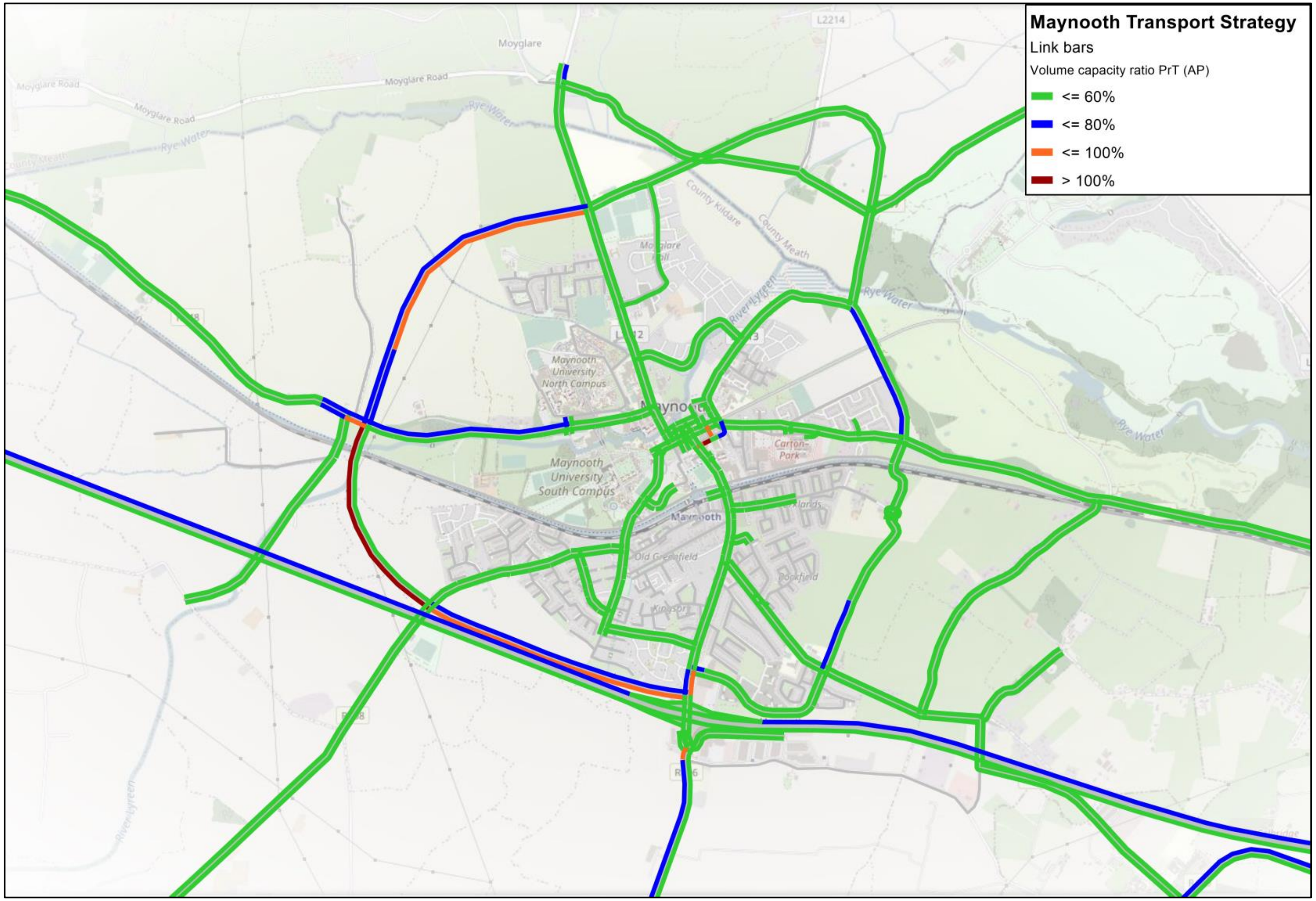

Figure 5.18 Volume to Capacity Plot Combined Road Strategy 2038 - AM Peak

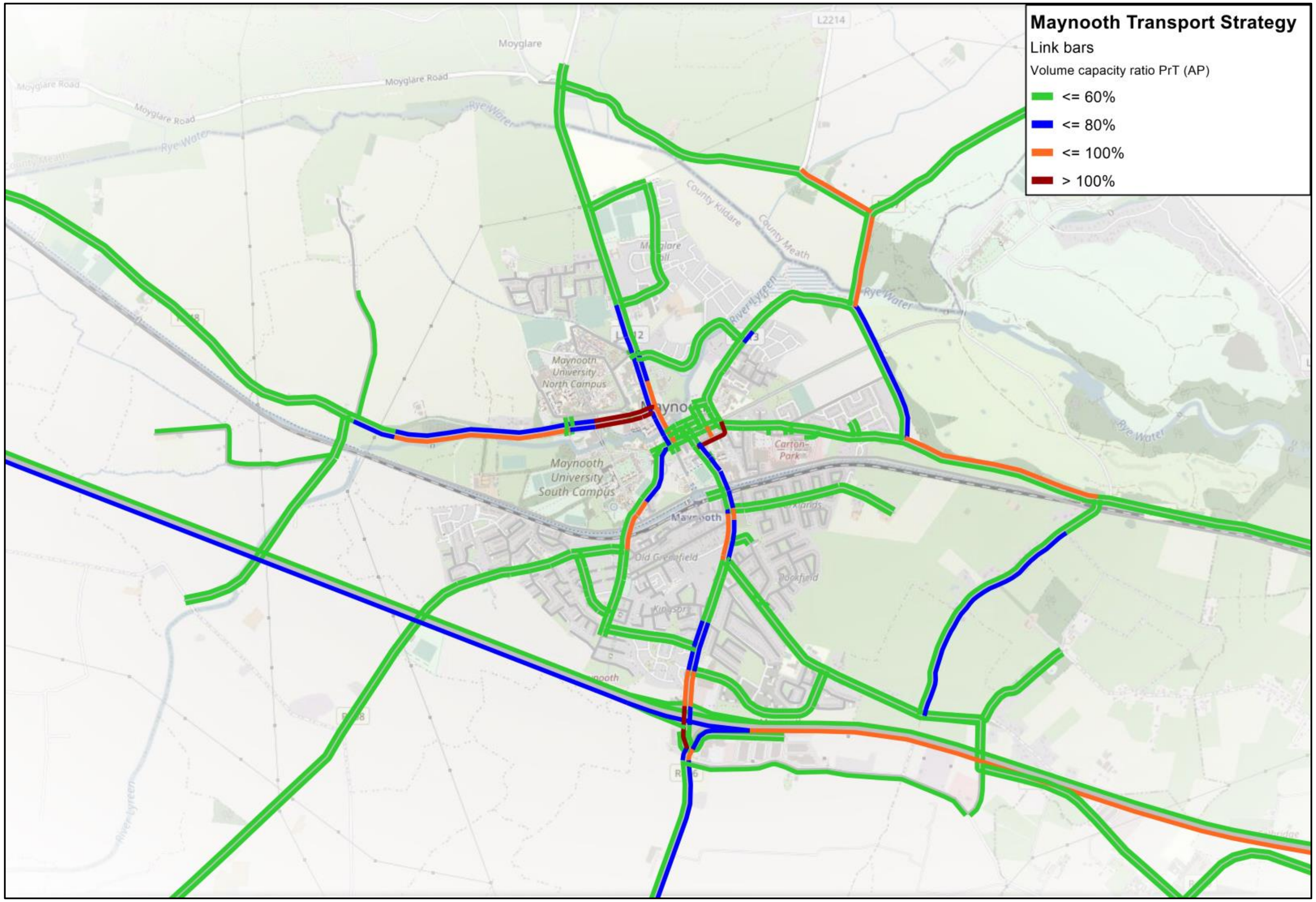

Figure 5.19 Volume to Capacity Plot Do Minimum 2038 - PM Peak

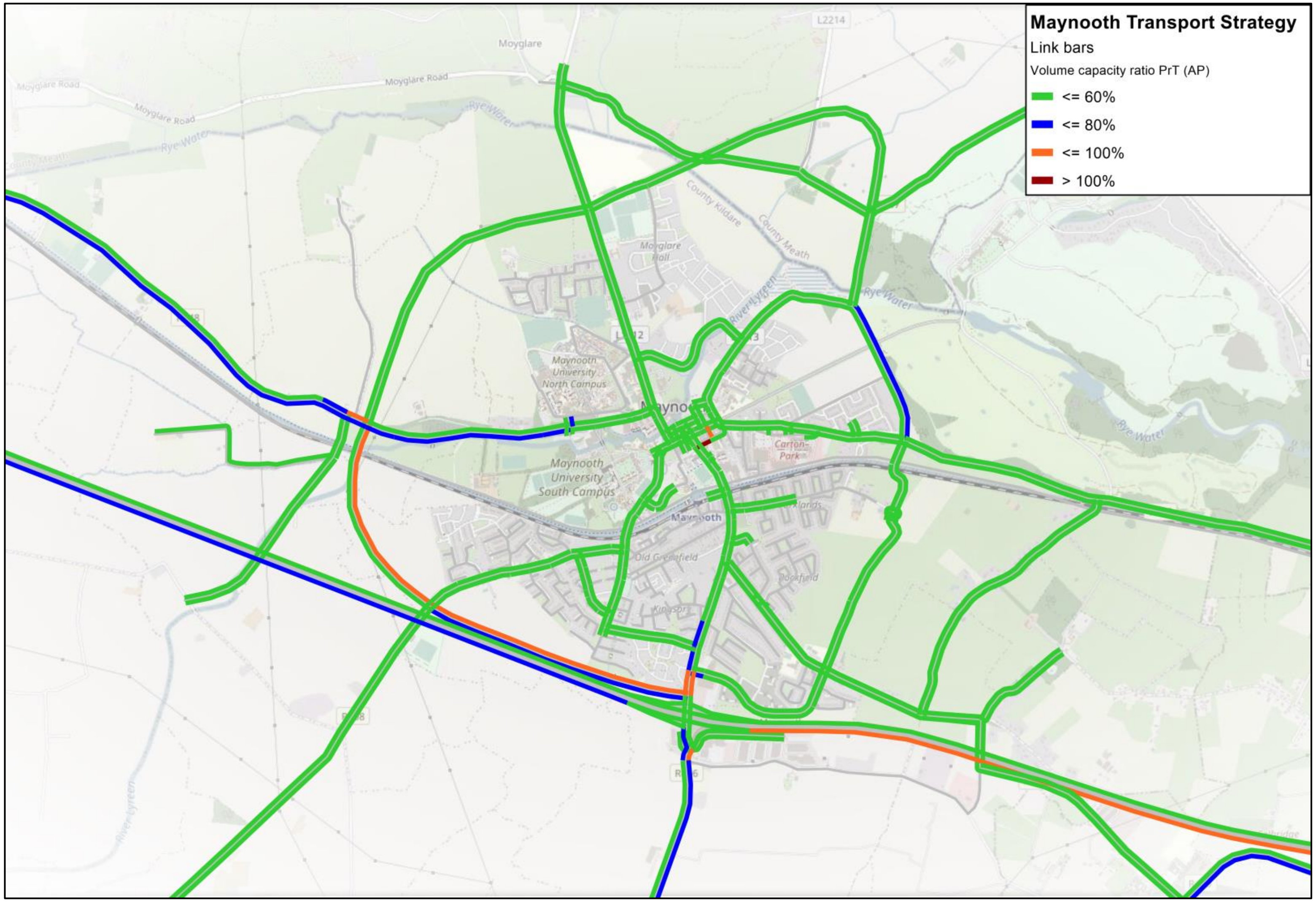

Figure 5.20 Volume to Capacity Plot Combined Road Strategy 2038 - PM Peak

Appendix D: Combined VISSIM Model Development/Traffic Modelling Report

Maynooth VISSIM Model

Model Development and Scenario Testing Report

Kildare County Council

Project number: 60660247

October 2023

Delivering a better world

Prepared for:
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1. Introduction

This VISSIM Model Report has been written to outline the base model development and subsequent scenario testing. The report discusses the traffic data used in the calibration and validation of the model and demonstrates the robustness of the base model for the testing of various scenarios.

1.1 Background

Kildare County Council has commissioned AECOM to create an AM and PM peak base VISSIM micro-simulation model of Maynooth Town Centre and the nearby road network including Dublin Road and Moyglare Road. The development of the base model allows the assessment of future network performance and scenario testing for roads in the study area.

1.2 Study Area

The model extents are displayed in Figure 1-1, with the network highlighted in yellow. The network encompasses Moyglare Road to the north, the R148 Maynooth University roundabout to the west, Straffan Road and Parson Street to the south and the R148 east until just before the junction with Carton Grove. Within Maynooth, side roads parallel to Main Street have also been modelled, namely Pound Lane and Doctor’s Lane with their associated connections to Main Street.

Figure 1-1: Model Extents and Areas of Interest (OS Data Mapping)

1.3 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 drivers of private motor vehicles and their interactions in one single model.

The VISSIM version used to develop the model is VISSIM 2022, service pack 4.

1.4 Scenario Testing

Due to the significant development pressures within and around Maynooth, it is proposed that a ring road will be constructed to reduce the pressure within Maynooth town centre by removing through traffic as illustrated in Figure 1-2. The precise details of the proposed road strategy are explained in the main MEATBA Volume 1 document.

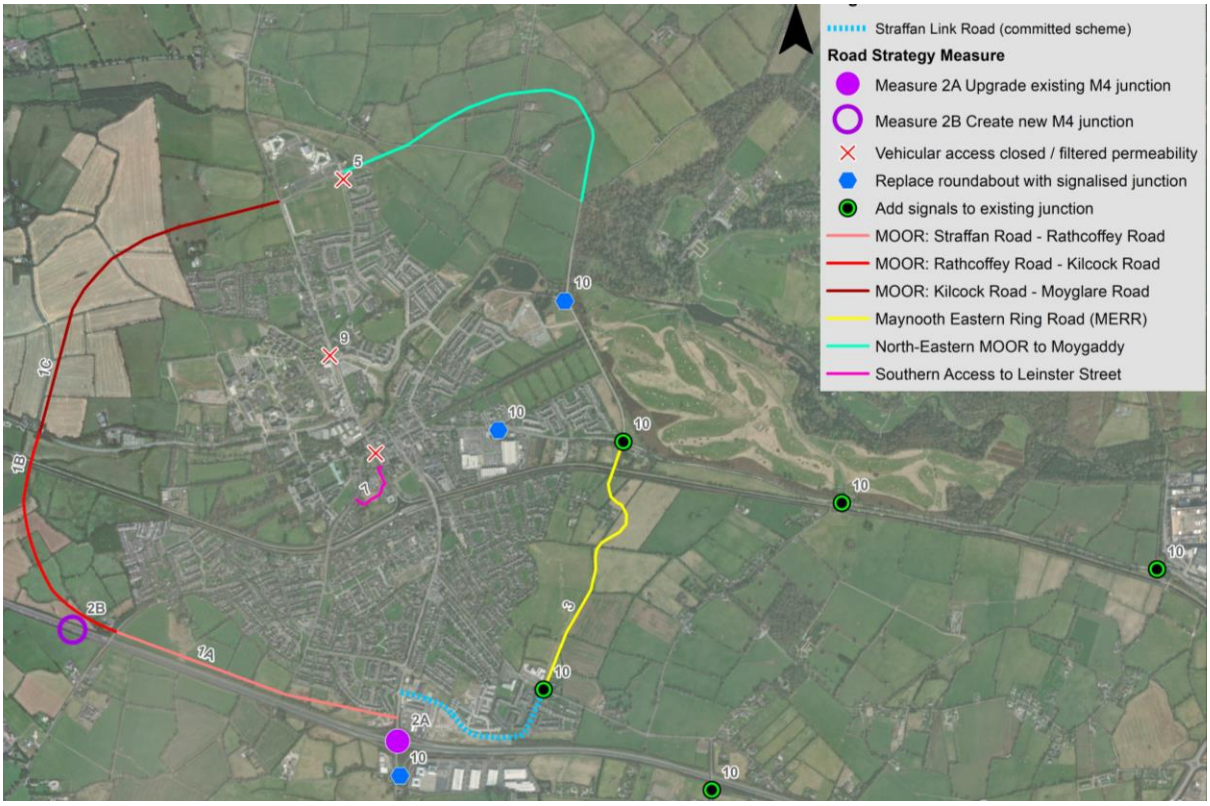


Figure 1-2: Proposed Road Strategy Measures

The proposals outline the development of the eastern and north-eastern section of the ring road in 2028, with the full completion by 2038. Other smaller interventions are proposed within Maynooth, including the closure of Leinster St onto Main Road.

The road strategy measures assumed in 2028 and 2038 in VISUM are shown below, but it should be noted only the closure of Leinster Street to traffic is within the VISSIM network extent:

Scenario	Measures Included in VISUM/VISSIM
2028 Do-Something (DS) combined roads strategy	• Do-Minimum Road network • M4 junction upgrade • Maynooth Eastern Ring Road (MERR) • Moygaddy MOOR / Northern Eastern Orbital • Leinster Street Pedestrianised with alternative access via Parsons Street
2038 Do-Something (DS) combined roads strategy	• Do-Minimum Road network • Maynooth Outer Orbital Road (MOOR) • M4 junction upgrade • Maynooth Eastern Ring Road (MERR) • Moygaddy MOOR / Northern Eastern Orbital • Leinster Street Pedestrianised with alternative access via Parsons Street • Eastern Maynooth University road entrance closed

1.5 Report Structure

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

- Section 2 – Calibration and Validation data, detailing the data used to make the model.
- Section 3 – Model Description, providing some details about the model.
- Section 4 – Network Development, describing the process of creating the model.
- Section 5 – OD Matrix Development, detailing the development of origin-destination matrices.
- Section 6 – Model Standards, introducing the criteria used to judge the suitability of the model.
- Section 7 – Model Convergence, describing the model convergence process.
- Section 8 – Calibration and Validation, detailing how well the model calibrates and validates.
- Section 9 – Scenario network and matrix development and model results.

- Section 10 – Summary and Conclusions.

2. Calibration and Validation Data

2.1 Overview

This chapter describes the different data sources that were used to calibrate and validate the base model namely:

- Junction turning counts
- Queue lengths
- Signal specifications staging and timings

2.1.1 Signal Specifications

Signal timing data was provided by Kildare County Council for five signal junctions in the study area as shown in Figure 2-1. This information was used to define the initial signal timings and inter-greens for input into the model.

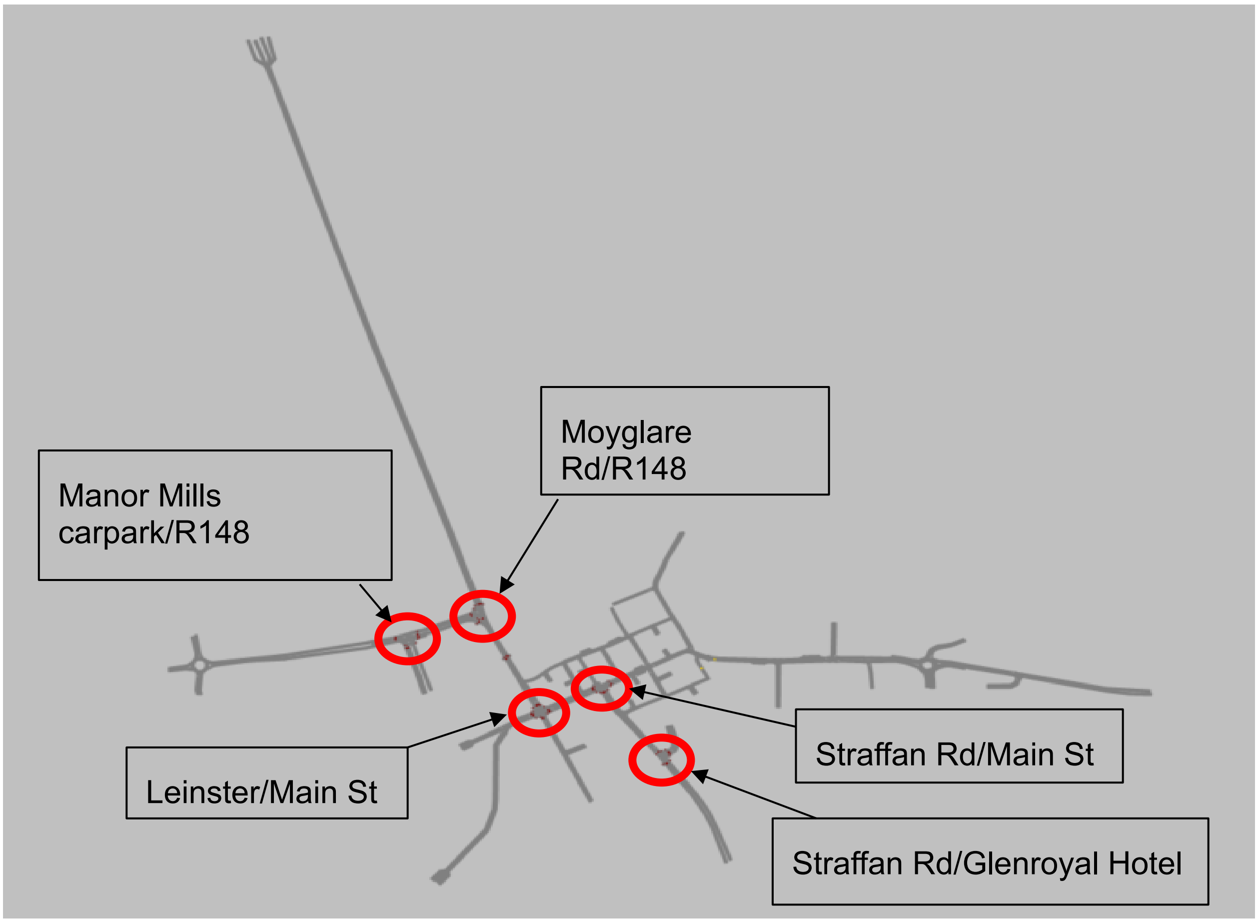


Figure 2-1: Signalised Junction Locations

The signals within Maynooth are controlled by a MOVA (Microprocessor Optimised Vehicle Actuation). MOVA monitors traffic demands on the approach to a junction via loop detectors embedded within the carriageway, the data is then used to optimise the signal timings at the junction. The signal timings adjust throughout the day to satisfy the changing traffic demand as illustrated in Figure 2-2.

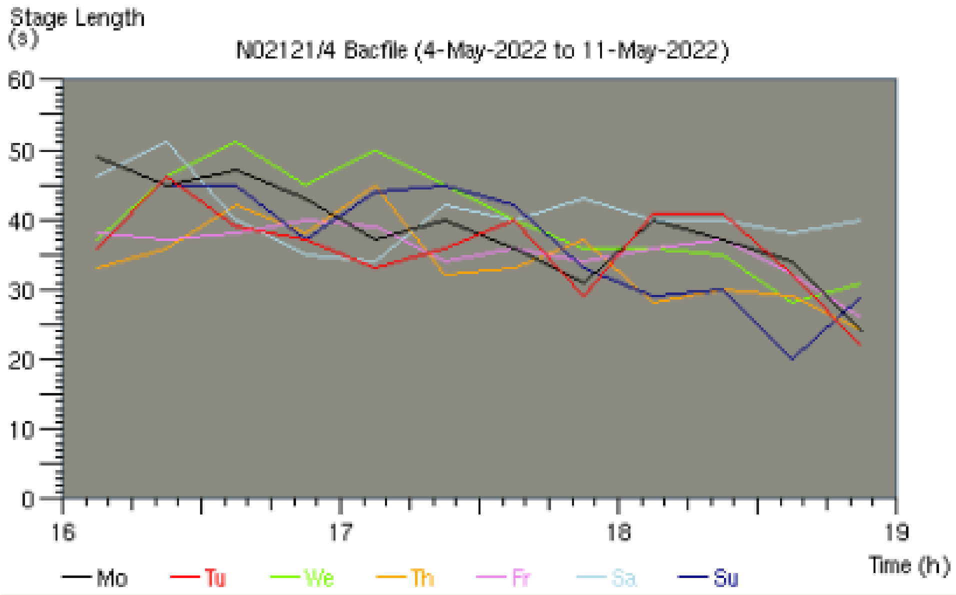


Figure 2-2: Example of the Variation in the Stage Duration by Day and Time

Varying the signal timings at junctions allow queues to be managed throughout the day, however this system requires more advanced modelling to replicate i.e. use of PCMOVA which was deemed unnecessary for this project. Signal timings were estimated using averages of the stage time data provided to AECOM, these estimated times were then used for fixed time signals. To ensure reasonable flow within the network, the cycle time of adjacent junctions were set to the same value (further discussed within **section 4.3** and **8.2**).

2.2 Survey Data

AECOM, on behalf of Kildare County Council, commissioned 'Nationwide Data Collection (NDC)' to undertake traffic surveys of the road network in the area in May 2016. Traffic surveys, which included Manual Classified Turning Counts (MCTCs), Automatic Number Plate Recognition (ANPR), Automatic Traffic Counts (ATCs) and Queue length surveys were undertaken for the following dates:

- Tuesday 17th May 2016, 07:00-19:00
- Thursday 19th May 2016, 07:00-19:00

AECOM subsequently undertook checks of the traffic survey data provided by 'Nationwide Data Collection (NDC)' to confirm the suitability of this data to undertake this Base VISSIM model development exercise.

This traffic survey data was fully used in the development of the Maynooth VISUM model, with only the Manual Classified Turning Counts (MCTC) and queue data being used in the VISSIM model.

2.2.1 Manual Classified Turning Count Data (MCC)

Manual Classified Turning Counts were carried out at the following junctions on Tuesday 17h May 2016 between 07:00-19:00:

- **Site 1**: R406(N) / Local Road / R406(S) / Maynooth Business Campus / Slip Road Off M4
- **Site 2**: R406(N) / Slip Road Onto M4 / R406(S)
- **Site 3**: R406(N) / Slip Road Off M4 / R406(S) / Slip Road Onto M4
- **Site 4**: R406(N) / Local Road / R406(S) / Lidl Access Road
- **Site 5**: R406(N) / Straffan Wood / R406(S) / Bus Bay
- **Site 6**: Meadowbrook Road(N) / Meadowbrook Road(S) / Straffan Wood
- **Site 7**: Meadowbrook Road(N) / Beaufield / Meadowbrook Road(S)
- **Site 8**: R408(W) / Beaufield / R408(E)
- **Site 9**: R408(N) / R408(W) / Meadowbrook Road
- **Site 10**: R406(N) / R406(S) / R405
- **Site 11**: R406(N) / Train Station / R406(S)
- **Site 17**: Moyglare Road(N) / Moyglare Road(S) / Moyglare Hall
- **Site 18**: Moyglare Road(N) / Local Road(W) / Moyglare Road(S) / Local Road(E)
- **Site 22-1**: R148(W) / Exit Only Access / R148(E)
- **Site 22-2:** Local Access / R148(W) / Main Tesco Access / R148(E)
- **Site 22-3:** R148(W) / Tesco Access / R148(E)
- **Site 23:** R157(N) / Local Road / R157(S)
- **Site 24:** R157(N) / Dillow's Road / R157(S)
- **Site 25:** R157 / R148(W) / R148(E)
- **Site 26:** R148(W) / L5053 / R148(E)

- **Site 27:** L5053 / R405(W) / R405(E)
- **Site 28:** R405(N) / Lawrences Avenue / R405(S)
- **Site 29:** R405(N) / R405(S) / Rail Park
- **Site 30:** R406(N) / R406(S) / Maynooth Park
- **Site 31:** R406(N) / R406(S) / Rail Park

Manual Classified Turning Counts (MCTCs) were also carried out at the following junctions on Tuesday 19th May 2016 between 07:00-19:00

- **Site 12:** R406(N) / R406(S) / Access Road
- **Site 13:** Fagan's Lane / R148(W) / R406 / R148(E)
- **Site 14:** R148(N) / R408 / Canal Place / R148(E)
- **Site 15:** Moyglare Road / R148(W) / R148(S)
- **Site 16:** Moyglare Road(N) / University Access / Moyglare Road(S)
- **Site 19:** University Access / R148(W) / Library Access / R148(E)
- **Site 20:** Maynooth Campus / R408(S) / R408(E)
- **Site 21:** Dillow's Road / R148(W) / Doctors Lane / R148(E)

The site locations are shown in Appendix A**.**

Classified turning counts were summarised for all surveyed junction and difference in flow between consecutive junctions was estimated to identify any significant flow differences in the survey data.

2.2.2 Queue Length Data

Queue length surveys were carried out at the following junctions 17th May 2016 and 19th May 2016 between 07:00-19:00:

- Site 1: Moyglare Road / R148 (W) / R148 (S)
- Site 2: R148 (N) / R408 / Canal place / R148 (E)
- Site 3: Fagan’s Lane / R148 (W) / R406 / R148 (E)
- Site 4: R406 (N) / R406 (S) / Access Road

The maximum queue was measured at 15-minute intervals at each site. The site locations are shown in Appendix A**.**

Queue length data was summarised for all junctions to identify time periods when the longest queues were recorded on each approach. The queue length data provided by the survey company only recorded queues up to a maximum length of 120m, which may not be an accurate representation of the queuing within the network as queues may stretch beyond this distance.

3. Model Description

As mentioned in Section 1, the model has been developed using VISSIM Version 2022, service pack 4. The following sections describe the model development in more detail, including:

- Modelled area
- Network structure
- Time periods
- User classes
- Public transport modelling
- Traffic assignment methodology

3.1 Modelled Study Area

The modelled study area in VISSIM relates to the network extent where significant impacts from interventions are likely to occur. Figure 3-1 below presents a screenshot of the modelled study area.

Figure 3-1: Overview of the Modelled Area

3.1.1 Justification of Model Coverage

The key to determining the boundaries of the model 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 to define the model area.

3.2 Network Structure

The model network contains 32 zones from which traffic enters and leaves the network via external points, known as parking lots in VISSIM.

The network structure connects these external points through the use of links and connectors to describe the road network.

As described in the Assignment Methodology section, the model has been built using dynamic traffic assignment, which requires the use of nodes within the network. The parking lot(s) for each zone must be located between two nodes. Nodes are equally required for representing a collection of links and connectors that form a significant traffic route decision, e.g. junctions.

3.2.1 Zoning System

Model zones are represented in VISSIM by 1 or multiple parking lot pairs with separate lots acting as entry and exit points. The model zones are summarised below in Figure 3-2.

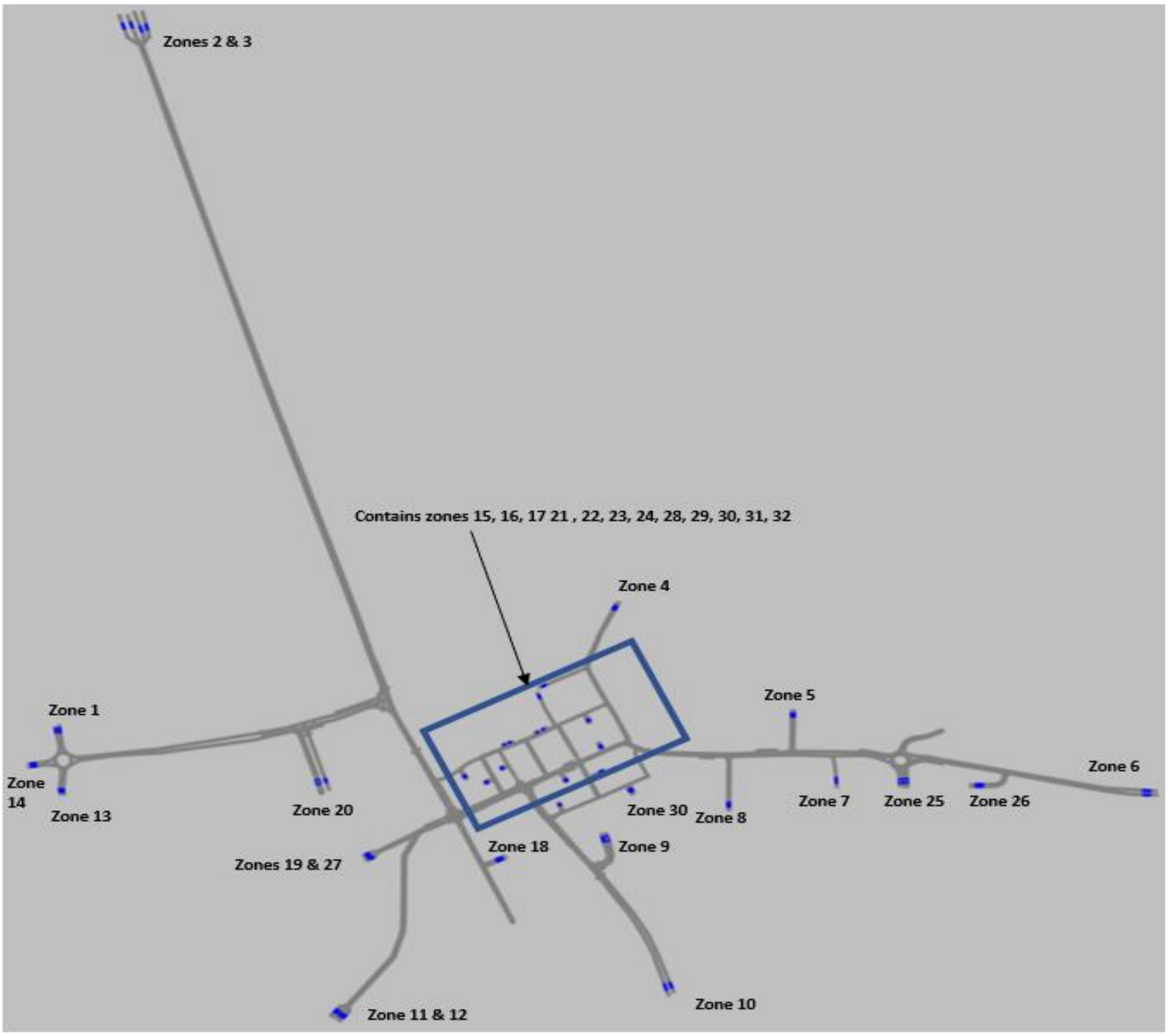


Figure 3-2: Zoning System – Model Zones

The zoning system above has been adopted from the VISUM model. This provides consistency between the VISSIM and VISUM models enabling firstly the extraction of the prior matrices to develop the base VISSIM model and secondly to enable forecasting to be undertaken more smoothly.

3.3 Time Periods

All vehicle counts have been extracted from the AM and PM survey data (sites 14, 15, and 21) to establish the peak hour, Table 3-1 below displays the hourly flow from different starting points i.e. 08:00, 08:15 etc to highlight the peak hour.

Table 3-1: Peak Hour Flows (All Vehicles)

AM Flows			PM Flows		
Start Time	End Time	All Vehicles	Start Time	End Time	All Vehicles
07:45 AM	08:45 AM	4187	16:45	17:45	4085
08:00 AM	**09:00 AM**	**4331**	**17:00**	**18:00**	**4144**
08:15 AM	09:15 AM	4303	17:15	18:15	4107
08:30 AM	09:30 AM	4129	17:30	18:30	4062
08:45 AM	09:45 AM	3995	17:45	18:45	4087

Based on the assessment of the cumulative hourly flows obtained from the survey data, the following morning and afternoon peak periods for the general traffic were estimated:

- Morning Peak (AM), 08:00-09:00; and
- Evening Peak (PM), 17:00-18:00.

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. Vehicles can then be aggregated into a Class (e.g. HGV). Vehicles may also be defined as a Type by Origin, Destination, Occupancy, Private, Taxi etc. This is used for a number of modelling features in VISSIM, such as defining groups of vehicles with speed or acceleration behaviours or segmenting vehicles with similar vehicle lengths or widths.

The following vehicle types have been used within the models:

- Lights (Car's and LGV's)
- HGVs

3.4.1 Vehicle Classes / Vehicle Compositions

Origin and destination trip matrices are given in two separate compositions, Lights (Cars and LGV's) and Heavy Vehicles (HGV's). VISSIM has a hierarchy system between Vehicle Types, Vehicle Classes and Vehicle Compositions.

Both Vehicle Classes and Compositions can be defined as a group of vehicle types but the use in VISSIM differs.

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. Vehicles with different technical driving properties can share the same vehicle class as long as they belong to different vehicle types.

Vehicle Compositions are required for generating the vehicles within the model, but their main use is limited to specify relative volumes and share of vehicle types at each entry to the model. These have been calculated from the junction turning count survey data.

Table 3-2. Vehicle Composition Split

Vehicle	AM % Split	PM % Split
Lights (Cars and LGV's)	98%	99%
HGV	2%	1%

3.5 Public Transport Modelling

Four bi-directional public transport routes and 6 bus stops have been coded in the model, as shown in Figure 3-3.

For all bus stops, dwell times have been set to a normal distribution that ranges between 0 seconds and 40 seconds with a mean of 20 seconds and a standard deviation of 2 seconds.

Figure 3-3: Modelled bus routes

3.6 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.

This is commonly known as a steady state assignment, in which an average set of cost conditions is assumed to apply across a fixed time period, and a fixed volume of trips is “assigned” to satisfy these conditions.

3.6.1 Steady State Assignment Model

This dynamic assignment approach was chosen because of data availability and the ease of amending a dynamic model for future scenarios. The nature of the network is also best replicated by a dynamic assignment due to the lane changing characteristics, which are catered for by forward thinking route choice rather than a static set of paths.

The aim of the assignment model is to reach an equilibrium such that costs and traffic flows are in balance, under the assumption that individual users will seek to minimise their own costs of travel through the network.

The algorithm used for reaching the equilibrium of costs and traffic flows is known as Stochastic User Equilibrium (SUE).

3.6.1.1 Simulated Travel Time

The travel times measured in the current iteration are not used directly for path selection in the same iteration but are adopted only in the following iterations.

For the simulation of the experience growing with time, not only the travel time of the previous iteration is considered, but in particular the travel times of all previous iterations. In doing this, the method used is known as “exponential smoothing of the travel times”.

The new smoothed value represents the travel time that we expect in the next iteration.

$$T_i^{n,k} = (1-\alpha)T_i^{n-1,k} + \alpha TO_i^{n,k}$$

Where,

- k is the index of the evaluation interval within the simulation time
- n is the index of the iteration, i is the index of the edge/link
- α is the given constant smoothing factor,
- TO_i is the measured (observed) travel time
- T_i is the smoothed travel time.

3.6.1.2 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 levels within peak periods. 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.

3.7 Running the Model

The model was run for the time periods identified in section 3.3.

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 results are required, with the end result being the average of some measure across these runs.

The average of 10 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 distribution of results was checked to ensure there are no outliers.

It should be noted that forecasting / optioneering models may require more than 10 seed runs to establish model results to ensure sufficient confidence.

4. Network Development

The development of the modelled network has been undertaken in line with Transport Analysis Guidance (TAG).

4.1 Network Data and Coding

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

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

4.1.1 Network Construction

Initially the VISSIM network was established by exporting a cordon network from the VISUM model, this provided a reasonable representation of the Maynooth town centre. Aerial photography data was then used as a background to finetune the network coding to ensure the correct usable road space was being modelled.

4.1.2 Pedestrian Crossings

Pedestrian crossings (signalised and non-signalised) were modelled in order to capture the interactive delay to vehicles. Figure 4-1 shows the locations of all pedestrian crossings in the model.

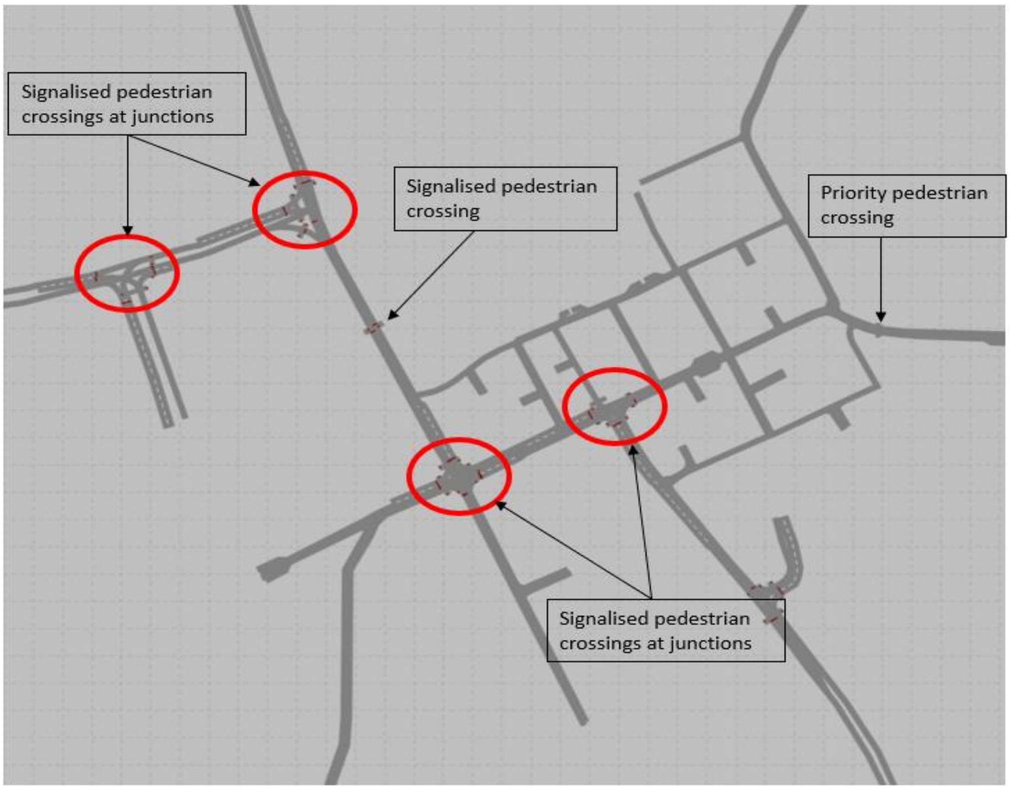


Figure 4-1. Modelled pedestrian crossings

4.1.3 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[1].

The default value of 200 metres has remained unchanged for all of the connectors.

Emergency stop distances have been kept to a default value of 5 metres for the entire network, with the exception of connectors at signalised junctions. The emergency stop distance at signalised junctions ranges from 20m – 80m.

4.1.4 Lane Restrictions

Lane restrictions are applied to restrict certain vehicle classes from using a particular lane on a link.

The following lane restrictions have been applied:

- At all bus stop laybys, a ban on Lights and HGV's has been applied.

[1] PTV VISSIM User Manual, Para. 6.10.2.

4.2 Flow/Delay and Flow/Speed Relationships

VISSIM computes these relationships based on randomly generated “micro” gap acceptance and car following behaviours.

At the junction level, the operational characteristics become a more predominant element with signal timings and phasing specification as well as give-way models playing a key role. On the other hand, the driving behaviours based on car-following models are more important at the link level.

4.2.1 Driving Behaviours

By default, five driving behaviours are available in VISSIM, making the modelling of different driving behaviours within the same model possible.

In total, two driving behaviours have been used within the model, albeit only one has been used for the road network (details of each driver behaviour is located in Appendix B). They have been assigned to link and connectors across the modelled network based on the individual characteristics of the road section to be represented. This is better shown in Figure 4-2. Pedestrian facilities are provided within the network area and therefore the default behaviour of Footpath (No Interaction) has been used.

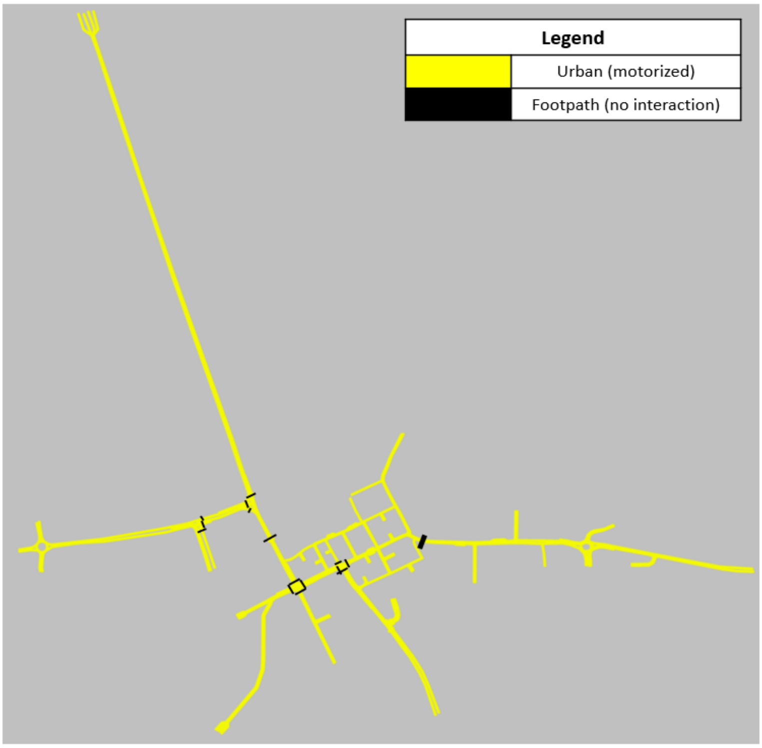


Figure 4-2. Network Development – Driving Behaviours

4.3 Signal Control

4.3.1 Fixed Time Signalised Junctions

As highlighted in Chapter 2, a number of junctions within Maynooth operate via a MOVA system, meaning that the signals adjust according to the traffic demand. Although the operation of MOVA can be replicated within VISSIM, it was deemed unnecessary for the purpose of this model, therefore signal timings at these junctions were derived from reviewing the MOVA outputs and establishing an average time for each stage. The following junctions have been coded as fixed times:

- Manor Mills car park/R148
- R148/Mill St
- Mill St/Main St
- Main St/Straffan Road
- Straffan Road/Glenroyal Hotel

Although all effort was made to replicate queue lengths within the model, a lack in the variation of signal timings throughout the model period means observed and modelled queue lengths will display differences, however generally remain a reasonable representation of the traffic conditions within Maynooth.

4.3.2 VAP Signalised Junctions

VAP (Vehicle Actuated Plans) have been used to replicate the pedestrian crossing at the Mill Street as shown in Figure 4-3. VAP enables the switching of signal plans to react to changes in demand, with regards to pedestrian crossing, the VAP file uses loop detectors to detect the presence of a pedestrian at the crossing which then activates the pedestrian stage.

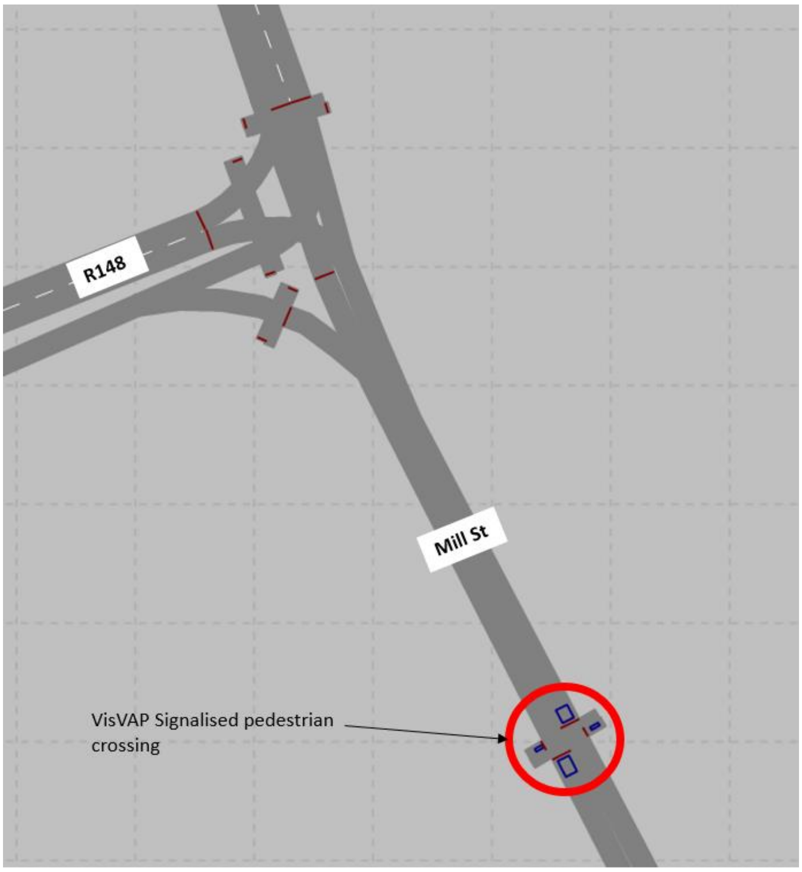


Figure 4-3. VAP Junctions and Detectors

4.4 Give-Way Model

For non-signalised junctions in VISSIM, the right-of-way is modelled using priority rules, conflict areas and stop signs.

4.4.1 Conflict Areas

With respect to conflict areas, the movement priority, visibility, gaps and safety distance factors must be specified accurately and realistically enough to reflect on-street observations[2].

For avoiding overlapping issues, conflict areas have been used for conflicts while priority rules have been used as the main give-way object at junctions.

In total, 725 conflict areas have been set within the model to be used for modelling branching conflicts and minimising overlapping.

[2] Transport for London (TfL) Traffic Modelling Guidelines 3.0. Para 5.3.3.4.

4.4.2 Priority Rules

Priority rules have been used at priority junctions and at junctions where conflict areas were exhibiting vehicle collisions. (Appendix C provides detailed information on gap acceptance)

4.5 Speed Control

Speed control measures need to modelled 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.

For the above, the use of Desired Speed Decisions (DSD) and Reduced Speed Areas (RSA) is required.

4.5.1 Desired Speed Distributions

The distribution function of desired speeds is a particularly important parameter, as it has an impact on link capacity and achievable travel times. If not hindered by other vehicles or network objects, e.g. signal controls, a driver will travel at his desired speed, establishing the baseline for free-flowing conditions3.

In total, 2 desired speed distributions (one per vehicle class) have been defined in VISSIM for modelling vehicle speeds as shown in Table 4-1.

Table 4-1. Desired Sped Distributions

Normal Distributions (km/h)			
LVs		HVs	
Lower	Upper	Lower	Upper
36	44	27	33
27	33	27	33

4.5.2 Reduced Speed Areas

Reduced Speed Areas (RSAs) have been used in the following way:

- At all stop lines, to calibrate junction approach saturation flows ensuring that modelled values are within reasonable limits
- 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 local speeds, such as on tight and wide bends

[3] PTV VISSIM User Manual, Para. 5.6.1.

The use of the reduce speed areas allows specific modelling of key behaviours, including the turning movement from Mill Street to Main Street by buses and other large vehicles which display a significant speed reduction to perform the turn in order to avoid vehicles making the opposite movement as shown in Figure 4-4.

Figure 4-4: Turning difficulties for buses travelling from Mill St to Main St

5. OD Matrix Development

The available sources of data such as junction turning counts and the overarching strategic VISUM model have been analysed to develop Origin-Destination (OD) matrices.

5.1 Zoning System

The zoning system for the VISSIM model is shown in Figure 3-2. The zones have been extracted from the VISUM model of the area to allow ease of transfer of demand matrices between the VISUM to VISSIM models.

5.2 Matrix Development

As mentioned in Section 3, it was concluded that the traffic survey data collected in May 2016 was considered suitable for use and has therefore been used for the matrix development process.

The matrix construction for the AM and PM VISSIM models was undertaken in 4 stages as follows:

Stage 1 – Cordoning

The first step was to cordon the demand matrices from the Maynooth VISUM model of the area of interest, this established our prior matrices.

Stage 2 – Matrix Estimation

Turning count data was added to the VISUM model as matrix estimation target values and an estimation process was run. This provided a single hour, flat profile matrix for the AM and PM periods.

Stage 3 – Profiling

The flat profile demands were then profiled using 15-minute turning counts. The profiles were applied across the full matrix.

Stage 4 – Refinement

Upon completion of Stage 3, individual OD movements were adjusted within the matrix to compensate the lack of survey data and to improve the calibration and validation of the model.

Based on the above steps, the matrices for the AM and PM peak, warm-up and cool-down periods were derived. Final AM and PM peak hour matrices used in the models are shown in Appendix D for information.

In total, for each of the AM and PM peak models, eight 15-minute interval O-D matrices were constructed for Light’s and three matrices were constructed for HGV’s.

- AM period (07:30 - 09:30)
  - Build-Up (2 matrices – Lights, 1 matrix - HGV): 07:30 - 08:00
  - Peak (4 matrices – Lights, 1 matrix - HGV): 08:00 – 09:00
  - Cool-Down (2 matrices – Lights, 1 matrix - HGV): 09:00 – 09:30
- PM period (16:30 – 18:30)
  - Build-Up (2 matrices – Lights, 1 matrix - HGV): 16:30 – 17:00
  - Peak (4 matrices – Lights, 1 matrix - HGV): 17:00 – 18:00
  - Cool-Down (2 matrices – Lights, 1 matrix - HGV): 18:00 – 18:30

6. Model Standards

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, for microsimulation the data generally related to traffic conditions, journey times or queue lengths.

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 Validation Criteria and Acceptability Guidelines

The calibration and validation of a model should include comparisons of the following:

- Assigned flows and counts on individual links and turning movements at junctions as a check on the quality of the assignment; and
- Modelled and observed journey times along routes, as a check on the quality of the network and the assignment.

It should be noted that in terms of journey time data this has not been supplied therefore validation has relied on queue length data.

6.1.1 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.

The calibration criteria and acceptability guidelines for link flows and turning movements are defined in Table 6-1 below.

Table 6-1. Link / Turning Movement Calibration – Criteria and Acceptability.

Description of Criteria	Acceptability
Individual flows within 100 veh/h of counts for flows less than 700 veh/h	> 85%
Individual flows within 15% of counts for flows from 700 to 2700 veh/h	> 85%
Individual flows within 400 veh/h of counts for flows more than 2700 veh/h	> 85%
GEH < 5 for individual flows	> 85%

6.2 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, is related to the need to provide stable, consistent and robust model results. This is important when the model outputs are being used to compare the with-scheme and without-scheme cases, and especially when estimating the Transport Economic Efficiency (TEE) impacts of a scheme.

In VISSIM, the assignment algorithms will not converge absolutely, and user-defined "stopping criteria" are required to define the point at which satisfactory convergence is considered to have been achieved.

Both stability and proximity criteria should be satisfied for four consecutive iterations before convergence can be judged to be acceptable. At least one of the stability criteria should be satisfied and the values of the other measures should also be reported[4].

Stability criteria results will be reported in section 7.

[4] TAG Unit M3.1: Highways Assignment Modelling, Para C.2.9.

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.

The following convergence criteria can be assessed within the context of VISSIM:

a) 95% of all path traffic volumes change by less than 5% for at least four consecutive iterations;

b) 95% of the travel times on all paths change by less than 20% for at least four consecutive iterations.

7.1 Convergence Process

The AM and PM models were initially run using random seed 42 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.

Using the path and cost files from the previous process, a batch run of each model was then undertaken, using random seed 42 and running the model until the criteria stated above 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.

An incremental vehicle volume loading approach has been used to try and achieve all three criteria. 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%. Multiple runs were undertaken until the convergence criteria was achieved.

7.2 Confidence Intervals

Due to the nature of dynamic assignment, modelling results from each seed will vary. The range in this variation is based on the characteristics of the model, i.e. levels of congestion, route choice, variable signals etc. Therefore, it is essential that a sufficient number of seed runs are carried out to provide a suitable level of confidence in the model outputs.

The level of confidence and confidence interval of this model has been set at 95% confidence with a ±2.5 second confidence interval, which means there is a 95% confidence that the average result presented is within ±2.5 seconds of the true average vehicle delay.

The performance indicator chosen for the confidence assessment is the average delay per vehicle, as this provides a general overview of the network performance and will provide a good indication of whether any “rogue seeds” – seed runs which perform outside the normal range of the other seeds –have been generated.

Table 7-1 below presents the confidence and confidence intervals for the AM and PM peak models.

Table 7-1: Confidence and Confidence Interval for AM and PM models

AM Peak			PM Peak		
Number of Runs	Confidence Level	Confidence Interval (seconds)	Number of Runs	Confidence Level	Confidence Interval (seconds)
10	96%	± 2.5	**10**	90%	± 2.5

As highlighted in Table 7-1, the model required 10 seed runs for the AM and PM peak respectively to achieve the confidence criteria set above. During the model runs, there were no “rogue” seed runs (outside a two times standard deviation) observed, therefore all seed runs were used in the confidence analysis and calibration / validation outputs. It is recommended that option models adopt the baseline confidence level criteria as a minimum, to ensure conclusions and recommendations are informed by statistically robust outputs.

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:

- Turning Counts and;
- Queue Length.

The following section includes calibration and validation summaries.

8.1 Junction Turning Count Calibration

Table 8-1 shows a comparison between the assignment and the survey turning flows display a high level of correlation, with GEH and Individual Flow criteria being met.

Table 8-1. Junction Turning Count Calibration

		Zones	Differences		Criteria Fulfilled?	
Peak	**Entry Flows**	**Total**	**<5GEH?**	**Individual Flow**	**Both?**	**>85%?**
AM	Zone Entry Flows	32	Y	Y	Y	**Y**
PM	Zone Entry Flows	32	Y	Y	Y	**Y**

A detailed breakdown of model calibration is provided in Appendix E.

8.2 Queue Length Validation

Comparison of observed and modelled queues is difficult due to the different definitions of a queue applied, the different methods of length measurement (observed number of vehicles versus modelled length in metres), and the different sample sizes (13 observed measurements collected on a single day versus lengths recorded every simulation second for 10 random seeds).

Nevertheless, a quantitative comparison has been undertaken at the following junctions:

- R148 (W)/ Moyglare Road/ R148 (S)
- R408 / R148 (N) / R148 (E) / Canal Place
- R148 (W) / Fagan’s Ln / R148 (E) / R406
- R406 (N) / Access Road / R406 (S)

The observed queues were collected in 15-minute intervals by the survey company, with lengths measured in vehicle numbers. A conversion factor of 6 metres per vehicle has been applied, based on the usual assumed length of a passenger car unit (PCU). It is noted that this does not take account of longer goods vehicles and therefore the observed queues may be underestimated.

The end of the observed queue will be determined by the judgment of the surveyor, whereas in VISSIM it is determined, by default, as the maximum distance between the traffic counter (which has been placed at the stopline) and a vehicle that meets the defined queue conditions. The default values define a vehicle as queueing when its speed drops below 3.1 mph and it remains in the queue until it exceeds 6.2 mph.

Queue length data provided by the survey company (Nationwide Data Collection) did not capture the entire queue length and restricted the maximum queue length to 120m. Given the queue length profiles provided, it is likely that a number of approaches are breeching the 120m maximum queue length recorded, one example is shown below at Site 13 on the R406 NB approach during the PM peak, where queues between 16:45 to 17:30 and 17:45 to 18:15 flatline at 120m.

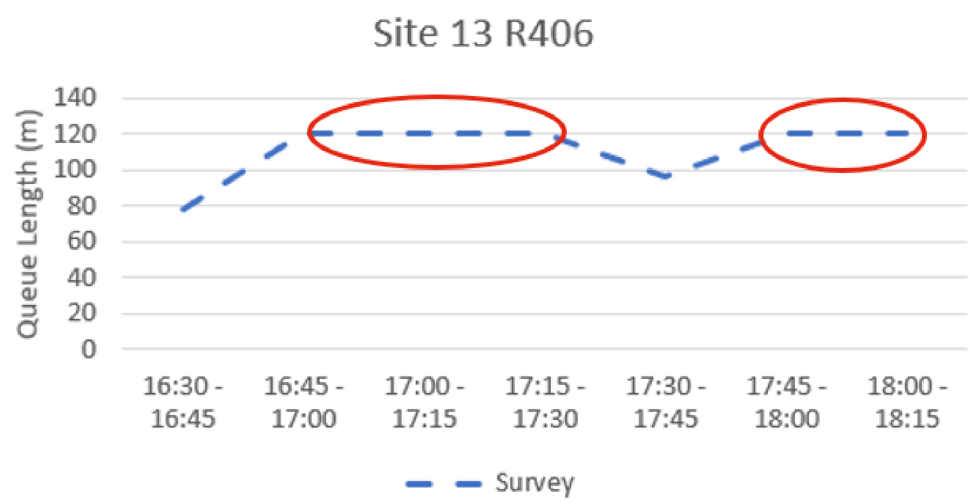


Figure 8-1: PM peak queue profile on the R405 approach to Main Road

It is important to also note that the model only records continuous queueing, 'yellow boxes' within the model create gaps which break the queue length. Figure 8-2 below illustrates the gap in queueing due to the yellow box located at Straffan Road/Doctor's Ln junction:

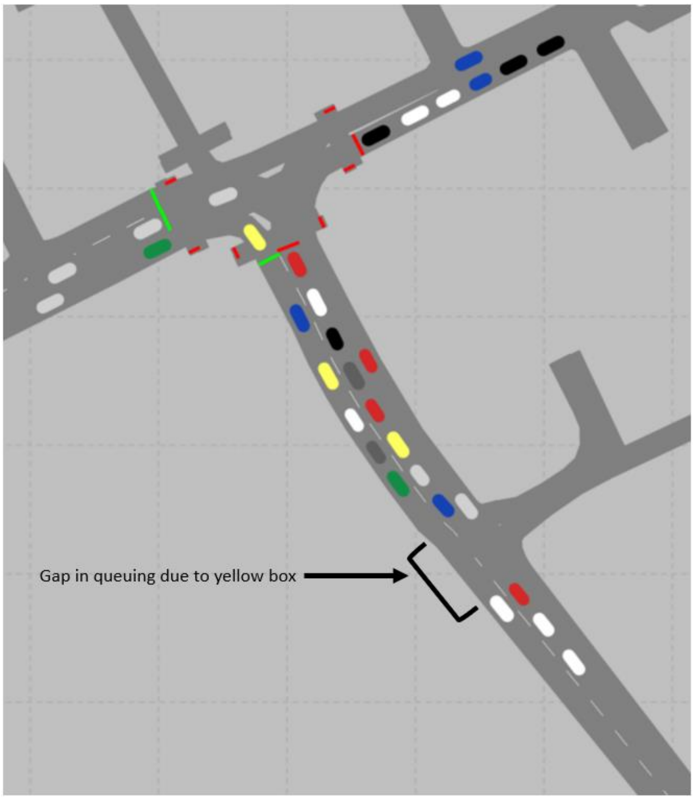


Figure 8-2: Queue length gap (yellow box)

Appendix F shows a full breakdown of the queue length validation.

8.2.1 Modelling Limitations in terms of Queueing

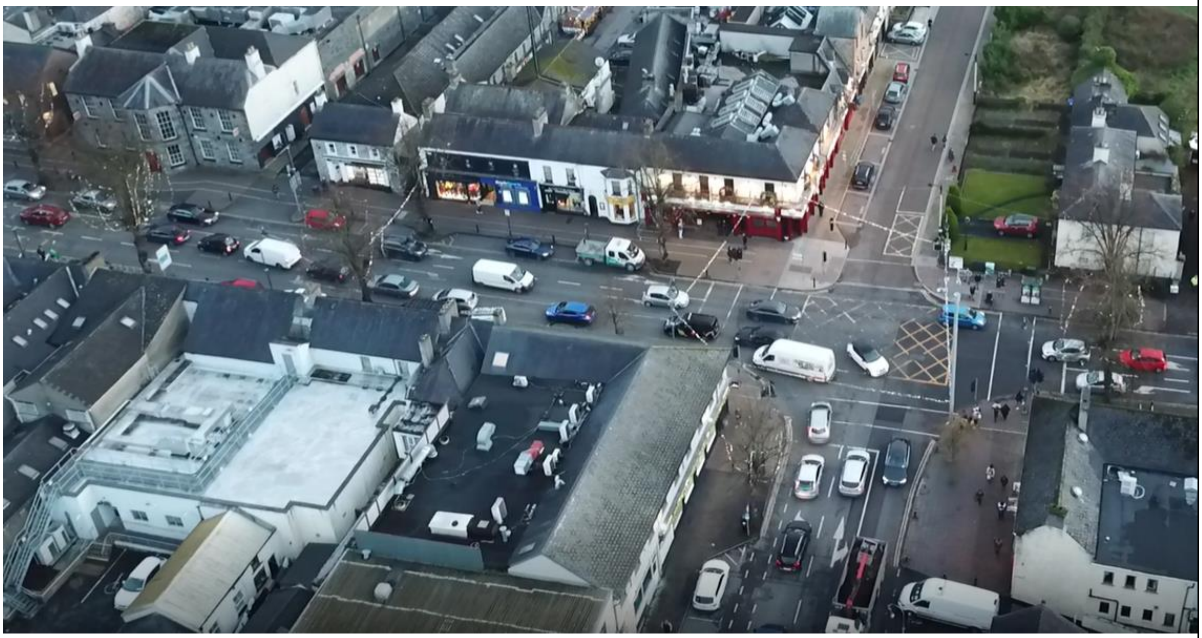
The modelling exercise has highlighted a number of limitations with the model, including the maximum queue length recorded (120m) and the break in queue lengths within the model due to the presence of yellow boxes, however there are further limitation which are highlighted below.

- The use of MOVA is difficult to replicate within the model, which in turn bring challenges when replicating queue lengths
- Due to a lack of survey data at the Manor Mills Shopping Centre access / egress onto R148, conditions within this area are difficult to replicate, this has impacted the queue lengths within this area specifically in the PM peak where the queue lengths on the R148 (W) and R148 (S) present larger queues than observed; and
- The R406 (N) approach to the access road to the Glenroyal Hotel displays shorter queueing than observed, this is likely to be a result of better aligned

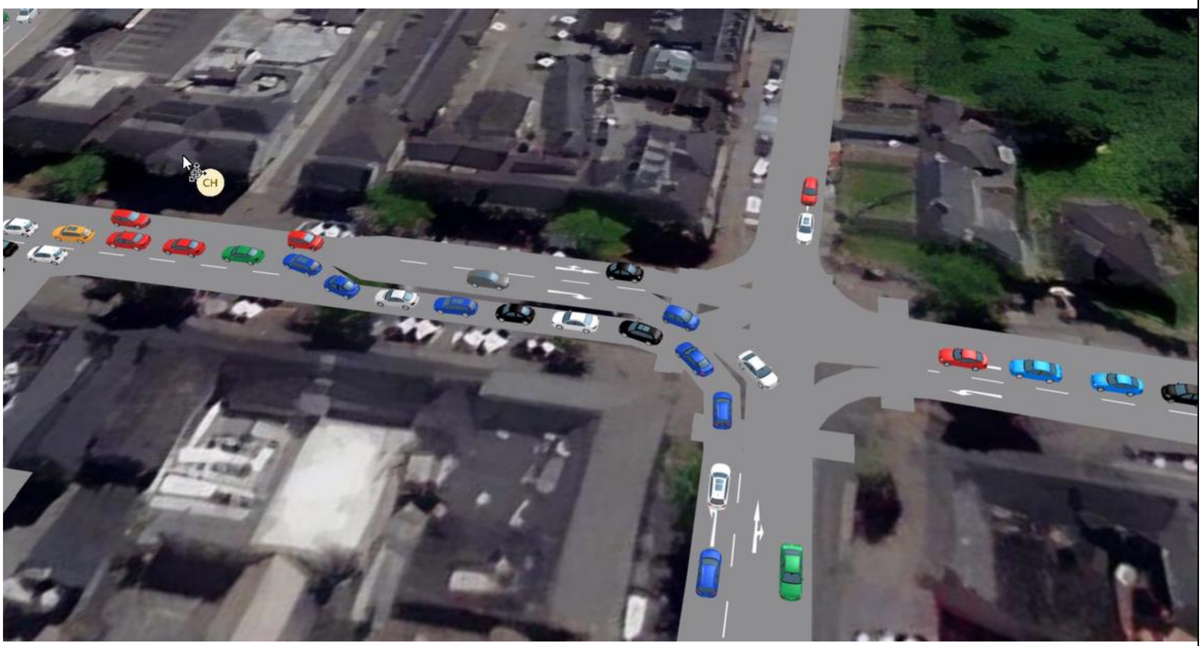
signal offsets between this junction and the Main Road / Straffan Road junction.

8.3 Supporting Evidence

In support of the queue length information, drone footage along the corridor was provided to AECOM as a general overview of the traffic conditions during the AM and PM peaks. Although this only provided a brief overview of the network, it did highlight traffic conditions which are being reflected by the model, including the right turn queue from Main Street into Straffan Road which blocks the through movement and the operation of the Mill Street / Main Street / Parsons St / Leinster St Junction.



Drone Footage



Model Footage

Figure 8-3: Observed right turning issues at the Main St / Straffan St Junction against the modelled conditions

9. Scenario Testing

The following chapter discusses the infrastructure being proposed within and around Maynooth and its impact on traffic conditions in the town centre. The following sections are presented below:

- The proposed infrastructure;
- The development of the forecast demands for 2028 and 2038;
- Model observations; and
- Model results.

9.1 Proposed Road Strategy

The proposals include a ring road around Maynooth town connecting Straffan Road, Rathcoffey Road, Kilcock Road, Moyglare Road, Dublin Road and R405 as illustrated in Figure 9-1 below. The completed ring road in 2038 is designed to reduce pressure on the town centre of Maynooth by reducing the need for through movements.

The precise details of the road strategy are explained in Volume 1 of the MEABTA. It should be noted that the MEABTA does not conclude on the preferred location for the upgrade or replacement of the M4 junction, this is explained in more detail in the MEABTA Volume 1 report.

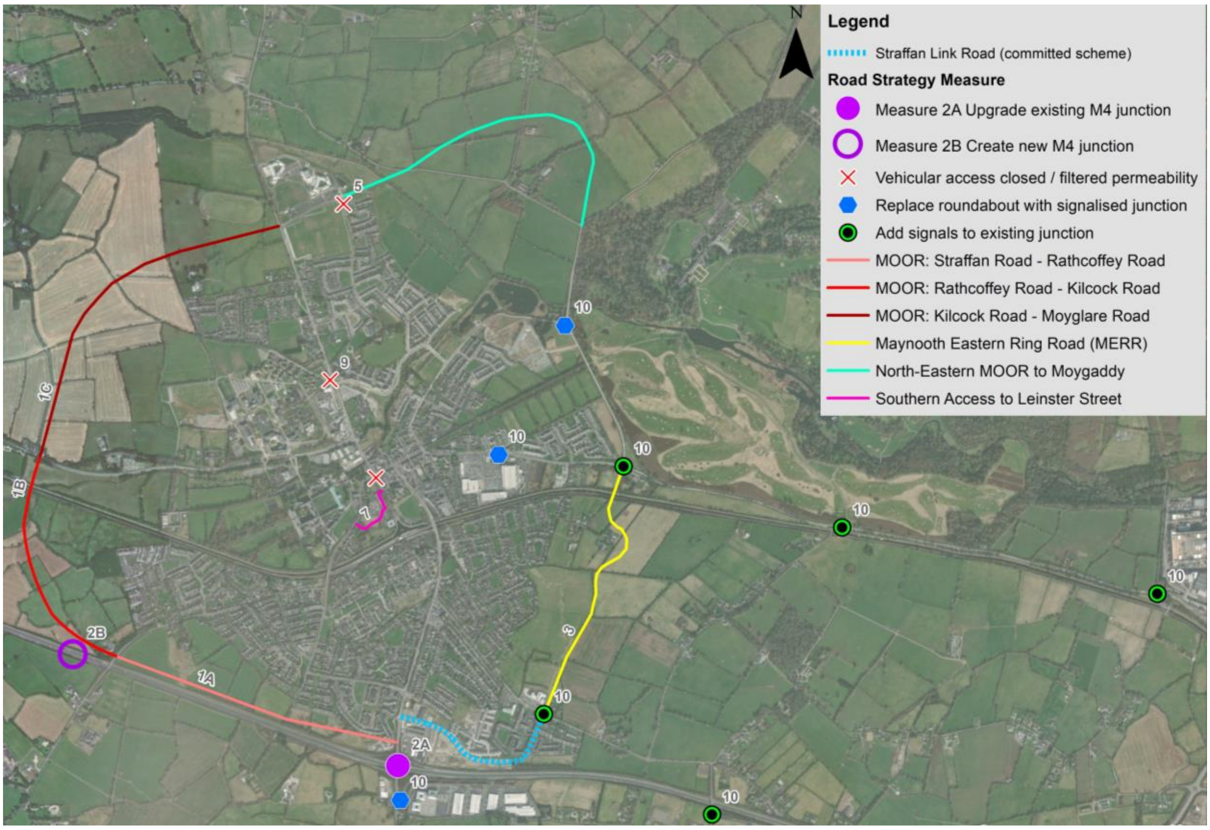


Figure 9-1: Proposed Road Strategy

Within the Maynooth town centre it is proposed to close the Leinster St arm of the Parson St / Leinster St / Main St / Moyglare Road signalised junction, this is part of a proposed development south of the town centre adjacent to Parson St. The closure of this arm would create a signalised T junction and would allow the green time from

Leinster St signal stage to be reallocated to the remaining arms, thus increasing their capacity to minimise congestion within the town.

Figure 9-2: Network and Development Proposal in Maynooth

9.2 Forecast Demand Process

Maynooth is covered by a strategic model developed in VISUM, this was used in the assessment of the proposed ring road and provided the microsimulation model with the forecast demand matrices.

The process for generating the forecast demand matrices is presented below:

1. Cordoning of the VISUM models (Base 2019; and Do Minimum and Do Something for 2028 and 2038);

2. From the cordoned models, the demand matrices for Lights and HGVs were extracted;

3. The growth in origin / destination movements was calculated by comparing the Base models against the Do Minimum and Do Something models;

4. In order to import the increase in demands from the forecast VISUM models into the VISSIM models, a zone equivalence table was produced for the Origin and

Destination zones. This enabled the changes in demand from the VISUM model to be allocated to the correct zones in the VISSIM model;

5. An additive approach was adopted whereby any increase in demand was added to the VISSIM base model to generate the forecast demands. However in the event that a reduction was observed, specifically a reduction which resulted in negative demands being presented in the VISSIM forecasts, a multiplicative approach was undertaken whereby a factor was used to reduce the base demands.[5]*

6. Due to the low number of HGVs, an individual origin and destination adjustment was deemed excessive therefore a general factor was applied.

7. General checks were then undertaken on the demands.

The following provides further information on the above process.

Figure 9-3 to Figure 9-5 present the network changes between the Do Minimum and Do Something networks for 2028 and 2038. It can be seen from the Do Something 2028 screenshot that the eastern section of the ring road has been completed, and by 2038 the ring road is fully complete.

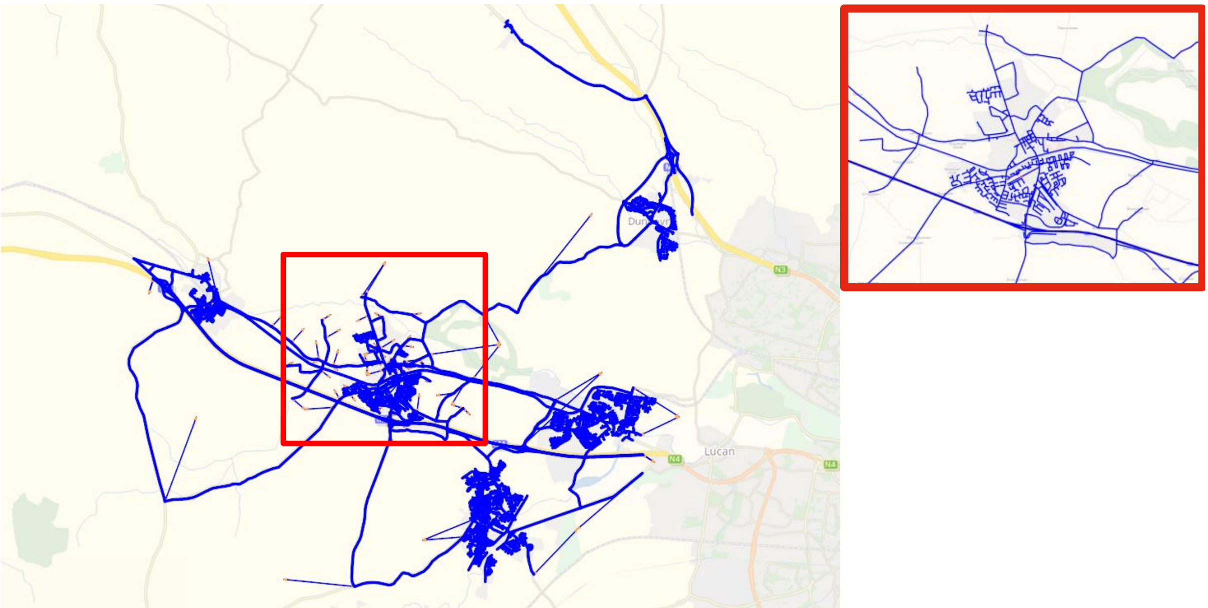


Figure 9-3: Do Minimum 2028 VISUM model

[5] Note: regarding step 5, it was noted that certain movements could not be factored in a multiplicative manner as the VISSIM matrix had no traffic making certain movements, therefore remained zero. This results in a larger demand matrix than expected. Therefore the initial demands generated should be seen as an over estimation of the forecast demand (see 9.3 regarding adjustments to mitigate against over estimation).

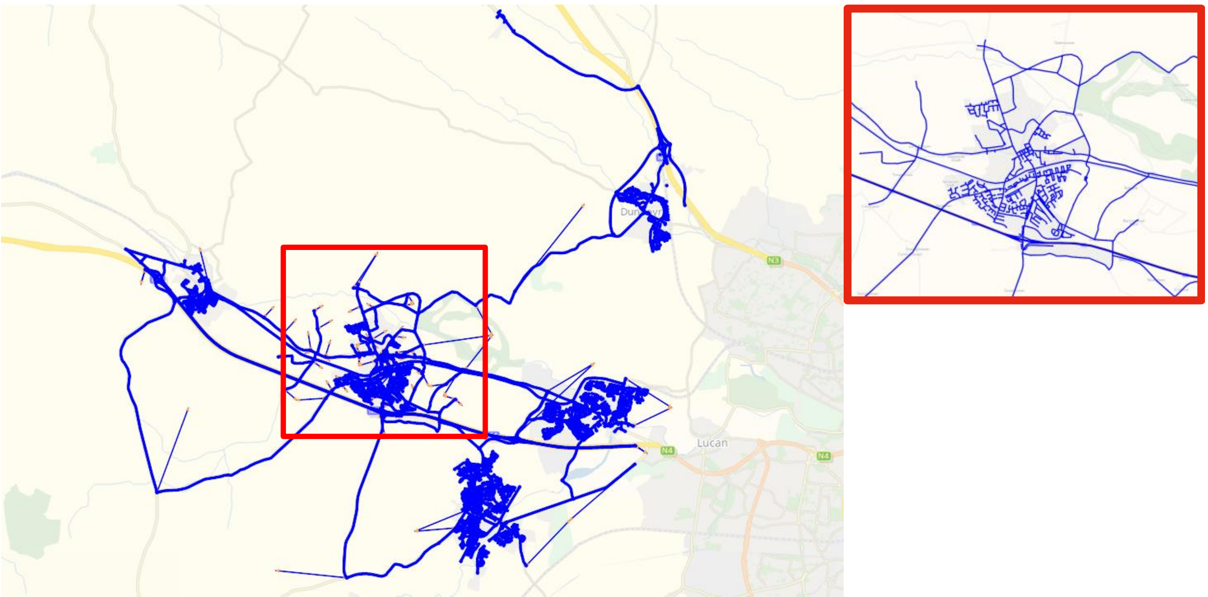


Figure 9-4: Do Something 2028 VISUM model

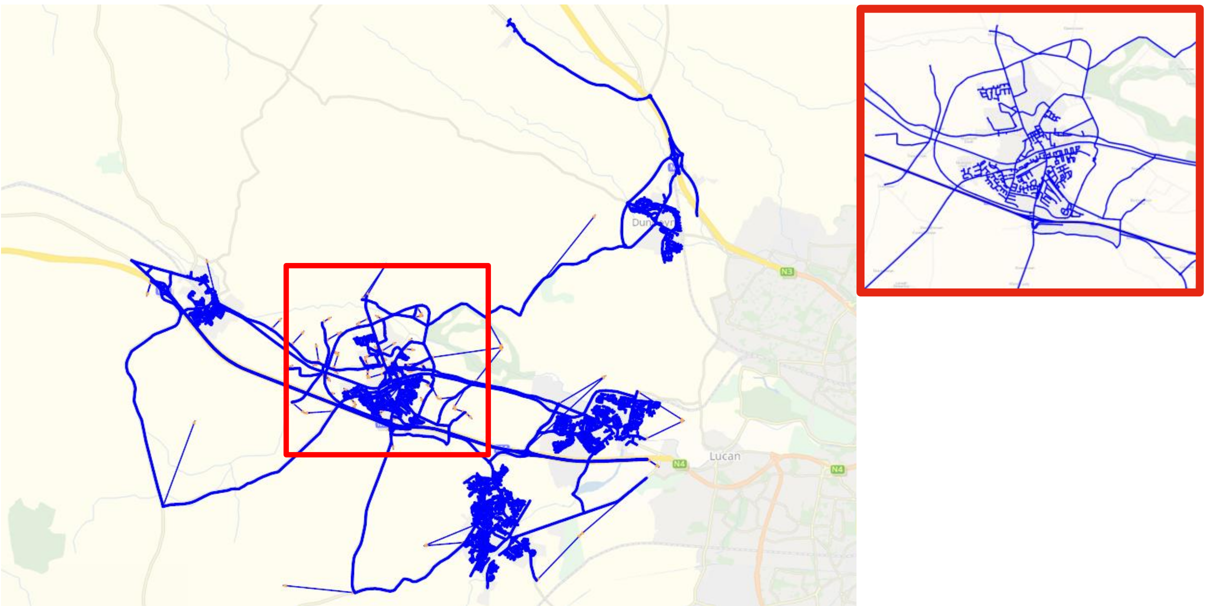


Figure 9-5: Do Something 2038 VISUM Model

As part of the forecasting procedure, a cordon of the VISUM model was extracted to cover the extents of the VISSIM model as shown in Figure 9-6. This covers the key arterial routes into the town and the minor roads adjacent to the town centre.

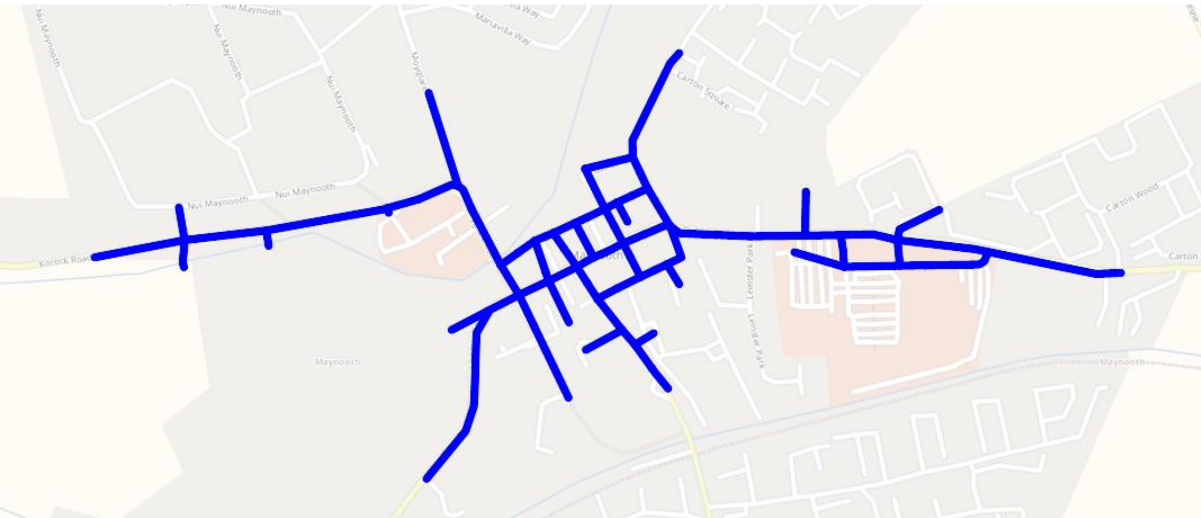


Figure 9-6: Extents of the Cordon from the VISUM model.

The cordon demands were extracted from the VISUM models, the totals for light vehicles and HGVs are presented for the AM and PM peak hours in

Table 9-1 and

Table 9-2 below. It highlights that the Do Minimum 2028 and 2038 show a significant increase in demands from the baseline, whereas the Do Something initially sees an increase in demand in 2028, however a drop in demand in 2038, with the PM 2038 reducing below that of the baseline demands. The differences between the Do Minimum and Do Something demands have been attributed to the various construction stages of the ring road.

Table 9-1. AM Peak hour VISUM Demand Totals

	Year	Lights	HGV
Base	2019	3,285	79
DM	2028	4,470	98
DS	2028	3,928	88
DM	2038	4,858	113
DS	2038	3,360	70

Table 9-2. PM Peak hour VISUM Demand Totals

	Year	Lights	HGV
Base	2019	3,870	68
DM	2028	4,790	83
DS	2028	4,372	73
DM	2038	4,960	94
DS	2038	3,736	65

The differences between the Base VISUM Model and the forecast VISUM models were undertaken and applied to the VISSIM demand matrices. These were applied as a flat profile across the four 15-minute demand segments within the VISSIM models. This is to account for peak spreading rather than aligning with the baseline demand profile, given the level of congestion being observed in the base VISSIM model it is expected that any additional forecast trips will generally try to avoid peak delays. A proportion of the forecast demand was applied to the shoulder periods, the proportion was calculated based on the proportion of the shoulder period demands to the peak hour demands.

The resulting VISSIM demand matrix totals are presented below.

Table 9-3. AM Peak hour VISSIM Demand Totals

	Year	Lights	HGV
Base	2019	3,455	76
DM	2028	4,865	95
DS	2028	4,437	85
DM	2038	5,345	108
DS	2038	4,040	67

Table 9-4. PM Peak hour VISSIM Demand Totals

	Year	Lights	HGV
Base	2019	4209	62
DM	2028	5442	71
DS	2028	5054	62
DM	2038	5823	81
DS	2038	4782	56

It is noted that the VISSIM demands are higher than that of the VISUM demands, this is partly due to the higher baseline and the issues with applying negative demands to origin destination pairs with no volumes as discussed in step 5 of the forecast demand process.

Checks were undertaken on demand profiles to ensure they were no errors in the process. The profiles should generally see a uniform increase in each 15-minute time slice if the process has been applied correctly given the flat profile increase. Figure 9-7 and Figure 9-8 present the VISSIM demand profiles, it can be seen that the Do Minimum and Do Something profiles have been displaced by the increase in demand as expected.

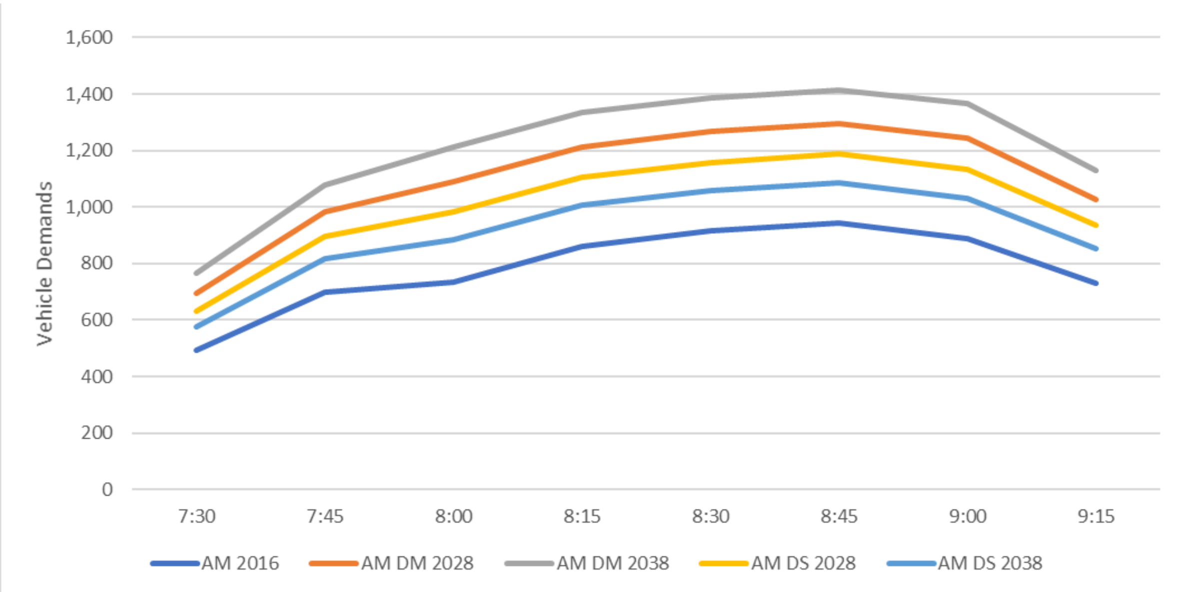


Figure 9-7: VISSIM Demand Profiles for the AM Peak (light vehicles)

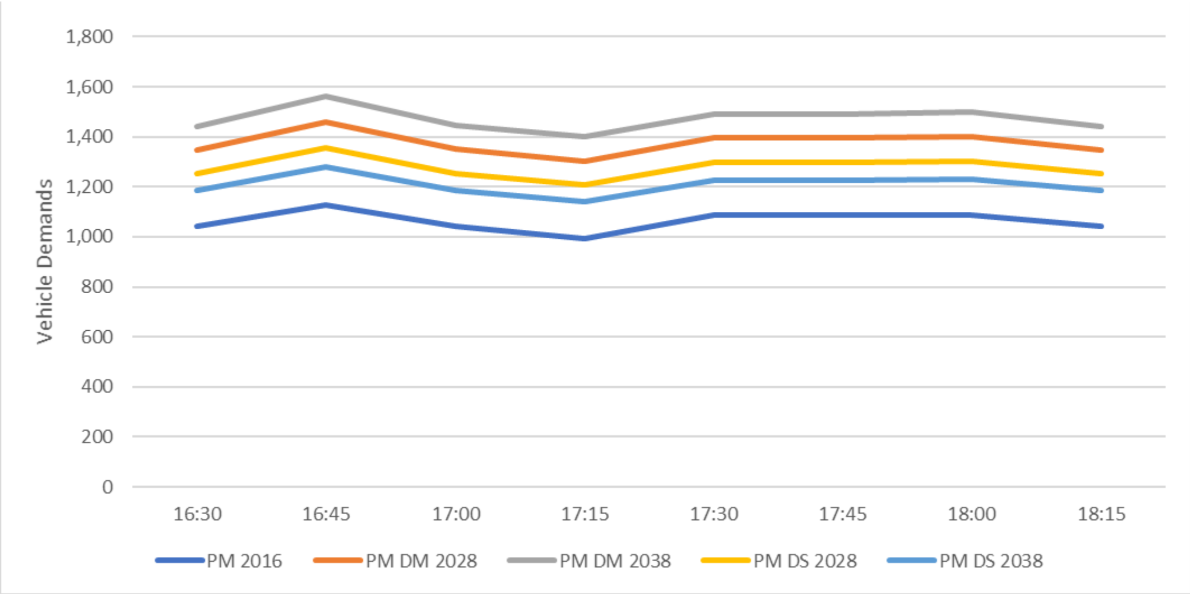


Figure 9-8: VISSIM Demand Profiles for the PM Peak (light vehicles)

Forecasting HGV demands was based on a general network factor based on a comparison between the base and forecast models. The factors applied are shown in **Table 9-5**.

Table 9-5. HGV peak volumes (growth factors)

	Base 2016	Do Min 2028	Do Min 2038	Do Some 2028	Do Some 2038
AM Peak	76	95 (1.25)	109 (1.42)	85 (1.12)	68 (0.89)
PM Peak	62	72 (1.23)	81 (1.40)	63 (1.08)	56 (0.97)

9.3 Initial Assessment

The above forecast demands were assigned as an initial assessment to understand the impact on the network and whether they were realistic and would not cause the network to lock up. The assessment highlighted that a significant number of trips were unable to enter the network during the model period due to high levels of congestion, this was observed in both the Do Minimum and Do Something scenarios.

In order to present a more realistic assessment it was proposed that a 10% reduction in light vehicle demands would be applied to bring the demands in line with the VISUM total projections.

Table 9-6 and Table 9-7 present the adjusted demands which have been applied to the VISSIM models.

Table 9-6. AM Peak Demand Adjustment

		VISUM	VISSIM	10% reduction
Base	2016*	3,285	3,455	-
DM	2028	4,470	4,865	4,378
DS	2028	3,928	4,437	3,993
DM	2038	4,858	5,345	4,810
DS	2038	3,360	4,040	3,636

Table 9-7. PM Peak Demand Adjustment

		VISUM	VISSIM	10% reduction
Base	2016*	3,870	4,209	-
DM	2028	4,790	5,442	4,898
DS	2028	4,372	5,054	4,548
DM	2038	4,960	5,823	5,240
DS	2038	3,736	4,782	4,303

**Note: The VISSIM model has a baseline of 2016 compared to the VISUM model which has a baseline of 2019, for the purpose of this assessment no growth has been applied to align these model years as data was not available to calibrate and validate the VISSIM model to 2019.*

9.4 Network Alternations

The Do Something models include a closure of the Leinster St arm of the Parson St / Leinster St / Main St / Moyglare Road signalised junction. This closure allows for the reallocation of green time to be applied to other arms on the junction.

The screenshot below presents the network adjustments which have been applied

Do Minimum Do Something

Figure 9-9: Network Coding at the Parson St / Leinster St / Main St / Moyglare Road signalised junction

In addition to the Parson St / Leinster St / Main St / Moyglare Road signalised junction, further signal adjustments were applied to the model, specifically at the Moyglare Road/ Kilcock Road and the Kilcock Road / Manor Mills Car Park signalised junctions. These adjustments were necessary to ensure the road network within the town centre continued to flow in a reasonable manner.

9.5 Model Observations

The following sections provide a general overview of the network conditions for each of the forecast models. The same viewpoint has been taken, viewing northbound across Maynooth from above Parson St.

9.5.1 2028 Observations

The Do Minimum scenarios see long queues on all approaches into Maynooth during the AM Period in 2028 as shown in **Figure 9-10**. Of most note are the queues along Kilcock Road and Moyglare Rd.

Figure 9-10: Do Minimum AM Peak 2028 @8:30

The Do Something scenario during the AM Peak 2028 shows a significant reduction in queueing on the Parson Street approach into Maynooth and also the Moyglare Road Southbound between Kilcock Road and Main Road. With closure of the Leinster Street approach to Parson St / Leinster St / Main St / Moyglare Road junction allows for additional green time to be reallocated to other approaches and reduce queueing.

Figure 9-11: Do Something AM Peak 2028 @8:30

In the PM peak 2028, the Do Minimum scenario is similar to that of the AM peak, with queueing along Kilcock Road and Moyglare Road as well as queueing within the town centre extending onto Straffan Road. No queueing is observed on Parson St.

Figure 9-12: Do Minimum PM Peak 2028 @17:30

Similar traffic conditions are observed in the PM between the Do Something scenario and Do Minimum in 2028. Given the similar demands being imposed on the network this is not unexpected and requires a more detailed analysis to distinguish them apart (see model results in **section 9.6** and **9.7**).

Figure 9-13: Do Something PM Peak 2028 @17:30

9.5.2 2038 Observations

The AM peak 2038 experiences significant queueing on all approaches into the town in the Do Minimum scenario, whereas the Do Something scenario presents little to no queueing in the network. The reduction in demand as a result of the completed ring road has had a noticeable effect on the traffic conditions within Maynooth.

Figure 9-14: Do Minimum AM Peak 2038 @08:30

Figure 9-15: Do Something AM Peak 2038 @08:30

The PM peak 2038 displays similar differences between the Do Minimum and Do Something scenarios to that of the AM peak with queues significantly reducing on all approaches to Maynooth with the exception of the Kilcock Road where long queues are still observed.

Figure 9-16: Do Minimum PM Peak 2038 @17:30

Figure 9-17: Do Something PM Peak 2038 @17:30

9.6 Network Statistics

The following section provides a general overview of the network performance. Table 9-8 and Table 9-9 present the average delay and average speed per vehicle, plus the latent demand i.e. the number of vehicles which could not access the network at the end of the model period.

Table 9-8: AM Network Statistics

Scenario		Average Delay per Vehicle (min:sec)	Average Speed per Vehicle (kph)	Latent Demand (vehicles)
2028	DM	03:07	13	228
	DS	02:24	16	55
2038	DM	05:14	8	1193
	DS	00:51	24	2

Table 9-9: PM Network Statistics

Scenario		Average Delay per Vehicle (min:sec)	Average Speed per Vehicle (kph)	Latent Demand (vehicles)
2028	DM	02:23	14	581
	DS	02:31	13	473
2038	DM	03:48	10	1149
	DS	01:13	19	28

The Do Minimum scenarios perform poorest with an average delay of around 3 minutes and 5 minutes 10 seconds delay during the AM peak in 2028 and 2038 respectively. The introduction of a partial ring road in 2028 and a full ring road in 2038 significantly reduces the delay, this is most noticeable in the 2038 where the average delay per vehicle reduces by around 4 minutes and 20 seconds to around 50 seconds.

The PM period sees a similar trend to that of the AM period however to a lesser extent, with a marginal increase in 2028 between the Do Minimum and Do Something, however closer examination into the model data indicated that the individual seeds (the individual model runs that are used to produce an average model result) were showing significant variations, therefore based on the model runs it cannot be stated that the Do Something model is either worse of better than that of the Do Minimum scenario. A more noticeable separation can be seen in 2038, with the Do Something presenting savings of 2 minutes and 30 seconds per vehicle once the ring road has been completed.

Average speeds per vehicle are directly related to the average delay per vehicle, with speeds increasing as delays reduce. In 2038 both the AM and PM periods see a significant increase in speed within Maynooth once the ring road has been completed with average speed increasing from 8kph to 24kph during the AM and 10kph to 19kph during the PM.

Of most note is the latent demand which highlights the number of vehicles which are unable to access the modelled network due to queueing restricting their access. The Do Minimum 2038 scenarios highlight latent demands of over 1,000 vehicles in both the AM and PM periods, the significant reductions in the Do Something scenario are as a result of a reduction in demand (see Table 9-6 and Table 9-7). The latent demand in the Do minimum 2038 scenario is mainly from Kilcock Road (R148), Moyglare Road and Straffan Road (A406). Latent demand for the Do Something model is only noticeable during the 2028 PM period where around 400 vehicles are held off the network, this is mainly from Kilcock Road (R148) and to a lesser extent the University north access onto Kilcock Road. Once the western section of the ring road is complete there are very few vehicles being held off the network.

9.7 Queue Lengths

The following section considers the impact on queueing within the network. Figure 9-18 references the four junctions being analysed:

Figure 9-18: Queue Analysis Locations

Table 9-10 presents the AM peak average queue lengths, however Appendix G contains the average and maximum queue lengths. The table highlights that the approaches to each of the four junctions generally see a reduction in queue lengths with the partial and full completion of the ring road. The largest reduction is seen in 2038 where the queues significantly reduce from 100s of meters in the Do Minimum scenario to 10s of meters in the Do Something scenario. The largest reductions are at Junction 1 where queues of 300m on the approaches from Kilcock Road and Moyglare Road (north of Kilcock Road) are reduced below 40m.

Table 9-10: AM Peak Average Queue Lengths (metres)

Junction	Arm	AM 2016	AM DM 2028	AM DS 2028	AM DM 2038	AM DS 2038
1	Kilcock Road	38	210	197	351	37
	Moyglare Rd (North of Kilcock Road)	29	291	258	368	14
	Moyglare Rd (South of Kilcock Road)	40	90	97	133	25
2	Moyglare Rd	61	103	24	141	15
	Main St	35	64	55	81	14
	Leinster St	1	0	0	1	0
	Parson St	36	140	23	235	10
3	Main St (West of Straffan Rd)	43	19	23	11	16
	Straffan Rd (South of Main St)	17	26	27	32	16
	Main St (East of Straffan Rd)	26	113	110	130	9
4	Straffan Rd (North of Doctor's Lane)	1	1	2	2	0
	Doctor's Lane	1	2	1	4	0
	Straffan Rd (South of Doctor's Lane)	9	104	100	182	1

The PM peak 2028 scenarios presents similar queue lengths in both the Do Minimum and Do Something (Table 9-11 presents the Average queue lengths, however Appendix G contains the average and maximum queue lengths). However in 2038 the Do Something presents a significant reduction in queueing with the exception of Kilcock Road approach to Moyglare Road (junction 1). Further investigation has highlighted that the VISUM model is distributing more traffic from the Maynooth University Campus onto the Kilcock Road rather than the Moyglare Road in the Do Something model, hence the long queue on Kilcock Road. It is expected that a more even distribution of trips from the University Campus (as per the Do Minimum 2038 model), would result in queues reducing on Kilcock Road.

Table 9-11: PM Peak Average Queue Lengths (metres)

Junction	Arm	PM 2016	PM DM 2028	PM DS 2028	PM DM 2038	PM DS 2038
1	Kilcock Road	122	433	427	440	280
	Moyglare Rd (North of Kilcock Road)	16	320	324	367	6
	Moyglare Rd (South of Kilcock Road)	22	71	54	56	43
2	Moyglare Rd	49	67	28	27	27
	Main St	20	12	12	12	11
	Leinster St	3	2	0	0	0
	Parson St	14	43	28	32	24
3	Main St (West of Straffan Rd)	40	22	20	20	23
	Straffan Rd (South of Main St)	20	19	16	16	16
	Main St (East of Straffan Rd)	36	25	18	15	18
4	Straffan Rd (North of Doctor's Lane)	1	1	0	0	0
	Doctor's Lane	22	19	3	2	2
	Straffan Rd (South of Doctor's Lane)	2	1	1	1	0

10. Summary and Conclusions

10.1 Summary of the Base Model

A model of Maynooth has been developed and calibrated using count data. The lack of validation data (i.e. journey time data) has been substituted with queue length data which the model generally replicates. Furthermore, key behavioural and typical conditions have been modelled to improve the overall realism of the modelling.

Models have been developed for morning (AM peak) and evening (PM peak) periods.

The modelled area includes the Maynooth town centre as well as the adjacent local road network. Within the modelled extent, the following key performance indicators have been reported:

- All 32 turning counts pass TAG criteria in both the AM and PM peaks;
- Queue lengths provide a good representation of the congestion levels within Maynooth; and
- Detailed driver / vehicle behaviours have been captured within the model.

10.2 Scenario Testing Summary

The strategic VISUM model was utilised to extract the forecast demands through Maynooth for the 2028 and 2038 Do Minimum and Do Something scenarios. The forecast demands indicated that there was a steady growth in demand during the AM and PM peak with the Do Minimum scenario, however, the Do Something scenario highlights a lower demand projection between the base and 2028 followed by a reduction in demand in 2038 (Figure 10-1). A manual adjustment of 10% reduction to the demands was necessary due to high levels of congestion generally observed in the Do Minimum and Do Something scenarios (PM peak 2028 only). The reduction aligned the demands more closely with that of the VISUM model.

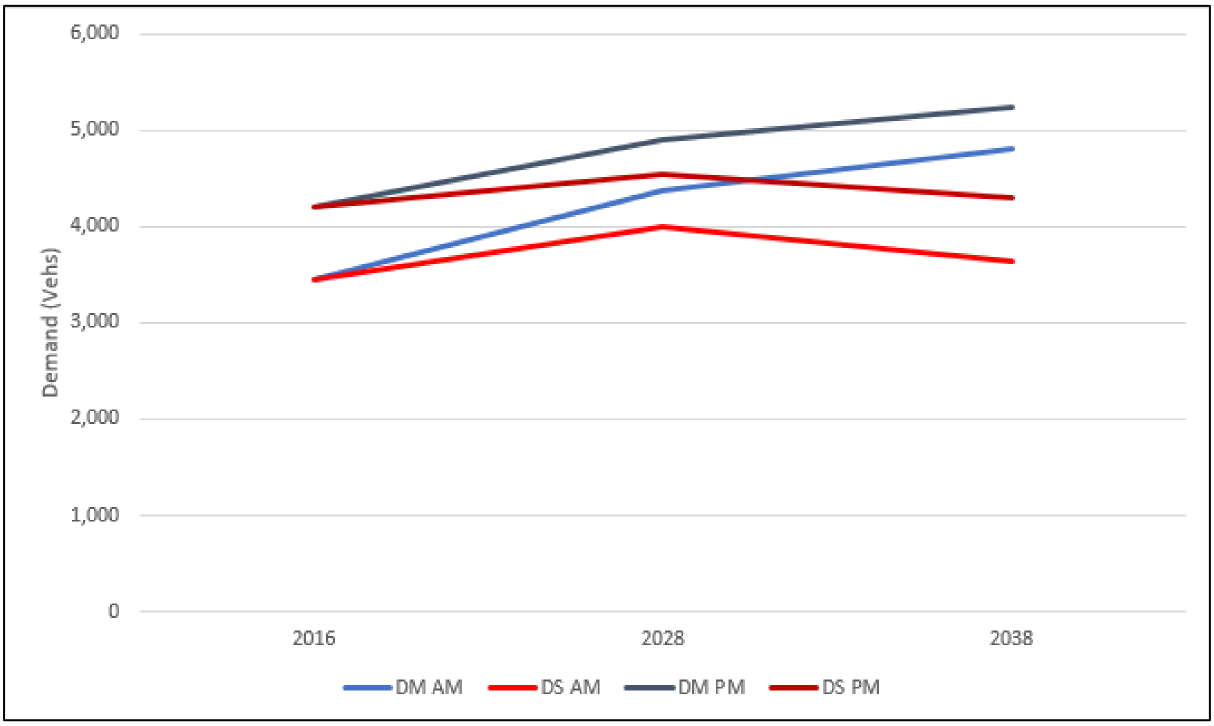


Figure 10-1: Demand Projections

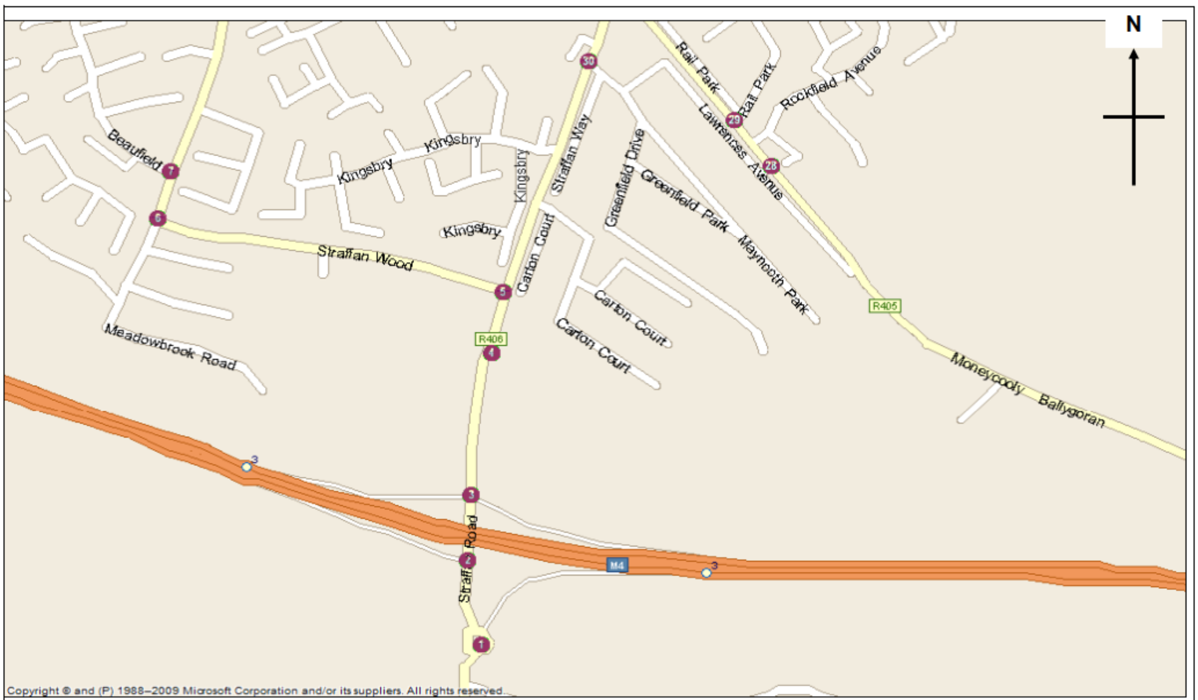
The majority of the network changes lie outside the VISSIM modelled network i.e. the ring road, therefore their impact is observed in the demands, however the Leinster St closure has been modelled in VISSIM, where signal adjustments were implemented to the Parson St / Leinster St / Main St / Moyglare Road signalised junction. Further adjustments were made to other signalised junctions for both the Do Minimum and Do Something scenarios in order to improve the network operation, these adjustments were focused on the Kilcock Road/ Moyglare Road junction and the adjacent Manor Mills Car Park entrance junction.

Model observations aligned well with the model results as expected, with significant queueing in the Do Minimum models, whereas the Do Something models indicated smaller queues, especially after the completion of the full ring road in 2038. The only exception to this was the 2028 PM Do Something scenario which continued to display high level of queuing in the network similar to that of the Do Minimum scenario. Further adjustments to the signals could improve the operation of the network, however this would require modelling in LINSIG to optimise and coordinate the signals through Maynooth.

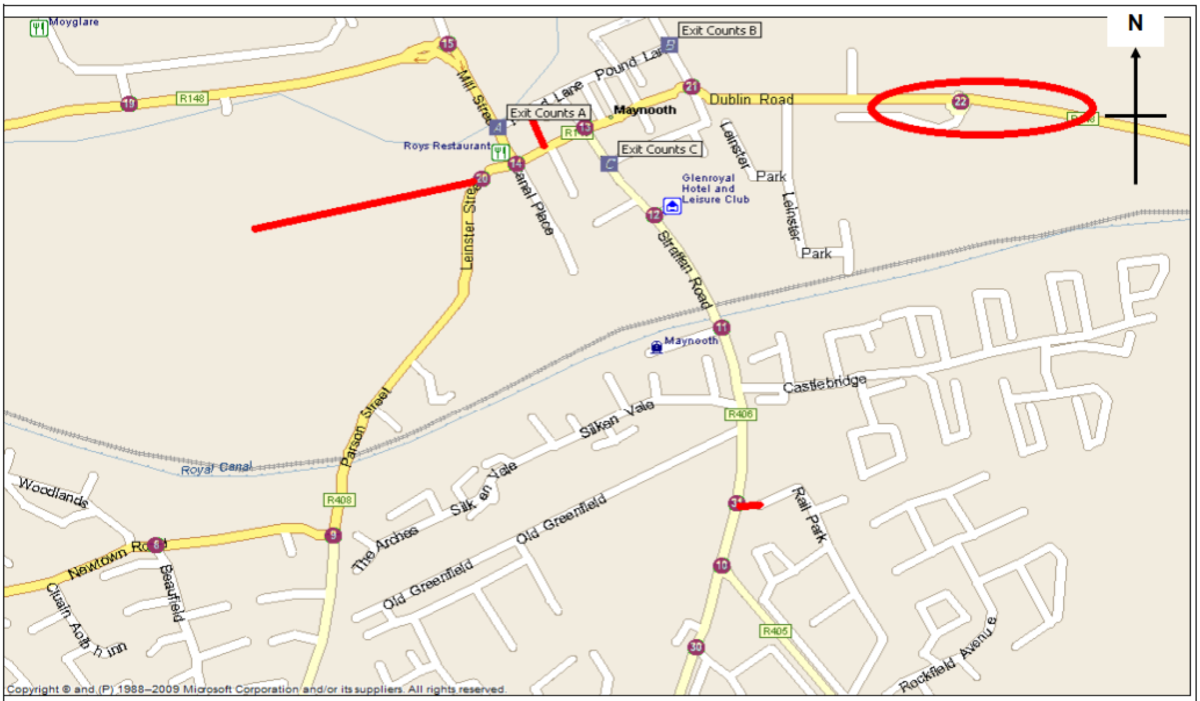
10.3 Conclusions

The forecast demand projections within Maynooth will place considerable pressure on the constrained road network, due to the substantial level of growth expected. In the Do-Minimum scenario, vehicle queues are likely to extend beyond the town centre and cause major delays to both local access and through traffic. In the Do-Something scenario, the introduction of the eastern section of the ring road will have some benefit to Maynooth in 2028, however, this is mainly in the AM peak, although there will be a reduction in demand during the PM peak. The main benefit will come with the completion of the MOOR ring road in 2038, where town centre demands could reduce lower than the current baseline flow, resulting in shorter queues on most approach to the key junctions in Maynooth. This modelling data indicates the positive role of the alternative MOOR and MERR roads in reducing cross-town centre trips by private motor vehicles, which will reduce the impact of the wider sustainable travel proposals in the Maynooth and Environs ABTA to restrict town centre access to private motor vehicles when alternative roads become available to bypass the centre.

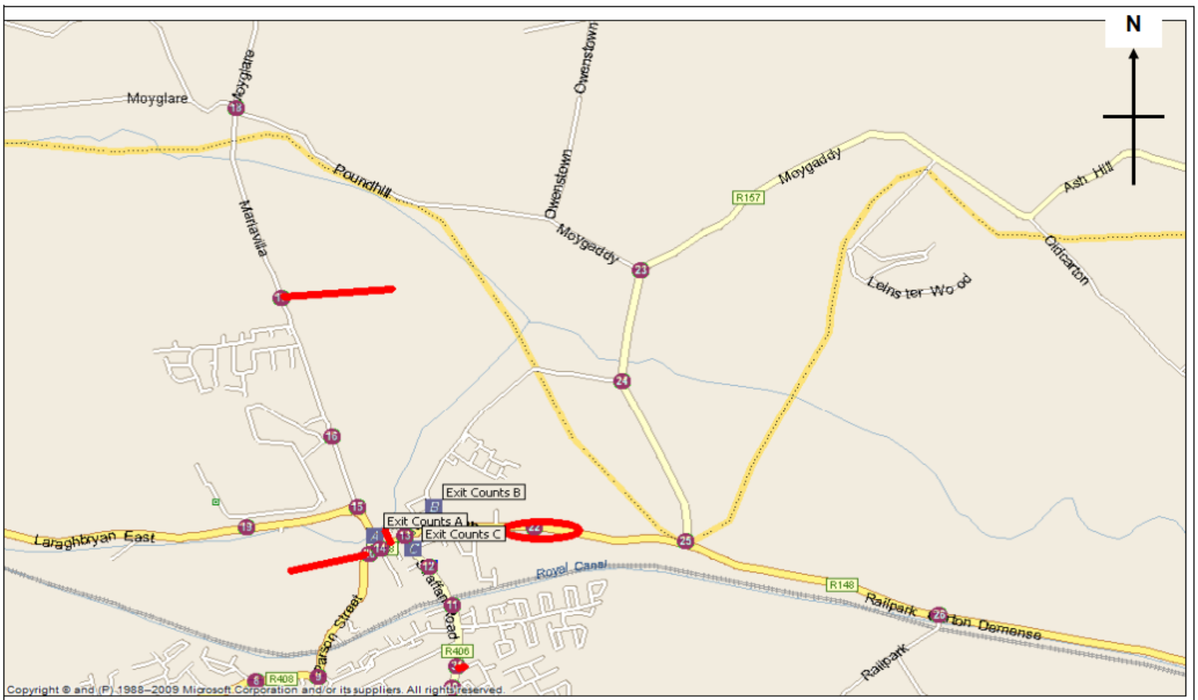
Appendix A – Traffic Survey Data Locations



NDC NATIONWIDE DATA COLLECTION	**Sites / Location:**	1 to 7 and 28 to 30 / Maynooth	**Project No:**	6288	**Diagram No:**	6288-01	**Drawn By:**	AC
	Survey Date:	Tuesday 17th May 2016	**Project Name:**	MAYNOOTH				
	Survey Times:	07:00 to 19:00	**Diagram Title:**	General Location Plan - JTC and Queues				



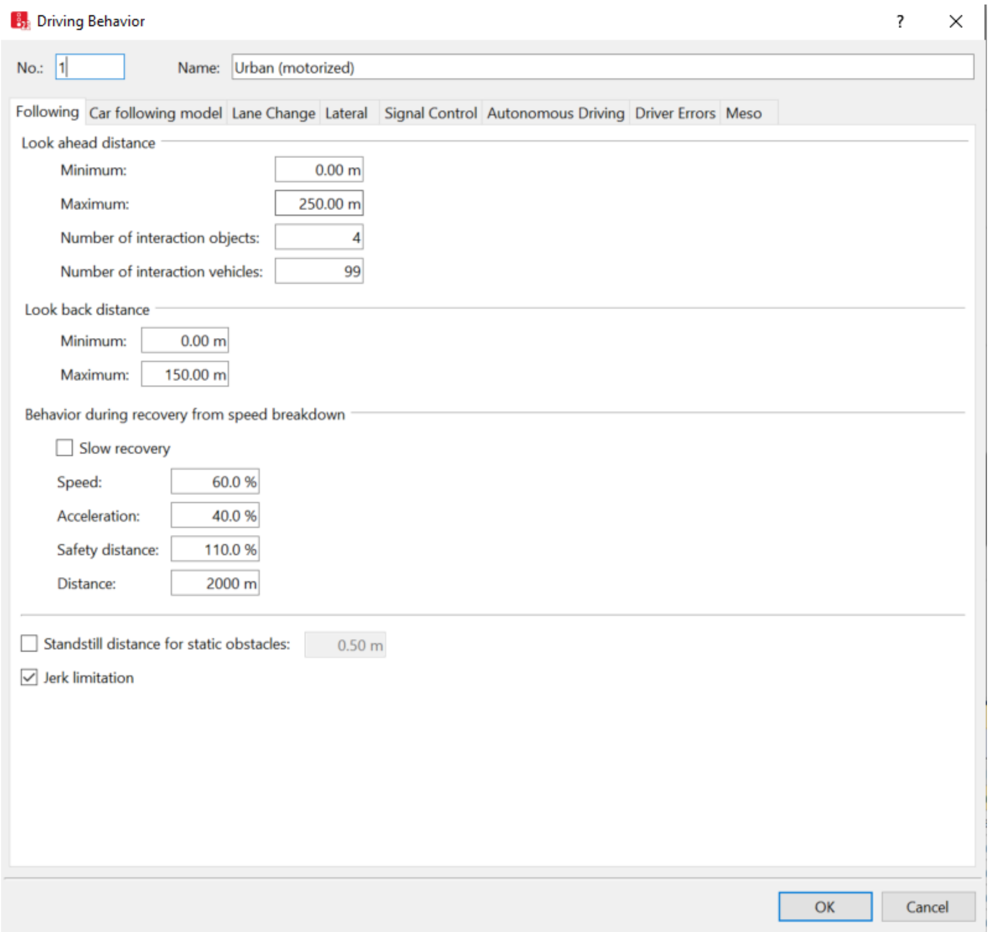
NDC NATIONWIDE DATA COLLECTION	Sites / Location:	8 to 15, 19 to 22, 31 and Exit A to C / Maynooth	Project No:	6288	Diagram No:	6288-02	Drawn By:	AC
	Survey Dates:	Sites 8 to 11, 22: Tuesday 17th May 2016 Sites 12 to 15, 19 to 21, 31 and Exit A to C: Thursday 19th May 16	Project Name:	MAYNOOTH				
	Survey Times:	07:00 to 19:00	Diagram Title:	General Location Plan - JTC and Queues				

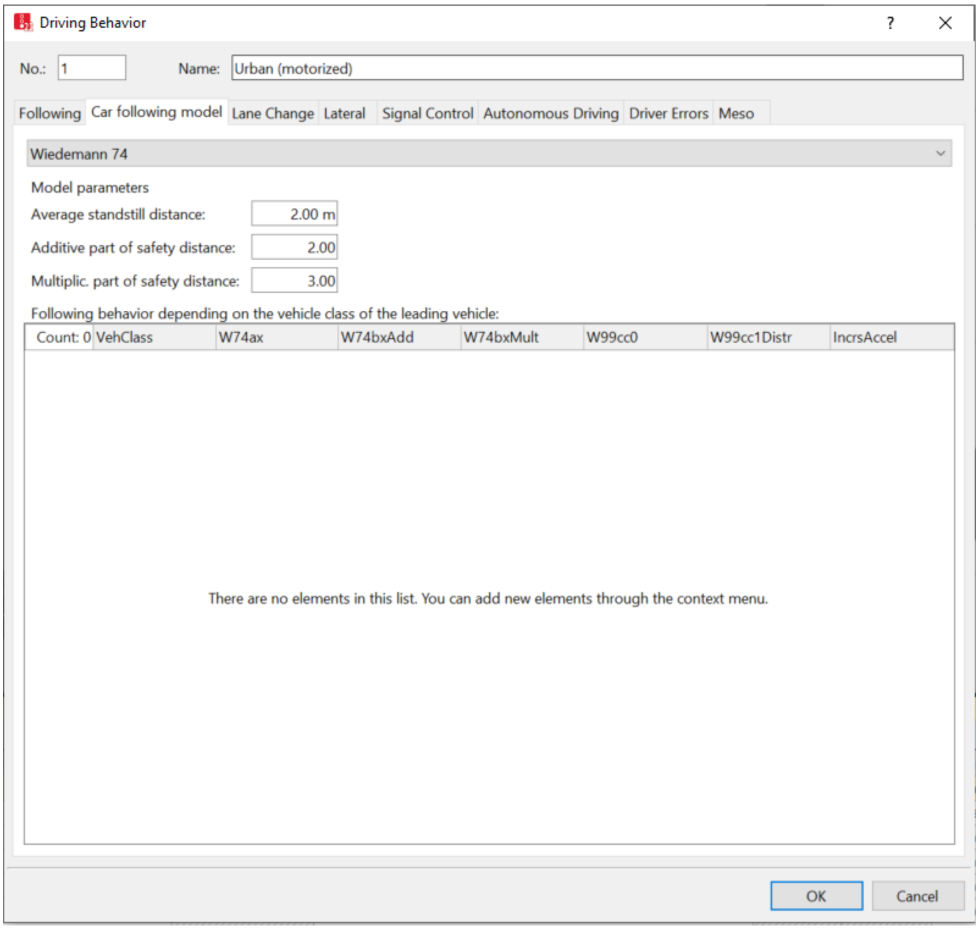


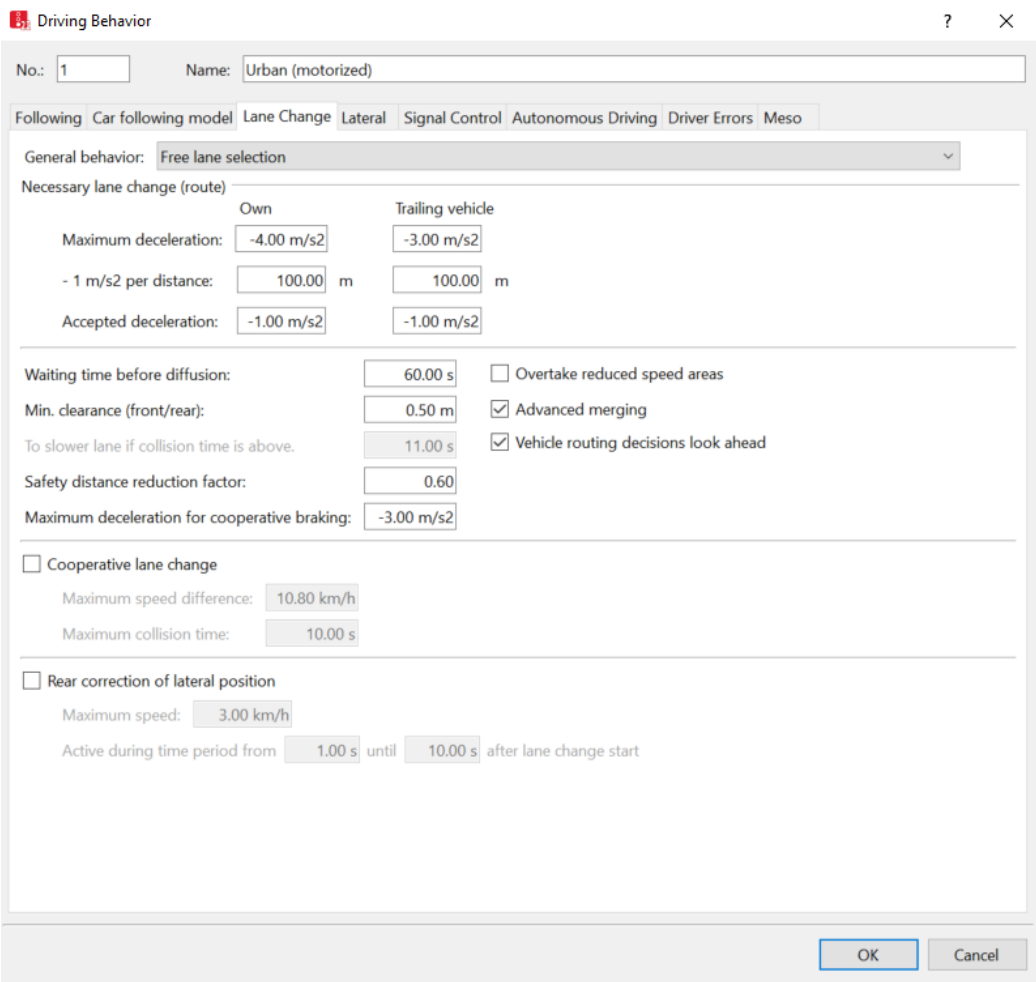
NDC NATIONWIDE DATA COLLECTION	Sites / Location:	16 to 18 and 23 to 26 / Maynooth	Project No:	6288	Diagram No:	6288-03	Drawn By:	AC
	Survey Dates:	Site 16: Thursday 19th May 2016 Sites 17 & 18, 23 to 26: Tuesday 17th May 2016	Project Name:	MAYNOOTH				
	Survey Times:	07:00 to 19:00	Diagram Title:	General Location Plan - JTC and Queues				

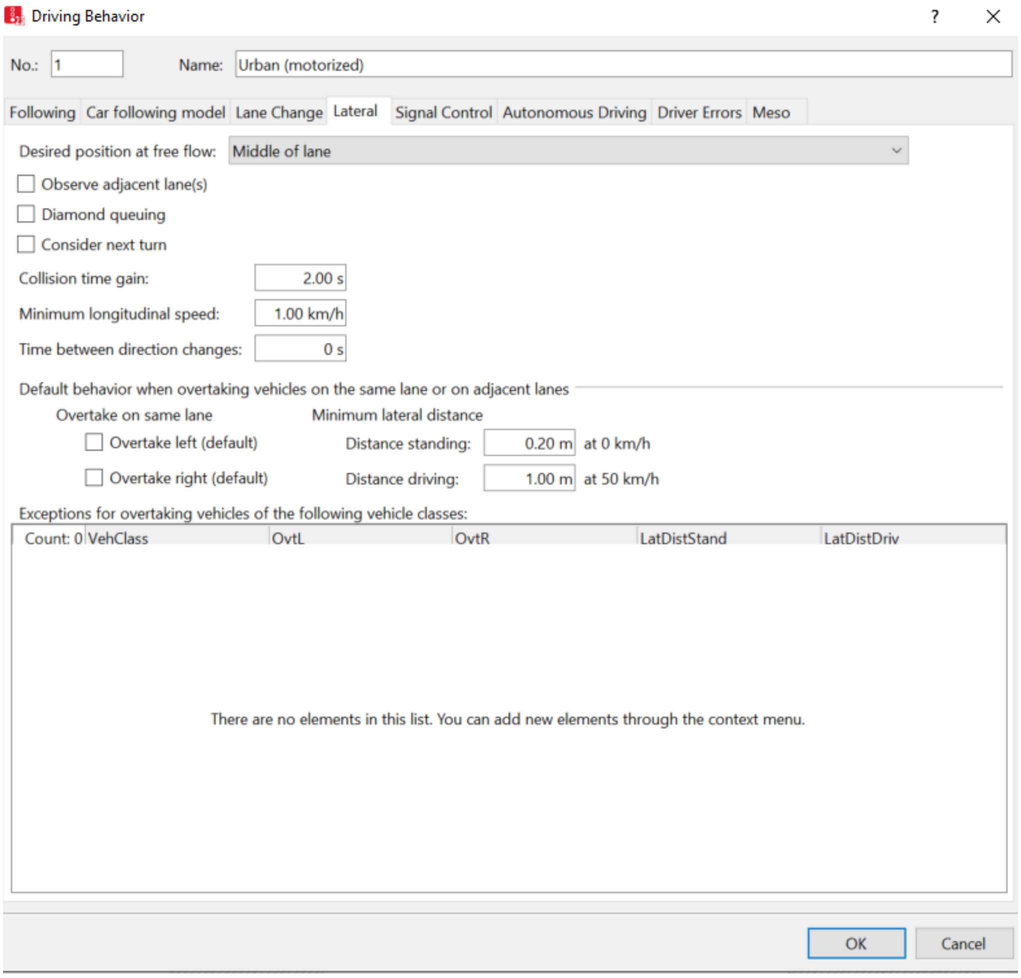
Appendix B – Driving Behaviour Parameters

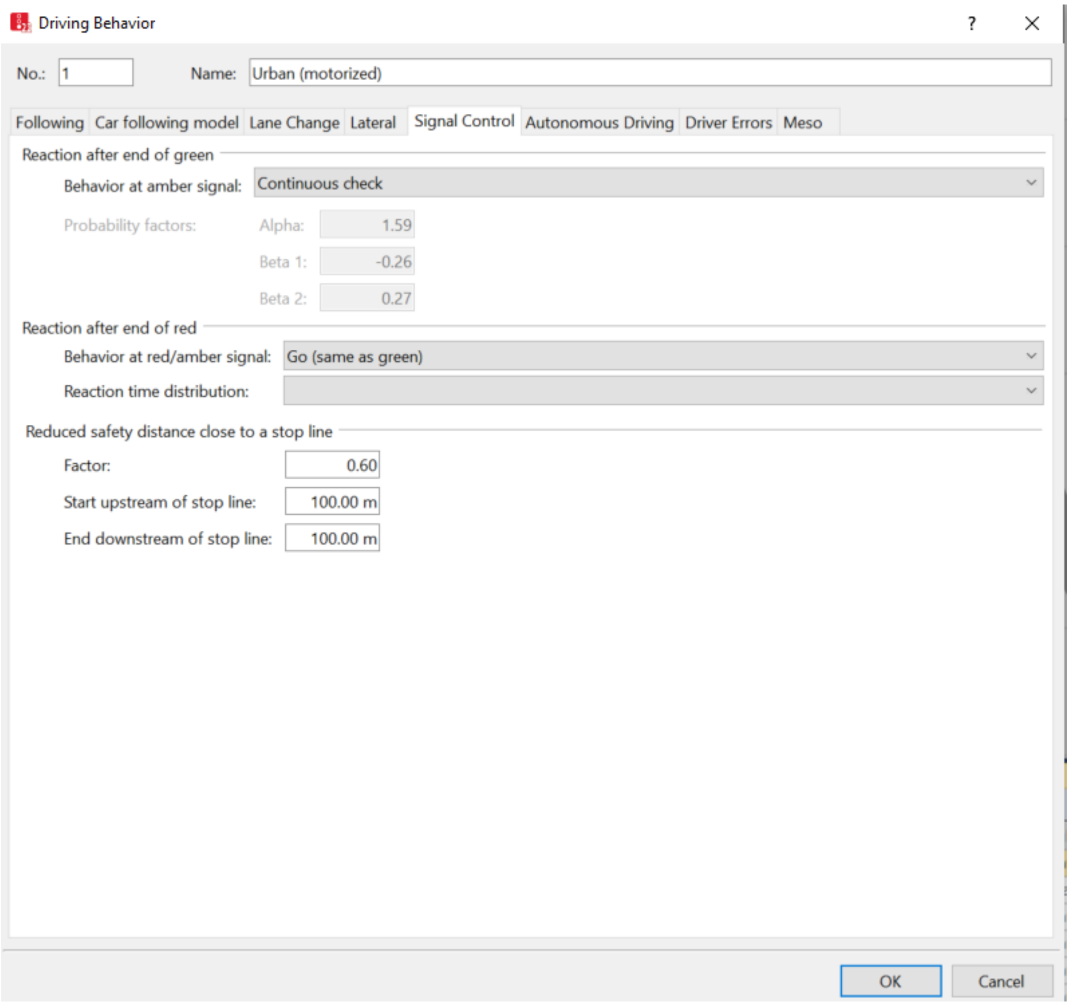
B.1 Urban (Motorized)

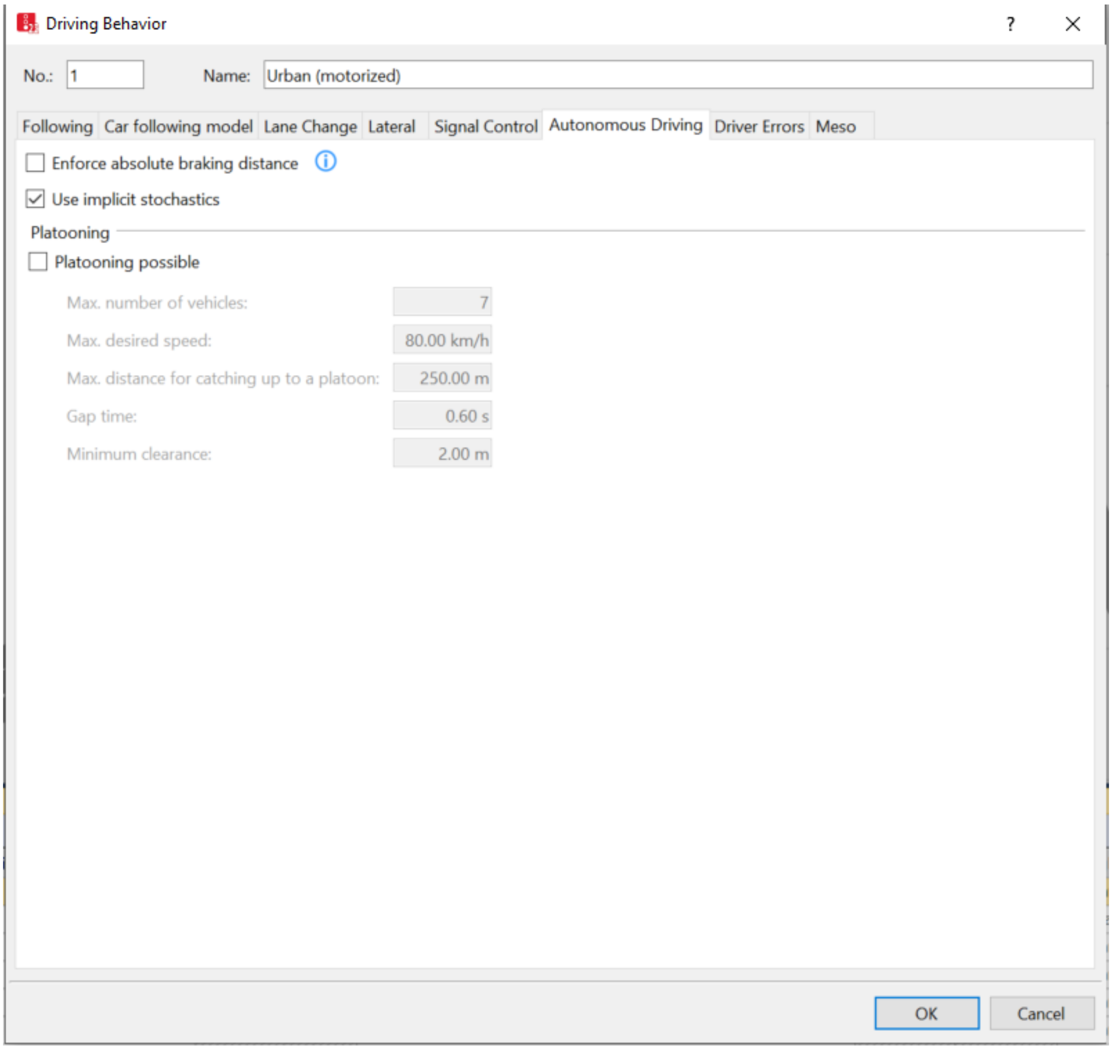


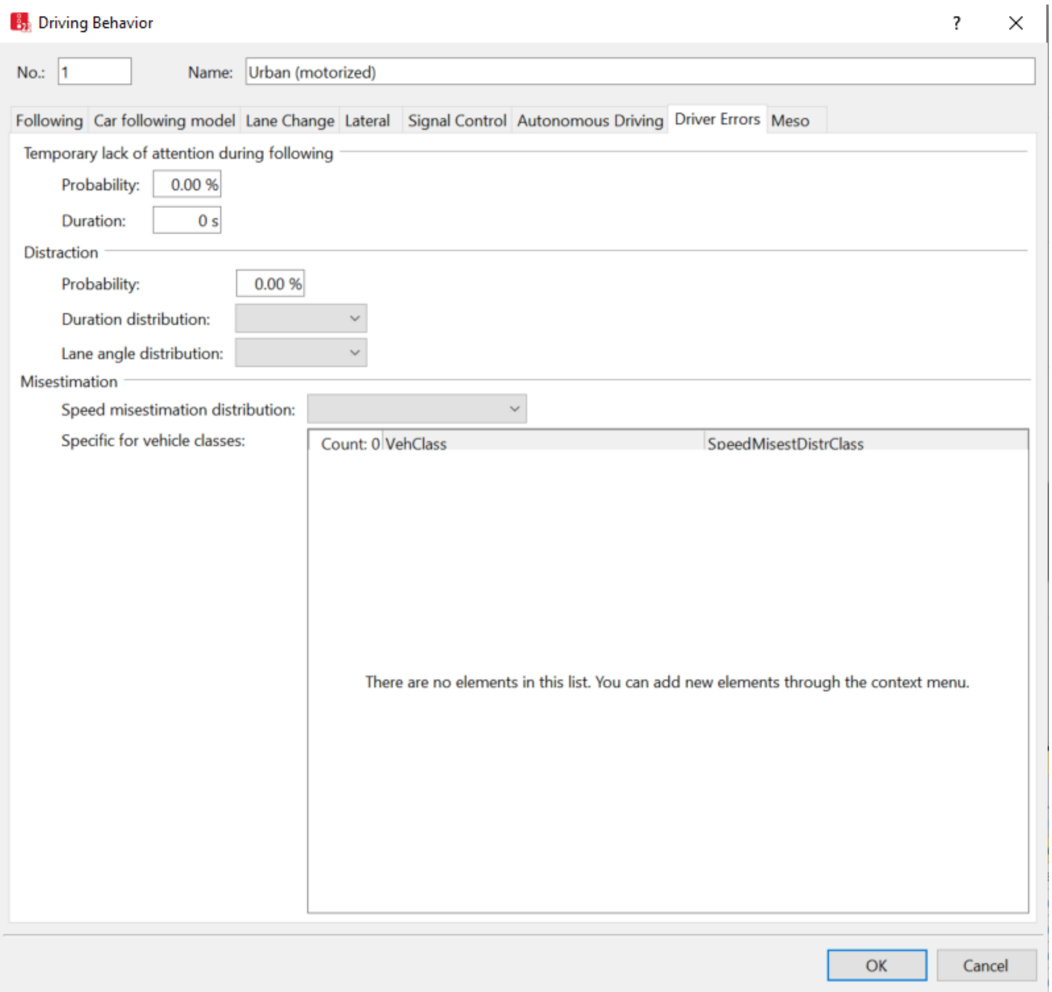

Driving Behavior
No.: 1
Name: Urban (motorized)
Following
Car following model
Lane Change
Lateral
Signal Control
Autonomous Driving
Driver Errors
Meso
Wiedemann 74
Model parameters
Average standstill distance: 2.00 m
Additive part of safety distance: 2.00
Multiplic. part of safety distance: 3.00
Following behavior depending on the vehicle class of the leading vehicle:
Count: 0
VehClass
W74ax
W74bxAdd
W74bxMult
W99cc0
W99cc1Distr
IncrsAccel
There are no elements in this list. You can add new elements through the context menu.
OK
Cancel

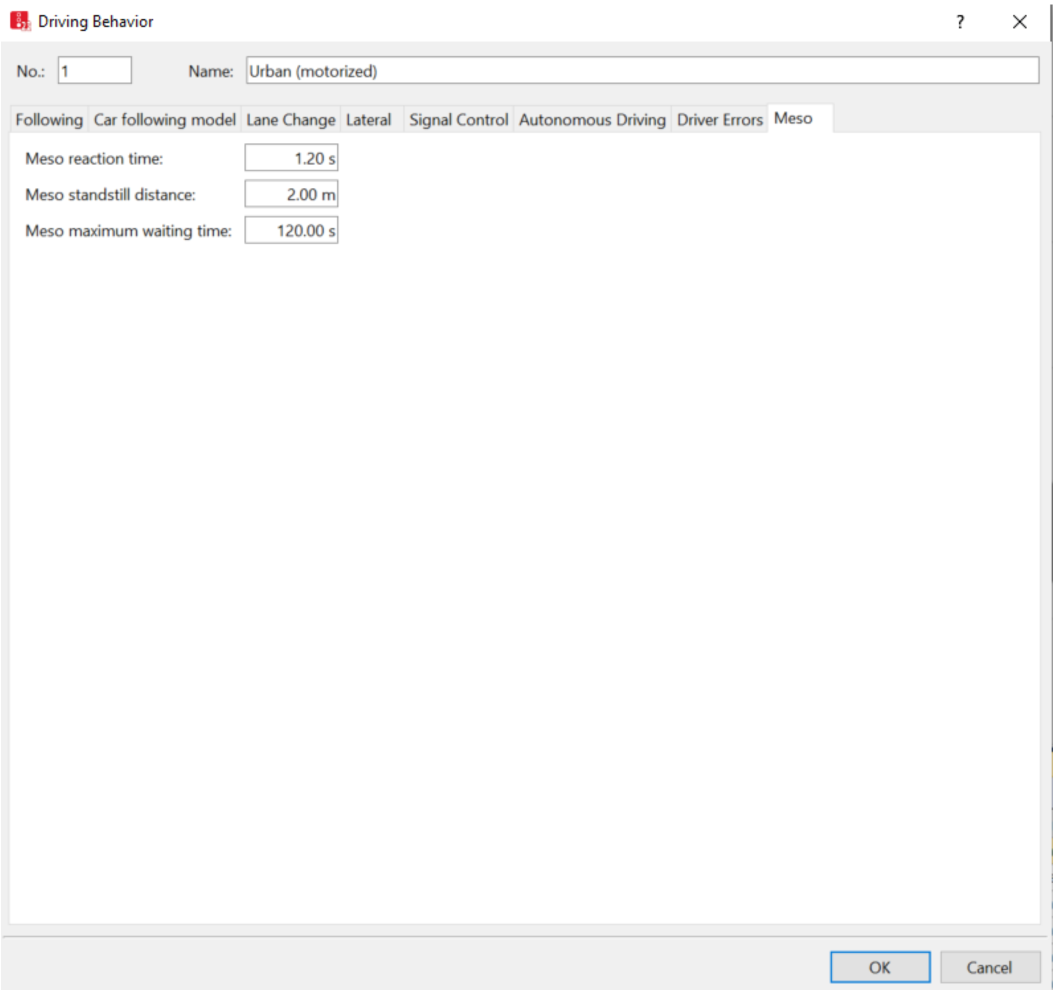

Driving Behavior
No.: 1
Name: Urban (motorized)
Following
Car following model
Lane Change
Lateral
Signal Control
Autonomous Driving
Driver Errors
Meso
General behavior: Free lane selection
Necessary lane change (route)
Own
Trailing vehicle
Maximum deceleration: -4.00 m/s2 -3.00 m/s2
- 1 m/s2 per distance: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


Driving Behavior
No.: 1
Name: Urban (motorized)
Following
Car following model
Lane Change
Lateral
Signal Control
Autonomous Driving
Driver Errors
Meso
Desired position at free flow: Middle of lane
Observe adjacent lane(s)
Diamond queuing
Consider next turn
Collision time gain: 2.00 s
Minimum longitudinal speed: 1.00 km/h
Time between direction changes: 0 s
Default behavior when overtaking vehicles on the same lane or on adjacent lanes
Overtake on same lane
Minimum lateral distance
Overtake left (default)
Distance standing: 0.20 m at 0 km/h
Overtake right (default)
Distance driving: 1.00 m at 50 km/h
Exceptions for overtaking vehicles of the following vehicle classes:
Count: 0
VehClass
OvtL
OvtR
LatDistStand
LatDistDriv
There are no elements in this list. You can add new elements through the context menu.
OK
Cancel


Driving Behavior
No.: 1
Name: Urban (motorized)
Following
Car following model
Lane Change
Lateral
Signal Control
Autonomous Driving
Driver Errors
Meso
Reaction after end of green
Behavior at amber signal: Continuous check
Probability factors:
Alpha: 1.59
Beta 1: -0.26
Beta 2: 0.27
Reaction after end of red
Behavior at red/amber signal: Go (same as green)
Reaction time distribution:
Reduced safety distance close to a stop line
Factor: 0.60
Start upstream of stop line: 100.00 m
End downstream of stop line: 100.00 m
OK
Cancel


Driving Behavior
No.: 1
Name: Urban (motorized)
Following
Car following model
Lane Change
Lateral
Signal Control
Autonomous Driving
Driver Errors
Meso
Enforce absolute braking distance
Use implicit stochastics
Platooning
Platooning possible
Max. number of vehicles: 7
Max. desired speed: 80.00 km/h
Max. distance for catching up to a platoon: 250.00 m
Gap time: 0.60 s
Minimum clearance: 2.00 m
OK
Cancel


Driving Behavior
No.: 1
Name: Urban (motorized)
Following
Car following model
Lane Change
Lateral
Signal Control
Autonomous Driving
Driver Errors
Meso
Temporary lack of attention during following
Probability: 0.00 %
Duration: 0 s
Distraction
Probability: 0.00 %
Duration distribution:
Lane angle distribution:
Misestimation
Speed misestimation distribution:
Specific for vehicle classes:
Count: 0
VehClass
SpeedMisestDistrClass
There are no elements in this list. You can add new elements through the context menu.
OK
Cancel


Driving Behavior
No.: 1
Name: Urban (motorized)
Following
Car following model
Lane Change
Lateral
Signal Control
Autonomous Driving
Driver Errors
Meso
Meso reaction time: 1.20 s
Meso standstill distance: 2.00 m
Meso maximum waiting time: 120.00 s
OK
Cancel

Appendix C – Priority Rule Gap Times

PrioRule	Link	Lane	Pos	AllLanes	AllVehTypes	VehClasses	AllPedTypes	PedClasses	MinGapTime	MinClear	MaxSpeed	LookBeyRedSig	EffectDrivDir
1	41		9.230	✔	✔		✔		3.0	0.0	180.0		Forward
2	41		6.696	✔	✔		✔		3.0	0.0	180.0		Forward
3	46		15.048	✔	✔		✔		3.0	0.0	180.0		Forward
4	10099		8.069	✔	✔		✔		3.0	0.0	180.0		Forward
5	10099		8.277	✔	✔		✔		3.0	0.0	180.0		Forward
6	40		0.947	✔	✔		✔		3.0	0.0	180.0		Forward
7	40		3.555	✔	✔		✔		3.0	0.0	180.0		Forward
8	3: 1	3 - 1	51.136		✔		✔		3.0	0.0	180.0		Forward
8	8: R148/	8 - 1	144.382		✔		✔		3.0	0.0	180.0		Forward
9	8: R148/	8 - 1	144.619		✔		✔		3.0	0.0	180.0		Forward
10	27	27 - 1	126.940		✔		✔		3.0	0.0	180.0		Forward
11	27	27 - 1	126.630		✔		✔		3.0	0.0	180.0		Forward
12	27	27 - 1	96.849		✔		✔		3.0	0.0	180.0		Forward
13	26	26 - 1	67.802		✔		✔		3.0	0.0	180.0		Forward
13	27	27 - 1	53.633		✔		✔		3.0	0.0	180.0		Forward
14	27	27 - 1	56.258		✔		✔		3.0	0.0	180.0		Forward
14	10083	10083 - 1	2.726		✔		✔		3.0	0.0	180.0		Forward
15	27	27 - 1	56.581		✔		✔		3.0	0.0	180.0		Forward
16	27	27 - 1	3.654		✔		✔		3.0	0.0	180.0		Forward
16	10085	10085 - 1	1.661		✔		✔		3.0	0.0	180.0		Forward
17	27	27 - 1	3.564		✔		✔		3.0	0.0	180.0		Forward
17	10078	10078 - 1	2.639		✔		✔		3.0	0.0	180.0		Forward
18	27	27 - 1	3.754		✔		✔		3.0	0.0	180.0		Forward
19	23: Dillow's Road/	23 - 1	68.046		✔		✔		3.0	0.0	180.0		Forward
20	22: Dillow's Road/	22 - 1	185.944		✔		✔		3.0	0.0	180.0		Forward
21	23: Dillow's Road/	23 - 1	135.383		✔		✔		3.0	0.0	180.0		Forward
22	22: Dillow's Road/	22 - 1	120.966		✔		✔		3.0	0.0	180.0		Forward
23	85: 1	85 - 1	166.123		✔		✔		3.0	0.0	180.0		Forward
24	85: 1	85 - 1	167.863		✔		✔		3.0	0.0	180.0		Forward
25	85: 1	85 - 1	166.382		✔		✔		3.0	0.0	180.0		Forward
25	86: 1	86 - 1	147.306		✔		✔		3.0	0.0	180.0		Forward
26	86: 1	86 - 1	131.491		✔		✔		3.0	0.0	180.0		Forward
27	10003	10003 - 1	5.361		✔		✔		3.0	0.0	180.0		Forward
28	10000	10000 - 1	6.961		✔		✔		3.0	0.0	180.0		Forward
28	10107	10107 - 1	7.388		✔		✔		3.0	0.0	180.0		Forward
29	4: 1	4 - 1	83.005		✔		✔		3.0	0.0	180.0		Forward
29	10107	10107 - 1	5.234		✔		✔		3.0	0.0	180.0		Forward
30	10239	10239 - 1	8.751		✔		✔		3.0	0.0	180.0		Forward

PrioRule	Link	Lane	Pos	AllLanes	AllVehTypes	VehClasses	AllPedTypes	PedClasses	MinGapTime	MinClear	MaxSpeed	LookBeyRedSig	EffectDrivDir
30	10239	10239 - 1	8.751		✔		✔		3.0	0.0	180.0		Forward
31	5: 1	5 - 1	81.416		✔		✔		3.0	0.0	180.0		Forward
31	10243	10243 - 1	9.256		✔		✔		3.0	0.0	180.0		Forward
32	5: 1	5 - 1	81.416		✔		✔		3.0	0.0	180.0		Forward
33	10267	10267 - 1	3.696		✔		✔		3.0	0.0	180.0		Forward
34	44: Doctors Lane/New Man Plac...	44 - 1	123.953		✔		✔		3.0	0.0	180.0		Forward
35	10036	10036 - 1	1.363		✔		✔		3.0	0.0	180.0		Forward
36	10034	10034 - 1	4.668		✔		✔		2.5	0.0	180.0		Forward
37	15: Single C/W Regional Road	15 - 1	53.284		✔		✔		2.5	0.0	180.0		Forward
37	10034	10034 - 1	4.260		✔		✔		2.5	0.0	180.0		Forward
38	135: Single C/W Regional Road	135 - 1	49.334		✔		✔		3.0	0.0	180.0		Forward
39	85: 1	85 - 1	32.889		✔		✔		3.0	0.0	180.0		Forward
40	85: 1	85 - 1	32.542		✔		✔		3.0	0.0	180.0		Forward
40	86: 1	86 - 1	277.425		✔		✔		3.0	0.0	180.0		Forward
41	85: 1	85 - 1	32.356		✔		✔		3.0	0.0	180.0		Forward
42	49: 1	49 - 1	26.468		✔		✔		3.0	0.0	180.0		Forward
42	49: 1	49 - 2	26.483		✔		✔		3.0	0.0	180.0		Forward
43	49: 1	49 - 1	26.103		✔		✔		3.0	0.0	180.0		Forward
43	49: 1	49 - 2	26.168		✔		✔		3.0	0.0	180.0		Forward
44	49: 1	49 - 1	26.300		✔		✔		3.0	0.0	180.0		Forward
44	49: 1	49 - 2	26.308		✔		✔		3.0	0.0	180.0		Forward
45	49: 1	49 - 1	25.929		✔		✔		3.0	0.0	180.0		Forward
45	49: 1	49 - 2	25.985		✔		✔		3.0	0.0	180.0		Forward
45	50: 1	50 - 1	20.439		✔		✔		3.0	0.0	180.0		Forward
46	10175	10175 - 1	0.000		✔		✔		3.0	0.0	180.0		Forward
47	10170	10170 - 1	0.000		✔		✔		3.0	0.0	180.0		Forward
48	10170	10170 - 1	0.000		✔		✔		3.0	0.0	180.0		Forward
48	10172	10172 - 1	74.343		✔		✔		3.0	0.0	180.0		Forward
48	10174	10174 - 1	73.660		✔		✔		3.0	0.0	180.0		Forward
49	45: 1	45 - 1	6.941		✔		✔		0.0	5.0	10.0		Forward
50	10004	10004 - 1	17.553		✔		✔		3.0	0.0	180.0		Forward
50	10052	10052 - 1	15.709		✔		✔		0.0	15.0	30.0		Forward
51	50: 1	50 - 1	3.729		✔		✔		0.0	5.0	10.0		Forward
52	86: 1	86 - 1	138.449		✔		✔		0.0	5.0	15.0		Forward
53	8: R148/	8 - 1	32.928		✔		✔		0.0	10.0	15.0		Forward
54	137: Single C/W Regional Road	137 - 1	8.555		✔		✔		0.0	5.0	15.0		Forward
55	137: Single C/W Regional Road	137 - 2	8.709		✔		✔		0.0	5.0	15.0		Forward
56	16: Single C/W Regional Road	16 - 1	10.640		✔		✔		0.0	5.0	15.0		Forward

57	86: 1	86 - 1	37.887	☐	✔		✔		3.0	0.0	180.0	☐	Forward
58	5: 1	5 - 1	65.228	☐	✔		✔		3.0	0.0	180.0	☐	Forward
59	85: 1	85 - 1	79.220	☐	✔		✔		3.0	0.0	180.0	☐	Forward
60	86: 1	86 - 1	249.225	☐	✔		✔		3.0	0.0	180.0	☐	Forward
61	10190	10190 - 1	2.743	☐	✔		✔		0.0	3.0	10.0	☐	Forward
62	10004	10004 - 1	27.524	☐	✔		✔		3.0	0.0	180.0	☐	Forward
62	10004	10004 - 1	28.817	☐	✔		✔		0.0	10.0	30.0	☐	Forward
63	10058	10058 - 1	20.426	☐	✔		✔		0.0	15.0	50.0	☐	Forward
64	123	123 - 1	8.474	☐	✔		✔		0.0	8.0	180.0	☐	Forward
64	124	124 - 1	7.818	☐	✔		✔		0.0	8.0	180.0	☐	Forward
65	123	123 - 1	8.421	☐	✔		✔		0.0	8.0	180.0	☐	Forward
65	124	124 - 1	7.871	☐	✔		✔		0.0	8.0	180.0	☐	Forward

Appendix D – Flow Matrices

D.1 AM Matrices

07:30 - 07:45 Lights

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	1	0	0	0	0	0	0	0	1	0	0	4	6	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	3	0	0	0	29	0	3	6	2	0	3	0	0	0	0	0	0	0	0	3	1	0	0	3	1	0	0
3	0	0	0	0	0	4	0	0	0	10	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
4	0	0	0	0	0	0	0	0	3	12	0	3	0	2	0	2	0	0	0	0	0	1	0	0	2	1	0	0	0	2	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	2	6	5	1	0	0	0	0	2	1	0	0	0	1	0	2	0	0	0	1	0	2	0	1	6	7	1	4	1	2	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1	1	0	2	0	1	0	0	0	8	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
10	8	25	3	23	0	8	0	0	14	0	0	3	2	7	0	1	3	4	3	7	0	1	0	0	2	1	3	0	1	1	0	1
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1	4	3	4	1	1	0	0	1	0	1	0	0	2	0	2	1	0	1	1	0	2	0	0	8	1	10	0	1	2	1	0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	20	7	5	1	0	5	0	0	1	12	0	1	4	0	0	1	0	0	2	9	0	0	0	0	0	0	0	0	0	1	0	0
15	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	1	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
20	6	2	2	0	0	1	0	0	0	5	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	1	0	0	0	3	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0

07:45 - 08:00 Lights

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	1	1	0	0	1	0	0	0	2	0	0	5	9	0	0	0	0	1	6	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	4	0	0	0	41	0	4	8	3	0	4	0	0	0	0	0	0	0	0	4	1	0	0	4	1	0	0
3	0	0	0	0	0	6	0	0	0	14	0	1	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
4	0	0	0	0	0	0	0	0	4	18	0	4	0	2	0	3	0	0	0	0	0	2	0	0	2	1	0	0	0	3	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	3	9	7	2	0	0	0	0	3	1	0	0	0	2	0	3	0	0	0	2	0	3	0	2	8	9	1	5	1	3	0	0
7	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	2	2	0	2	0	1	0	0	0	12	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
10	12	36	4	33	0	12	0	0	20	0	0	5	2	10	0	1	5	5	4	11	0	1	0	0	2	1	4	0	1	1	0	2
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1	6	4	5	1	1	0	0	1	0	2	0	0	3	0	2	1	0	1	1	0	3	0	0	11	1	15	0	1	2	2	0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	29	11	7	1	0	7	0	0	1	17	0	1	6	0	0	1	0	0	3	14	0	0	0	0	0	0	0	0	1	1	0	0
15	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	2	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	2	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
20	9	3	2	0	0	2	0	0	1	7	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	1	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	10	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
26	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	1	0	0	0	4	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0

08:00 - 08:15 Lights

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	1	1	0	0	1	0	0	0	2	0	0	5	9	0	0	0	0	2	6	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	4	0	0	0	43	0	4	9	3	0	4	0	0	0	0	0	0	0	0	5	1	0	0	4	1	0	0
3	0	0	0	0	0	7	0	0	0	15	0	1	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
4	0	0	0	0	0	0	0	0	4	19	0	4	0	2	0	3	0	0	0	0	0	2	0	0	2	1	0	0	0	3	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	4	9	8	2	0	0	0	0	3	1	0	0	0	2	0	3	0	0	0	2	0	3	0	2	8	10	1	6	1	3	0	0
7	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	2	2	0	2	0	1	0	0	0	12	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
10	12	38	4	36	0	12	0	0	22	0	0	5	2	11	0	1	5	6	5	12	0	1	0	0	2	1	4	0	1	1	0	2
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1	6	4	5	1	1	0	0	1	0	2	0	0	4	0	3	1	0	1	1	0	4	0	0	11	1	16	0	1	3	2	0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	30	11	7	1	0	8	0	0	1	18	0	1	7	0	0	1	0	0	3	14	0	0	0	0	0	0	0	0	1	1	0	0
15	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	2	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	2	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
20	9	3	3	0	0	2	0	0	1	7	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	1	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	11	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
26	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	1	0	0	0	4	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0

08:15 - 08:30 Lights																																
Zone	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
1	0	1	1	0	0	1	0	0	0	2	0	0	6	11	0	0	0	0	2	8	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	5	0	0	0	52	0	5	11	3	0	5	0	0	0	0	0	0	0	0	6	1	0	0	5	1	0	0
3	0	0	0	0	0	8	0	0	0	18	0	1	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
4	0	0	0	0	0	0	0	0	5	22	0	5	0	3	0	4	0	0	0	0	0	2	0	0	3	1	0	0	0	4	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	4	11	9	3	0	0	0	0	4	2	0	0	0	3	0	4	0	0	0	2	0	3	0	2	10	12	1	7	2	4	0	0
7	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	2	2	0	3	0	1	0	0	0	15	0	2	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
10	13	40	4	37	0	13	0	0	23	0	0	5	2	11	0	1	5	6	5	12	0	1	0	0	2	1	4	0	1	1	0	2
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	2	8	5	7	1	1	0	0	1	0	3	0	0	4	0	3	1	0	1	2	0	4	0	0	14	1	19	0	2	3	2	0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	36	13	8	1	0	9	0	0	1	22	0	1	8	0	0	1	0	0	4	17	0	0	0	0	0	0	0	0	1	1	0	0
15	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	10	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	2	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	2	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
20	11	3	3	1	0	2	0	0	1	8	0	1	0	0	0	0	0	0	7	0	0	0	0	0	1	0	0	0	1	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	13	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
26	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	1	0	0	0	5	0	0	0	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	4	1	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0

08:30 - 08:45 Lights																																
Zone	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
1	0	1	1	0	0	1	0	0	0	2	0	0	7	12	0	0	0	0	2	8	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	5	0	0	0	54	0	5	11	3	0	5	0	0	0	0	0	0	0	0	6	1	0	0	5	1	0	0
3	0	0	0	0	0	8	0	0	0	19	0	1	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
4	0	0	0	0	0	0	0	0	5	23	0	5	0	3	0	4	0	0	0	0	0	2	0	0	3	1	0	0	0	4	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	4	12	10	3	0	0	0	0	4	2	0	0	0	3	0	4	0	0	0	2	0	3	0	2	10	12	1	7	2	4	0	0
7	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	2	2	0	3	0	1	0	0	0	15	0	2	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
10	15	47	5	44	0	15	0	0	27	0	0	6	3	14	0	1	6	7	6	14	0	1	0	0	3	1	5	0	1	1	0	2
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	2	8	5	7	1	1	0	0	1	0	3	0	0	4	0	3	1	0	1	2	0	4	0	0	14	1	19	0	2	3	2	0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	37	14	9	1	0	9	0	0	2	23	0	1	8	0	0	1	0	0	4	18	0	0	0	0	0	0	0	0	1	1	0	0
15	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	10	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	2	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	2	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
20	11	4	3	1	0	2	0	0	1	9	0	1	0	0	0	0	0	0	7	0	0	0	0	0	1	0	0	0	1	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	13	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
26	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	1	0	0	0	5	0	0	0	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	4	1	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0

08:30 - 08:45 Lights

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	1	1	0	0	1	0	0	0	2	0	0	7	12	0	0	0	0	2	8	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	5	0	0	0	56	0	5	11	4	0	5	0	0	0	0	0	0	0	0	6	1	0	0	5	1	0	0
3	0	0	0	0	0	9	0	0	0	19	0	1	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
4	0	0	0	0	0	0	0	0	5	24	0	5	0	3	0	4	0	0	0	0	0	2	0	0	3	1	0	0	0	4	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	5	12	10	3	0	0	0	0	4	2	0	0	0	3	0	4	0	0	0	2	0	4	0	2	11	13	1	7	2	4	0	0
7	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	2	2	0	3	0	1	0	0	0	16	0	2	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
10	16	49	5	46	0	16	0	0	28	0	0	6	3	14	0	1	6	7	6	15	0	1	0	0	3	1	5	0	1	1	0	2
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	2	8	5	7	1	1	0	0	1	0	3	0	0	5	0	3	1	0	1	2	0	5	0	0	15	1	20	0	2	3	2	0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	39	14	9	1	0	10	0	0	2	23	0	1	8	0	0	1	0	0	4	18	0	0	0	0	0	0	0	0	1	1	0	0
15	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	11	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	2	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	2	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
20	12	4	3	1	0	3	0	0	1	9	0	1	0	0	0	0	0	0	7	0	0	0	0	0	1	0	0	0	1	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	14	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
26	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	1	0	0	0	5	0	0	0	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	5	1	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0

08:45- 09:00 Lights

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	1	1	0	0	1	0	0	0	2	0	0	7	12	0	0	0	0	2	8	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	5	0	0	0	56	0	5	11	4	0	5	0	0	0	0	0	0	0	0	6	1	0	0	5	1	0	0
3	0	0	0	0	0	9	0	0	0	19	0	1	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
4	0	0	0	0	0	0	0	0	5	24	0	5	0	3	0	4	0	0	0	0	0	2	0	0	3	1	0	0	0	4	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	5	12	10	3	0	0	0	0	4	2	0	0	0	3	0	4	0	0	0	2	0	4	0	2	11	13	1	7	2	4	0	0
7	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	2	2	0	3	0	1	0	0	0	16	0	2	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
10	16	49	5	46	0	16	0	0	28	0	0	6	3	14	0	1	6	7	6	15	0	1	0	0	3	1	5	0	1	1	0	2
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	2	8	5	7	1	1	0	0	1	0	3	0	0	5	0	3	1	0	1	2	0	5	0	0	15	1	20	0	2	3	2	0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	39	14	9	1	0	10	0	0	2	23	0	1	8	0	0	1	0	0	4	18	0	0	0	0	0	0	0	0	1	1	0	0
15	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	11	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	2	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	2	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
20	12	4	3	1	0	3	0	0	1	9	0	1	0	0	0	0	0	0	7	0	0	0	0	0	1	0	0	0	1	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	14	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
26	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	1	0	0	0	5	0	0	0	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	5	1	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0

09:00 - 09:15 Lights

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	1	1	0	0	1	0	0	0	2	0	0	6	11	0	0	0	0	2	8	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	5	0	0	0	52	0	5	11	3	0	5	0	0	0	0	0	0	0	0	6	1	0	0	5	1	0	0
3	0	0	0	0	0	8	0	0	0	18	0	1	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
4	0	0	0	0	0	0	0	0	5	22	0	5	0	3	0	4	0	0	0	0	0	2	0	0	3	1	0	0	0	4	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	4	11	9	3	0	0	0	0	4	2	0	0	0	3	0	4	0	0	0	2	0	3	0	2	10	12	1	7	2	4	0	0
7	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	2	2	0	3	0	1	0	0	0	15	0	2	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
10	15	45	5	41	0	15	0	0	26	0	0	6	3	13	0	1	6	7	5	13	0	1	0	0	3	1	5	0	1	1	0	2
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	2	8	5	7	1	1	0	0	1	0	3	0	0	4	0	3	1	0	1	2	0	4	0	0	14	1	19	0	2	3	2	0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	36	13	8	1	0	9	0	0	1	22	0	1	8	0	0	1	0	0	4	17	0	0	0	0	0	0	0	0	1	1	0	0
15	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	10	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	2	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	2	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
20	11	3	3	1	0	2	0	0	1	8	0	1	0	0	0	0	0	0	7	0	0	0	0	0	1	0	0	0	1	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	13	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
26	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	1	0	0	0	5	0	0	0	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	4	1	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0

09:15 - 09:30 Lights

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	1	1	0	0	1	0	0	0	2	0	0	5	9	0	0	0	0	2	6	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	4	0	0	0	43	0	4	9	3	0	4	0	0	0	0	0	0	0	0	5	1	0	0	4	1	0	0
3	0	0	0	0	0	7	0	0	0	15	0	1	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
4	0	0	0	0	0	0	0	0	4	19	0	4	0	2	0	3	0	0	0	0	0	2	0	0	2	1	0	0	0	3	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	4	9	8	2	0	0	0	0	3	1	0	0	0	2	0	3	0	0	0	2	0	3	0	2	8	10	1	6	1	3	0	0
7	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	2	2	0	2	0	1	0	0	0	12	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
10	12	37	4	35	0	12	0	0	21	0	0	5	2	11	0	1	5	6	4	11	0	1	0	0	2	1	4	0	1	1	0	2
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1	6	4	5	1	1	0	0	1	0	2	0	0	4	0	3	1	0	1	1	0	4	0	0	11	1	16	0	1	3	2	0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	30	11	7	1	0	8	0	0	1	18	0	1	7	0	0	1	0	0	3	14	0	0	0	0	0	0	0	0	1	1	0	0
15	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	2	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	2	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
20	9	3	3	0	0	2	0	0	1	7	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	1	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	11	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
26	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	1	0	0	0	4	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0

07:30 - 08:00 HGVs

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	1	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	2	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

08:00 - 09:00 HGVs

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	1	0	0	0	4	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	1	3	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	2	0	6	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	5	0	0	0	1	0	0	6	0	0	0	0	3	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	5	0	1	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

09:00 - 09:30 HGVs

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	1	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	2	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

D.2 PM Matrices

16:30 - 16:45 Lights																																
Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	1	0	0	0	26	0	3	0	0	0	20	0	0	0	0	0	0	0	0	0	1	0	0
2	0	0	0	0	0	4	0	0	3	36	0	5	0	18	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	2	0
3	0	0	0	0	0	6	0	0	0	5	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	6	0	3	0	7	0	0	0	0	0	0	0	1	0	5	5	0	0	0	0	6	1	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	3	0	0	0	0	0	0	1	23	0	0	0	5	0	1	0	1	0	1	0	3	0	0	23	40	0	0	1	0	0	0
7	0	3	3	0	0	1	0	0	0	1	0	9	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	1	1	11	1	1
8	0	0	0	5	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	10	0	2	0	0	0	0	0	39	0	2	2	0	0	2	0	0	0	7	0	0	4	0	0	0	0	0	0	1	2	2
10	0	28	2	21	0	9	0	6	57	0	5	7	1	21	1	2	1	4	0	6	0	0	0	0	2	0	1	0	0	1	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	6	2	6	0	0	0	0	2	0	0	0	0	17	0	0	1	0	3	2	0	0	0	0	1	0	2	0	0	0	0	0
13	2	1	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	3	5	2	0	0	5	0	0	1	9	0	1	1	0	0	2	0	0	0	14	0	0	0	0	1	0	0	0	0	1	1	0
15	0	0	0	0	0	1	0	0	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
16	1	3	2	5	0	11	0	0	1	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	1	0	0	0	1	0	0	0	1	0	3	0	7	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
19	0	1	0	0	0	1	0	0	0	0	0	19	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
20	4	8	7	1	0	6	0	0	3	21	0	2	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	1	0	1	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	87	0	0	0	2	0	3	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2	0	2	2
26	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	2	0	0	0	0	0	0	3	8	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	4	0	4	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	10	0	0	0	0	0	0	0
29	0	0	0	0	0	4	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	2	3	3	1	0	3	0	0	2	9	0	4	0	0	2	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
31	0	2	0	5	0	0	0	0	9	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
32	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

16:45 - 17:00 Lights																																
Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	1	0	0	0	28	0	3	0	0	0	22	0	0	0	0	0	0	0	0	0	1	0	0
2	0	0	0	0	0	5	0	0	3	39	0	6	0	19	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	3	0
3	0	0	0	0	0	7	0	0	0	5	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	6	0	3	0	7	0	0	0	0	0	0	0	1	1	5	5	0	0	0	0	6	1	1
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	3	0	0	0	0	0	0	1	25	0	0	0	5	0	1	0	1	0	1	0	3	0	0	24	43	0	0	1	0	0	0
7	0	3	3	0	0	1	0	0	0	1	0	10	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	1	1	12	1	1
8	0	0	0	6	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	10	0	2	0	0	0	0	0	42	0	2	3	0	0	2	0	0	0	7	0	0	4	0	0	0	0	0	0	1	3	2
10	0	30	2	22	0	10	0	7	61	0	6	7	1	22	1	2	1	4	0	7	0	0	0	0	2	0	2	0	0	1	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	6	2	6	0	0	0	0	2	0	0	0	0	18	0	0	1	0	3	2	0	0	0	0	1	0	2	0	0	0	0	0
13	2	1	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	4	5	2	0	0	5	0	0	1	10	0	1	2	0	0	2	0	0	0	15	0	0	0	0	1	0	0	0	0	1	1	0
15	0	0	0	0	0	1	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0
16	2	3	3	6	0	12	0	0	1	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	1	0	0	0	1	0	0	0	1	0	4	0	8	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
19	0	1	0	1	0	1	0	0	0	0	0	20	0	0	0	0	3	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
20	4	8	7	1	0	7	0	0	3	22	0	2	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	2	0	1	0	0	0	0	1	0	0	3	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	94	0	0	0	2	0	4	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2	0	2	2
26	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	2	0	0	0	0	0	0	3	8	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	4	0	5	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	11	0	0	0	0	0	0	0
29	0	0	0	0	0	5	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	2	4	3	1	0	3	0	0	2	10	0	5	0	0	2	0	0	0	0	1	0	0	0	0	4	0	0	0	0	0	0	0
31	0	2	0	5	0	0	0	0	10	0	0	0	0	1	0	0	2	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0
32	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

17:00 - 17:15 Lights																																
Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	1	0	0	0	26	0	3	0	0	0	20	0	0	0	0	0	0	0	0	0	1	0	0
2	0	0	0	0	0	4	0	0	3	36	0	5	0	18	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	2	0
3	0	0	0	0	0	6	0	0	0	5	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	6	0	3	0	7	0	0	0	0	0	0	0	1	0	5	5	0	0	0	0	6	1	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	3	0	0	0	0	0	0	1	23	0	0	0	5	0	1	0	1	0	1	0	3	0	0	23	40	0	0	1	0	0	0
7	0	3	3	0	0	1	0	0	0	1	0	9	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	1	1	11	1	1
8	0	0	0	5	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	10	0	2	0	0	0	0	0	39	0	2	2	0	0	2	0	0	0	7	0	0	4	0	0	0	0	0	0	1	2	2
10	0	28	2	21	0	9	0	6	57	0	5	7	1	21	1	2	1	4	0	6	0	0	0	0	2	0	1	0	0	1	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	6	2	6	0	0	0	0	2	0	0	0	0	17	0	0	1	0	3	2	0	0	0	0	1	0	2	0	0	0	0	0
13	2	1	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	3	5	2	0	0	5	0	0	1	9	0	1	1	0	0	2	0	0	0	14	0	0	0	0	1	0	0	0	0	1	1	0
15	0	0	0	0	0	1	0	0	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
16	1	3	2	5	0	11	0	0	1	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	1	0	0	0	1	0	0	0	1	0	3	0	7	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
19	0	1	0	0	0	1	0	0	0	0	0	19	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
20	4	8	7	1	0	6	0	0	3	21	0	2	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	1	0	1	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	87	0	0	0	2	0	3	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2	0	2	2
26	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	2	0	0	0	0	0	0	3	8	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	4	0	4	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	10	0	0	0	0	0	0	0
29	0	0	0	0	0	4	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	2	3	3	1	0	3	0	0	2	9	0	4	0	0	2	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
31	0	2	0	5	0	0	0	0	9	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
32	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

17:15 -17:30 Lights																																
Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	1	0	0	0	25	0	3	0	0	0	19	0	0	0	0	0	0	0	0	0	1	0	0
2	0	0	0	0	0	4	0	0	3	35	0	5	0	17	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	2	0
3	0	0	0	0	0	6	0	0	0	5	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	6	0	3	0	6	0	0	0	0	0	0	0	1	0	4	5	0	0	0	0	5	1	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	3	0	0	0	0	0	0	1	22	0	0	0	4	0	1	0	1	0	1	0	3	0	0	22	38	0	0	1	0	0	0
7	0	2	2	0	0	1	0	0	0	1	0	9	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	1	1	11	1	1
8	0	0	0	5	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	9	0	2	0	0	0	0	0	37	0	2	2	0	0	2	0	0	0	7	0	0	4	0	0	0	0	0	0	1	2	1
10	0	26	2	20	0	9	0	6	54	0	5	6	1	20	1	2	1	4	0	6	0	0	0	0	2	0	1	0	0	1	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	5	2	6	0	0	0	0	2	0	0	0	0	16	0	0	1	0	3	2	0	0	0	0	1	0	2	0	0	0	0	0
13	2	1	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	3	5	2	0	0	5	0	0	1	9	0	1	1	0	0	2	0	0	0	14	0	0	0	0	1	0	0	0	0	1	1	0
15	0	0	0	0	0	1	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
16	1	3	2	5	0	11	0	0	1	3	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	1	0	0	0	1	0	0	0	1	0	3	0	7	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
19	0	1	0	0	0	1	0	0	0	0	0	18	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
20	3	7	6	1	0	6	0	0	3	20	0	2	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	1	0	1	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	84	0	0	0	2	0	3	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2	0	2	2
26	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	2	0	0	0	0	0	0	3	7	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	3	0	4	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	10	0	0	0	0	0	0	0
29	0	0	0	0	0	4	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	2	3	3	1	0	2	0	0	2	9	0	4	0	0	2	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
31	0	2	0	4	0	0	0	0	9	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
32	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

17:30 - 17:45 Lights																																
Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	1	0	0	0	27	0	3	0	0	0	21	0	0	0	0	0	0	0	0	0	1	0	0
2	0	0	0	0	0	5	0	0	3	38	0	6	0	18	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	2	0
3	0	0	0	0	0	6	0	0	0	5	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	6	0	3	0	7	0	0	0	0	0	0	0	1	0	5	5	0	0	0	0	6	1	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	3	0	0	0	0	0	0	1	24	0	0	0	5	0	1	0	1	0	1	0	3	0	0	24	42	0	0	1	0	0	0
7	0	3	3	0	0	1	0	0	0	1	0	10	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	1	1	12	1	1
8	0	0	0	5	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	10	0	2	0	0	0	0	0	40	0	2	3	0	0	2	0	0	0	7	0	0	4	0	0	0	0	0	0	1	2	2
10	0	29	2	21	0	9	0	7	59	0	5	7	1	21	1	2	1	4	0	6	0	0	0	0	2	0	1	0	0	1	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	6	2	6	0	0	0	0	2	0	0	0	0	17	0	0	1	0	3	2	0	0	0	0	1	0	2	0	0	0	0	0
13	2	1	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	3	5	2	0	0	5	0	0	1	10	0	1	1	0	0	2	0	0	0	15	0	0	0	0	1	0	0	0	0	1	1	0
15	0	0	0	0	0	1	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
16	2	3	3	6	0	12	0	0	1	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	1	0	0	0	1	0	0	0	1	0	3	0	8	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
19	0	1	0	1	0	1	0	0	0	0	0	20	0	0	0	0	3	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
20	4	8	7	1	0	7	0	0	3	22	0	2	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	2	0	1	0	0	0	0	1	0	0	3	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	90	0	0	0	2	0	4	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2	0	2	2
26	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	2	0	0	0	0	0	0	3	8	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	4	0	5	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	10	0	0	0	0	0	0	0
29	0	0	0	0	0	5	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	2	4	3	1	0	3	0	0	2	9	0	4	0	0	2	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
31	0	2	0	5	0	0	0	0	10	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
32	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

17:45 - 18:00 Lights																																
Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	1	0	0	0	27	0	3	0	0	0	21	0	0	0	0	0	0	0	0	0	1	0	0
2	0	0	0	0	0	5	0	0	3	38	0	6	0	18	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	2	0
3	0	0	0	0	0	6	0	0	0	5	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	6	0	3	0	7	0	0	0	0	0	0	0	1	0	5	5	0	0	0	0	6	1	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	3	0	0	0	0	0	0	1	24	0	0	0	5	0	1	0	1	0	1	0	3	0	0	24	42	0	0	1	0	0	0
7	0	3	3	0	0	1	0	0	0	1	0	10	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	1	1	12	1	1
8	0	0	0	5	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	10	0	2	0	0	0	0	0	40	0	2	3	0	0	2	0	0	0	7	0	0	4	0	0	0	0	0	0	1	2	2
10	0	29	2	21	0	9	0	7	59	0	5	7	1	21	1	2	1	4	0	6	0	0	0	0	2	0	1	0	0	1	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	6	2	6	0	0	0	0	2	0	0	0	0	17	0	0	1	0	3	2	0	0	0	0	1	0	2	0	0	0	0	0
13	2	1	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	3	5	2	0	0	5	0	0	1	10	0	1	1	0	0	2	0	0	0	15	0	0	0	0	1	0	0	0	0	1	1	0
15	0	0	0	0	0	1	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
16	2	3	3	6	0	12	0	0	1	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	1	0	0	0	1	0	0	0	1	0	3	0	8	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
19	0	1	0	1	0	1	0	0	0	0	0	20	0	0	0	0	3	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
20	4	8	7	1	0	7	0	0	3	22	0	2	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	2	0	1	0	0	0	0	1	0	0	3	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	90	0	0	0	2	0	4	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2	0	2	2
26	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	2	0	0	0	0	0	0	3	8	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	4	0	5	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	10	0	0	0	0	0	0	0
29	0	0	0	0	0	5	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	2	4	3	1	0	3	0	0	2	9	0	4	0	0	2	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
31	0	2	0	5	0	0	0	0	10	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
32	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

18:00 - 18:15 Lights																																
Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	1	0	0	0	27	0	3	0	0	0	21	0	0	0	0	0	0	0	0	0	1	0	0
2	0	0	0	0	0	5	0	0	3	38	0	6	0	18	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	2	0
3	0	0	0	0	0	6	0	0	0	5	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1	0	0	0	0	0	0	6	0	3	0	7	0	0	0	0	0	0	0	1	0	5	5	0	0	0	0	6	1	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	3	0	0	0	0	0	0	1	24	0	0	0	5	0	1	0	1	0	1	0	3	0	0	24	42	0	0	1	0	0	0
7	0	3	3	0	0	1	0	0	0	1	0	10	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	1	1	12	1	1
8	0	0	0	5	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	10	0	2	0	0	0	0	0	40	0	2	3	0	0	2	0	0	0	7	0	0	4	0	0	0	0	0	0	1	2	2
10	0	29	2	21	0	9	0	7	59	0	5	7	1	21	1	2	1	4	0	6	0	0	0	0	2	0	1	0	0	1	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	6	2	6	0	0	0	0	2	0	0	0	0	17	0	0	1	0	3	2	0	0	0	0	1	0	2	0	0	0	0	0
13	2	1	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	3	5	2	0	0	5	0	0	1	10	0	1	1	0	0	2	0	0	0	15	0	0	0	0	1	0	0	0	0	1	1	0
15	0	0	0	0	0	1	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
16	2	3	3	6	0	12	0	0	1	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	1	0	0	0	1	0	0	0	1	0	3	0	8	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
19	0	1	0	1	0	1	0	0	0	0	0	20	0	0	0	0	3	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0
20	4	8	7	1	0	7	0	0	3	22	0	2	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	2	0	1	0	0	0	0	1	0	0	3	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	90	0	0	0	2	0	4	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	2	0	2	2
26	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	2	0	0	0	0	0	0	3	8	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	4	0	5	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	10	0	0	0	0	0	0	0
29	0	0	0	0	0	5	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	2	4	3	1	0	3	0	0	2	9	0	4	0	0	2	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
31	0	2	0	5	0	0	0	0	10	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
32	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

16:00 - 16:30 HGVs

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

17:00 - 18:00 HGVs

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0	0	3	0	0	1	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	3	1	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	1	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	5	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	1	0	0	2	0	0	3	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

18:00 - 18:30 HGVs

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix E – Turning Count Calibration

E.1 AM Model Calibration Summary

AM Model Calibration Summary				
Turn Ref (From Link-Node-To Link)	Model Flow	Survey Flow	Difference	GEH
48-18-14	142	143	1	0.08
48-18-75	328	360	32	1.73
48-18-51	31	43	12	1.97
13-18-70	45	53	8	1.14
13-18-51	25	23	-2	0.41
13-18-75	58	67	9	1.14
76-18-14	129	131	2	0.18
76-18-70	107	104	-3	0.29
76-18-51	59	56	-3	0.40
10-57-71	124	125	1	0.09
10-57-8	279	300	21	1.23
3-57-12	274	318	44	2.56
3-57-71	324	354	30	1.63
56-17-58	77	83	6	0.67
56-17-54	246	236	-10	0.64
59-17-57	15	14	-1	0.26
59-17-54	27	40	13	2.25
53-17-57	131	104	-27	2.49
53-17-58	90	96	6	0.62

55-9-3	81	96	15	1.59
55-9-45	189	175	-14	1.04
55-9-146	0	2	2	2.00
2-93-53	89	79	-10	1.09
2-9-146	0	12	12	4.90
2-9-45	623	637	14	0.56
47-9-3	524	526	2	0.09
47-9-53	129	112	-17	1.55
47-9-146	25	21	-4	0.83
147-9-53	4	7	3	1.28
147-9-3	0	8	8	4.00
147-9-45	17	11	-6	1.60
49-11-85	401	370	-31	1.58
49-11-135	419	429	10	0.49
86-11-50	172	160	-12	0.93
86-11-135	32	55	23	3.49
137-11-50	511	501	-10	0.44
137-11-85	284	279	-5	0.30
17-58-19	49	49	0	0.00
17-58-125	574	622	48	1.96
21-58-18	62	60	-2	0.26
21-58-125	68	47	-21	2.77
127-58-19	106	95	-11	1.10
127-58-18	737	752	15	0.55

85-3-23	214	236	22	1.47
85-3-85	351	341	-10	0.54
85-3-44	68	30	-38	5.43
22-3-86	91	82	-9	0.97
22-3-44	105	108	3	0.29
22-3-85	19	34	15	2.91
86-3-23	26	29	3	0.57
86-3-86	196	194	-2	0.14
86-3-44	92	74	-18	1.98
64-29-63	7	22	15	3.94
60-29-63	295	252	-43	2.60
62-29-61	372	356	-16	0.84
38-19-60	0	2	2	2.00
38-19-66	0	1	1	1.41
38-19-67	253	251	-2	0.13
38-19-42	119	104	-15	1.42
39-19-66	0	8	8	4.00
39-19-60	253	242	-11	0.70
39-19-42	40	42	2	0.31
39-19-67	0	6	6	3.46
43-19-60	42	36	-6	0.96
43-19-66	0	1	1	1.41
43-19-67	51	47	-4	0.57
67-20-160	284	304	20	1.17

67-20-148	20	1	-19	5.86
161-20-68	287	262	-25	1.51
161-20-148	47	80	33	4.14
149-20-68	7	10	3	1.03
149-20-160	0	2	2	2.00

Summary	
GEH < 5	70
Total Turns	72
%GEH <5	97%
Pass or fail?	PASS

E.2 PM Model Calibration Summary

PM Model Calibration Summary				
Turn Ref (From Link-Node-To Link)	**Model Flow**	**Survey Flow**	**Difference**	**GEH**
48-18-14	12	14	2	0.55
48-18-75	174	179	5	0.38
48-18-51	4	6	2	0.89
13-18-70	105	107	2	0.19
13-18-51	0	13	13	5.10
13-18-75	101	99	-2	0.20
76-18-14	29	50	21	3.34
76-18-70	321	314	-7	0.39
76-18-51	20	15	-5	1.20
10-57-71	93	89	-4	0.42
10-57-8	313	306	-7	0.40
3-57-12	351	350	-1	0.05
3-57-71	S	S	5	0.28
56-17-58	20	20	0	0.00
56-17-54	146	144	-2	0.17
59-17-57	89	91	2	0.21
59-17-54	87	78	-9	0.99
53-17-57	229	227	-2	0.13
53-17-58	16	30	14	2.92
55-9-3	125	109	-16	1.48

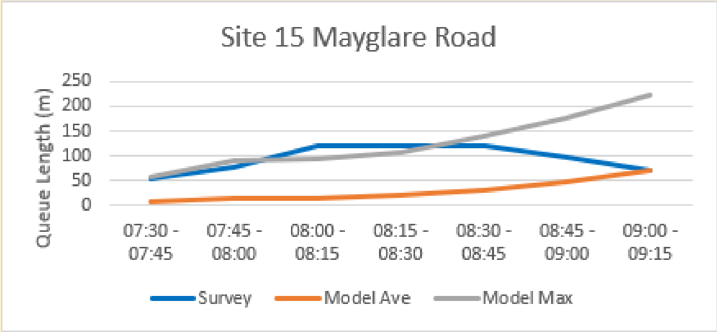
55-9-45	111	105	-6	0.58
55-9-146	0	12	12	4.90
2-93-53	67	94	27	3.01
2-9-146	2	12	10	3.78
2-9-45	556	552	-4	0.17
47-9-3	454	480	26	1.20
47-9-53	166	156	-10	0.79
47-9-146	19	41	22	4.02
49-11-85	260	269	9	0.55
49-11-135	478	428	-50	2.35
86-11-50	152	206	54	4.04
86-11-135	33	65	32	4.57
137-11-50	455	454	-1	0.05
137-11-85	231	224	-7	0.46
17-58-19	109	101	-8	0.78
17-58-125	649	687	38	1.47
21-58-18	157	154	-3	0.24
21-58-125	139	105	-34	3.08
22-3-86	62	73	11	1.34
22-3-44	153	120	-33	2.82
22-3-85	52	52	0	0.00
86-3-23	20	24	4	0.85
86-3-86	215	223	8	0.54
86-3-44	163	157	-6	0.47

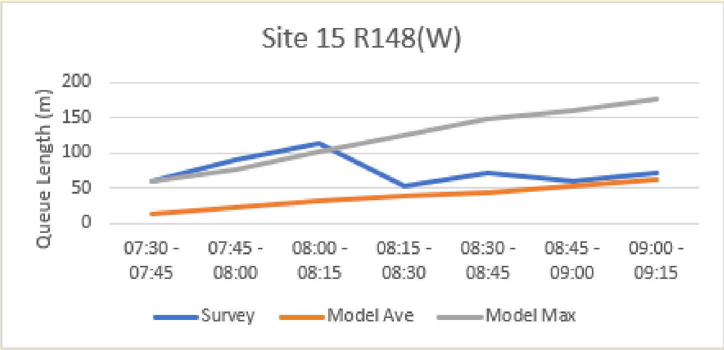
64-29-63	155	113	-42	3.63
60-29-63	223	244	21	1.37
62-29-61	428	387	-41	2.03
38-19-60	0	0	0	0.00
38-19-66	0	0	0	0.00
38-19-67	257	227	-30	1.93
38-19-42	170	184	14	1.05
39-19-66	0	1	1	1.41
39-19-60	161	177	16	1.23
39-19-42	93	85	-8	0.85
39-19-67	0	24	24	6.93
43-19-60	62	71	9	1.10
43-19-66	0	0	0	0.00
43-19-67	351	334	-17	0.92
67-20-160	609	600	-9	0.37
67-20-148	1	2	1	0.82

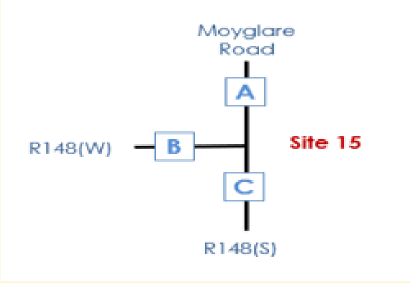
Summary	
GEH < 5	58
Total Turns	60
%GEH <5	97%
Pass or Fail?	PASS

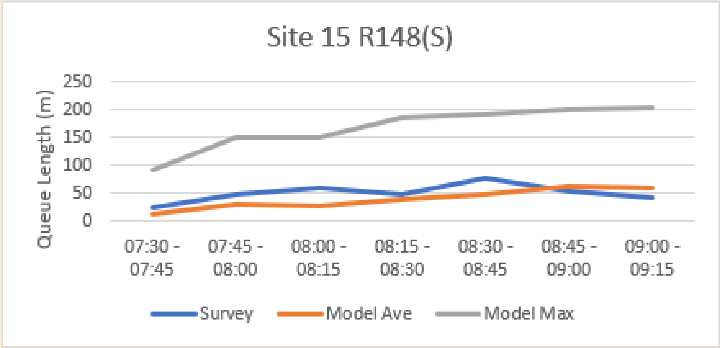
Appendix F – Queue Length Validation

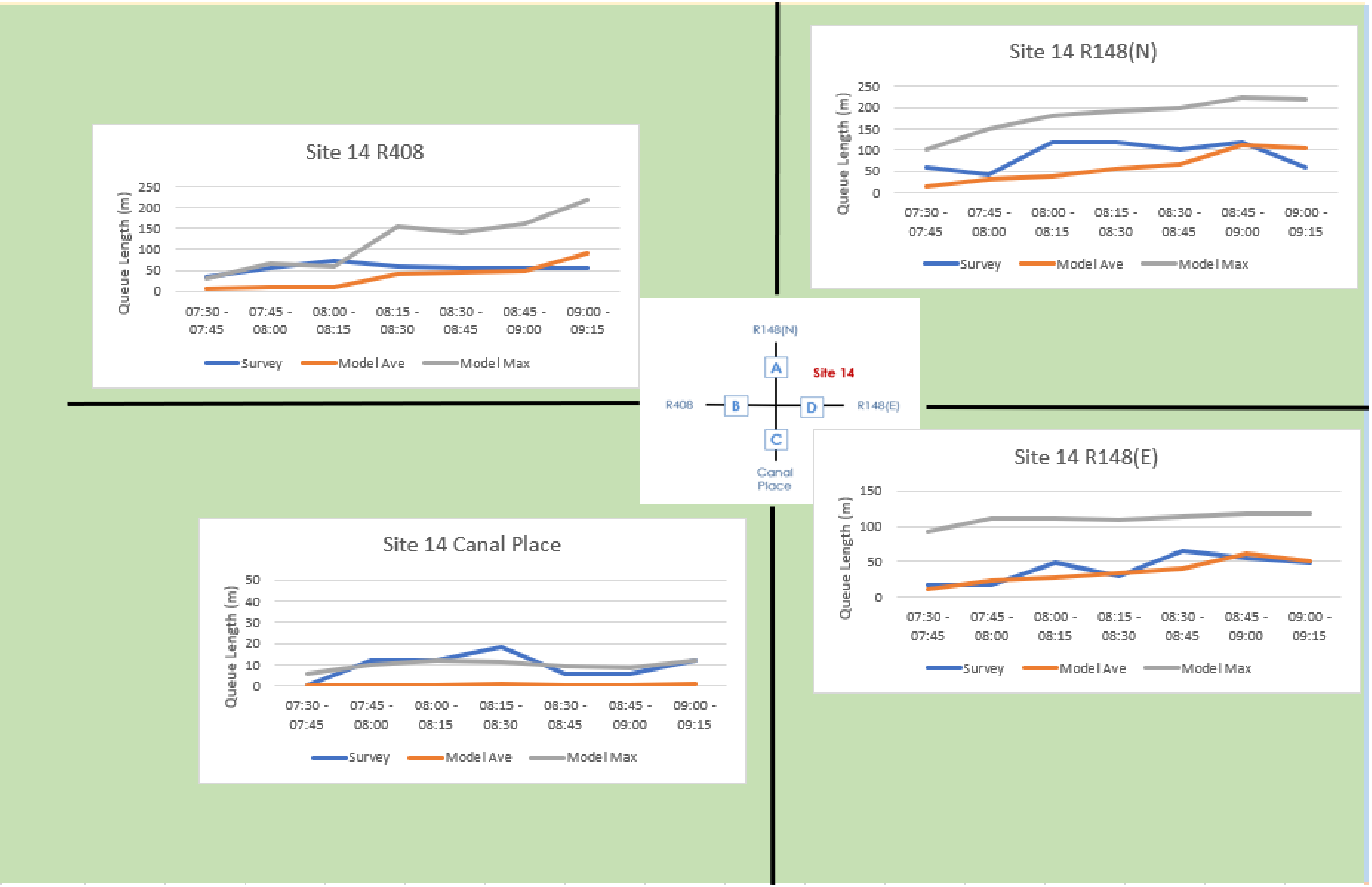
F.1 AM Queue Length Graphs

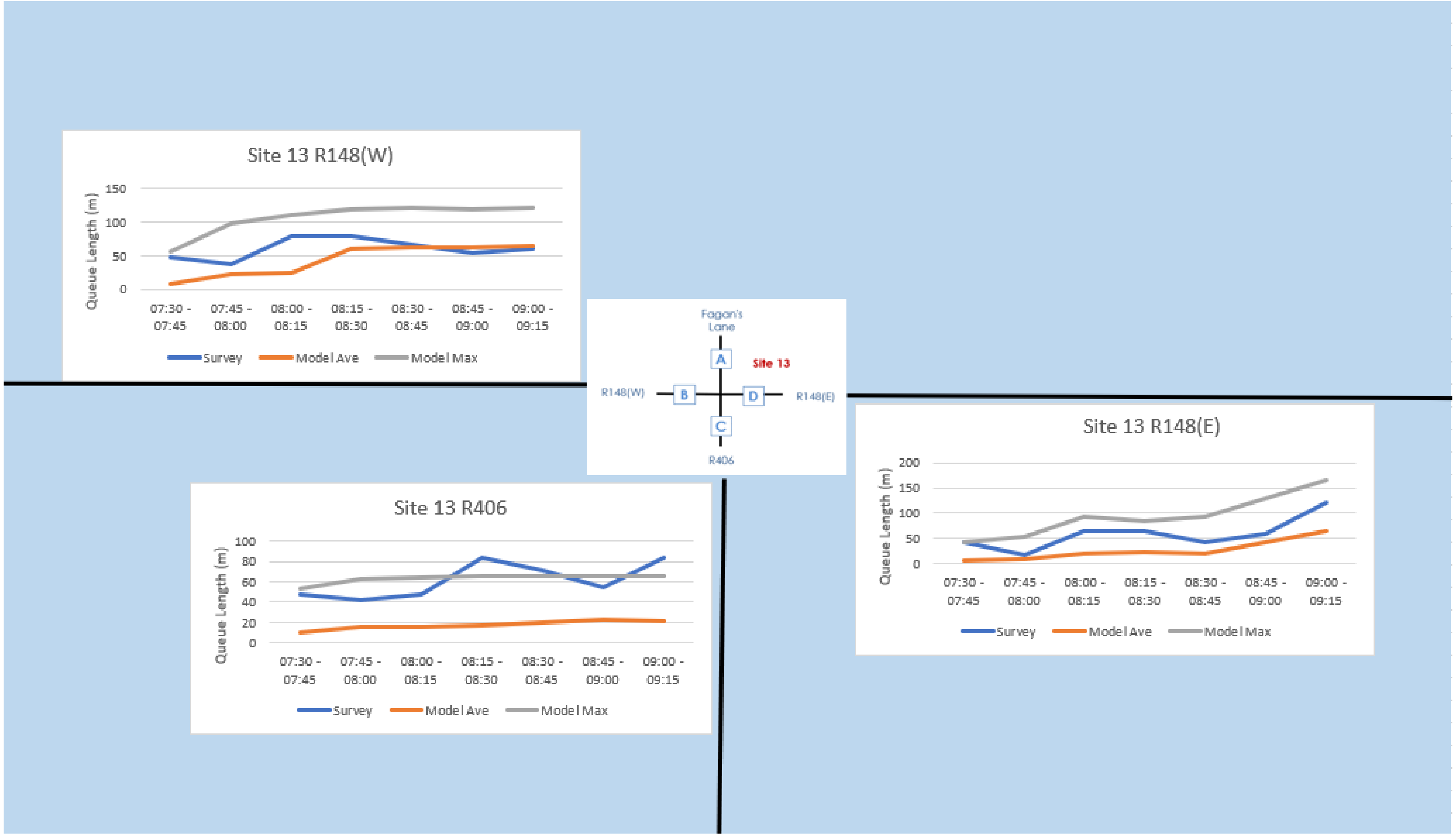

Site 15 Mayglare Road
Queue Length (m)
250
200
150
100
50
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max

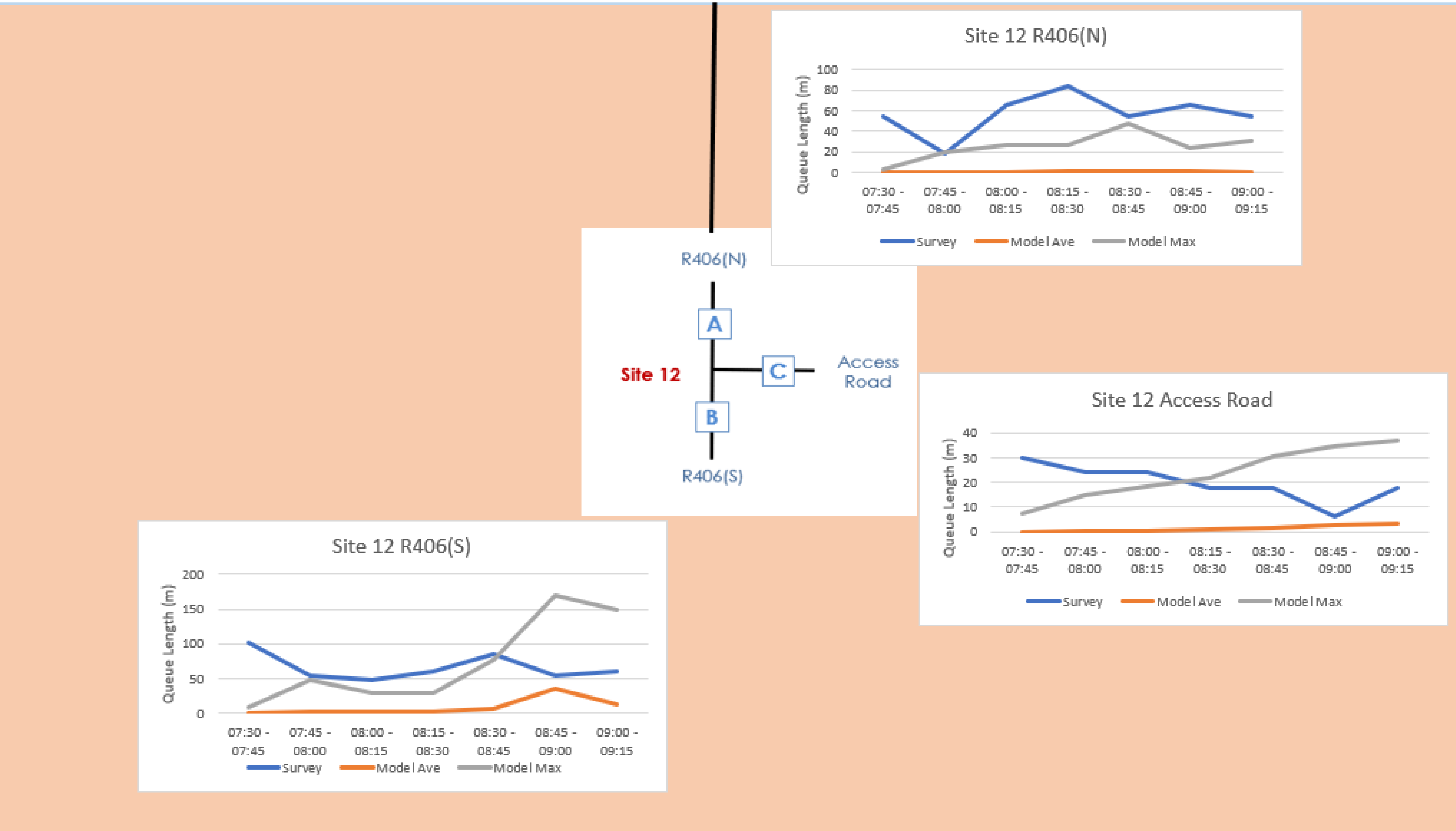

Site 15 R148(W)
Queue Length (m)
200
150
100
50
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max


Moyglare Road
A
R148(W)
B
Site 15
C
R148(S)


Site 15 R148(S)
Queue Length (m)
250
200
150
100
50
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max


Site 14 R408
Queue Length (m)
250
200
150
100
50
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max
Site 14 R148(N)
Queue Length (m)
250
200
150
100
50
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max
R148(N)
A
Site 14
R408
B
D
R148(E)
C
Canal Place
Site 14 R148(E)
Queue Length (m)
150
100
50
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max
Site 14 Canal Place
Queue Length (m)
50
40
30
20
10
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max


Site 13 R148(W)
Queue Length (m)
150
100
50
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max
Fagan's Lane
A
Site 13
R148(W)
B
D
R148(E)
C
R406
Site 13 R148(E)
Queue Length (m)
200
150
100
50
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max
Site 13 R406
Queue Length (m)
100
80
60
40
20
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max


Site 12 R406(N)
Queue Length (m)
100
80
60
40
20
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max
R406(N)
A
Site 12
C
Access Road
B
R406(S)
Site 12 Access Road
Queue Length (m)
40
30
20
10
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max
Site 12 R406(S)
Queue Length (m)
200
150
100
50
0
07:30 - 07:45
07:45 - 08:00
08:00 - 08:15
08:15 - 08:30
08:30 - 08:45
08:45 - 09:00
09:00 - 09:15
Survey
Model Ave
Model Max

F.2 AM Queue Length Summary Table

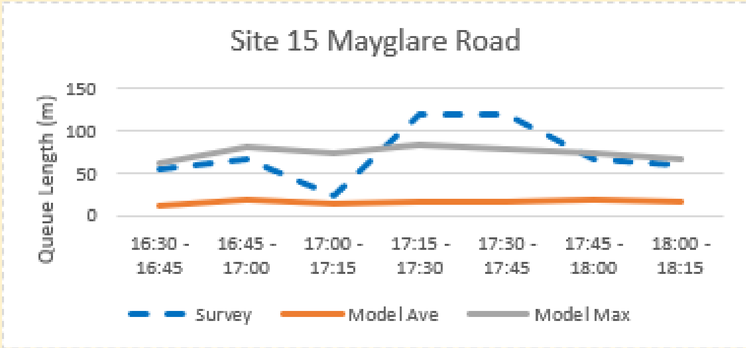
AM Peak - Queue length (meters)					
Junction	**Arm**	**Time**	**Survey**	**Model Average**	**Model Max**
Site 15 - Junction North	**Arm A**	07:30	54	7	58
		07:45	78	14	90
		08:00	120	16	94
		08:15	120	21	108
		08:30	120	32	141
		08:45	96	47	177
		09:00	72	70	222
	ARM B	07:30	60	13	61
		07:45	90	22	75
		08:00	114	31	101
		08:15	54	39	125
		08:30	72	44	148
		08:45	60	54	159
		09:00	72	62	176
	ARM C	07:30	24	12	91
		07:45	48	30	151
		08:00	60	29	149
		08:15	48	38	186
		08:30	78	47	191
		08:45	54	63	202
		09:00	42	60	203

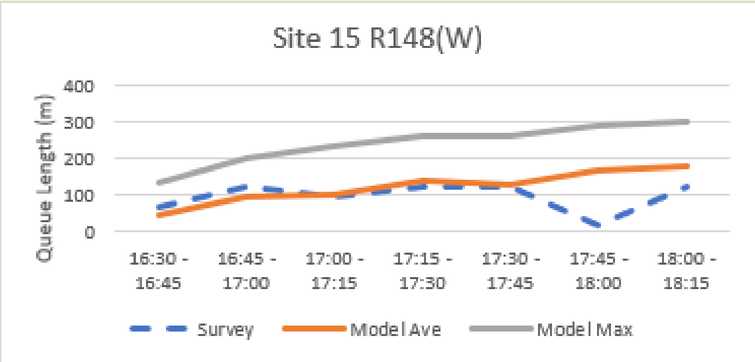
Site 14 - Four arm West	Arm A	07:30	60	16	102
		07:45	42	32	152
		08:00	120	37	183
		08:15	120	56	190
		08:30	102	68	200
		08:45	120	110	223
		09:00	60	105	221
	ARM B	07:30	36	5	32
		07:45	54	10	67
		08:00	72	11	57
		08:15	60	43	153
		08:30	54	44	142
		08:45	54	48	161
		09:00	54	91	218
	ARM C	07:30	0	0	6
		07:45	12	0	10
		08:00	12	1	12
		08:15	18	1	11
		08:30	6	0	9
		08:45	6	0	9
		09:00	12	1	12
	Arm D	07:30	18	11	92
		07:45	18	24	112
		08:00	48	27	111

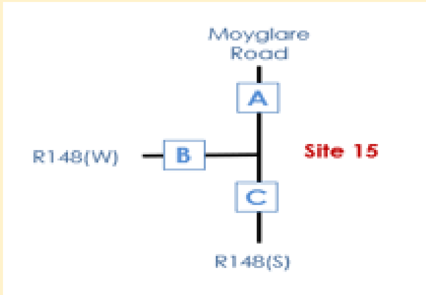
		08:15	30	33	110
		08:30	66	40	113
		08:45	54	62	119
		09:00	48	51	117
Site 13 - Four arm Main Street	**ARM B**	07:30	48	7	56
		07:45	36	21	98
		08:00	78	24	109
		08:15	78	59	118
		08:30	66	63	121
		08:45	54	62	118
		09:00	60	65	121
	ARM C	07:30	48	11	53
		07:45	42	15	63
		08:00	48	16	64
		08:15	84	16	66
		08:30	72	20	66
		08:45	54	23	66
		09:00	84	21	66
	Arm D	07:30	42	6	44
		07:45	18	9	54
		08:00	66	21	92
		08:15	66	22	84
		08:30	42	20	94
		08:45	60	42	130

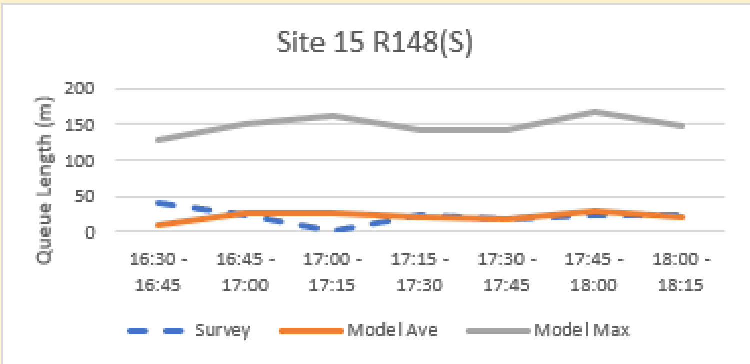
		09:00	120	66	167
Site 12 - Glen royal Hotel	**ARM A**	07:30	54	0	2
		07:45	18	0	19
		08:00	66	0	27
		08:15	84	1	27
		08:30	54	2	47
		08:45	66	2	24
		09:00	54	1	31
	ARM B	07:30	102	0	9
		07:45	54	3	47
		08:00	48	2	29
		08:15	60	2	29
		08:30	84	6	77
		08:45	54	35	170
		09:00	60	13	149
	Arm C	07:30	30	0	7
		07:45	24	0	15
		08:00	24	0	19
		08:15	18	1	22
		08:30	18	1	30
		08:45	6	3	34
		09:00	18	4	37

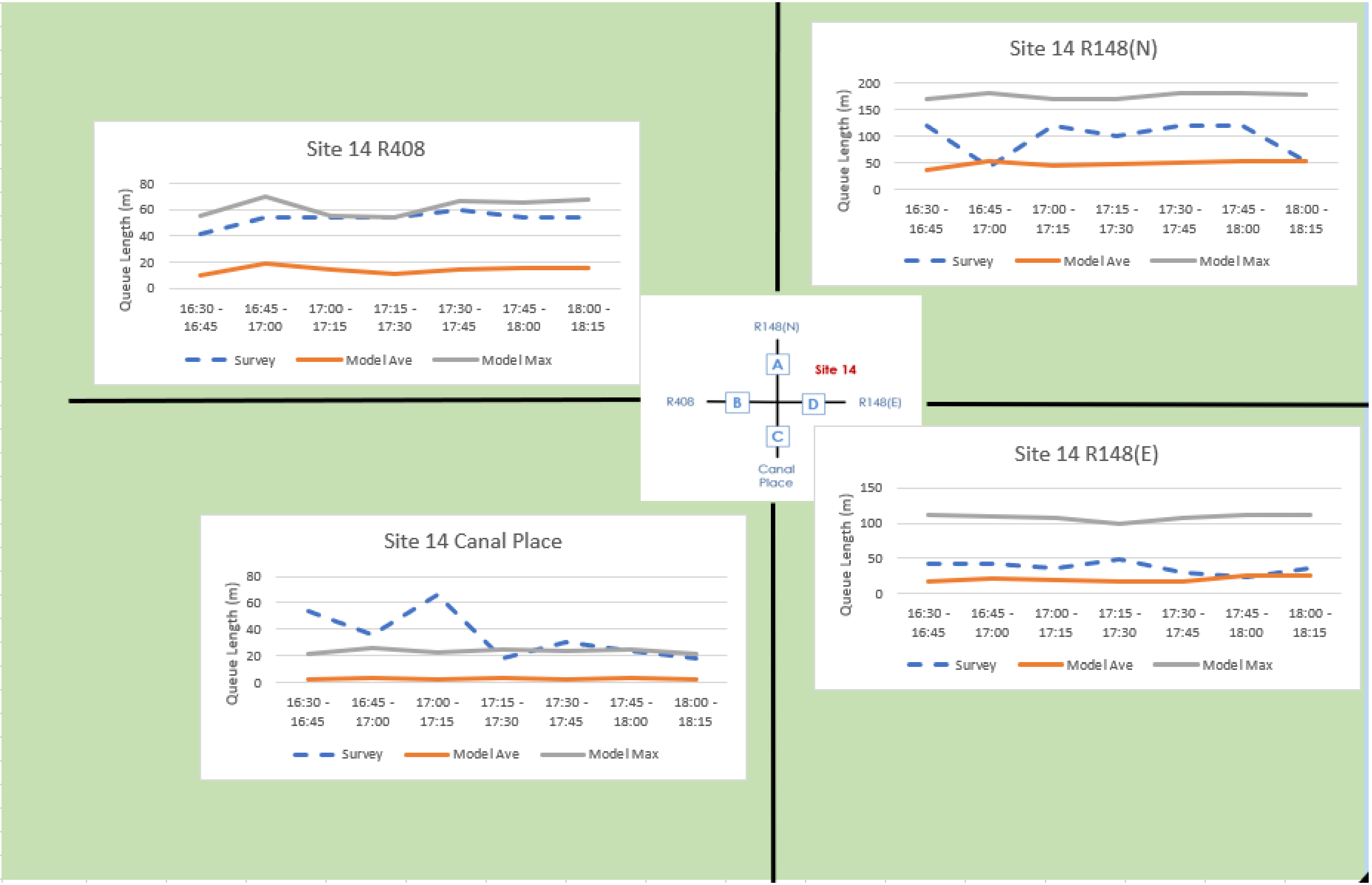
F.3 PM Queue Length Graphs

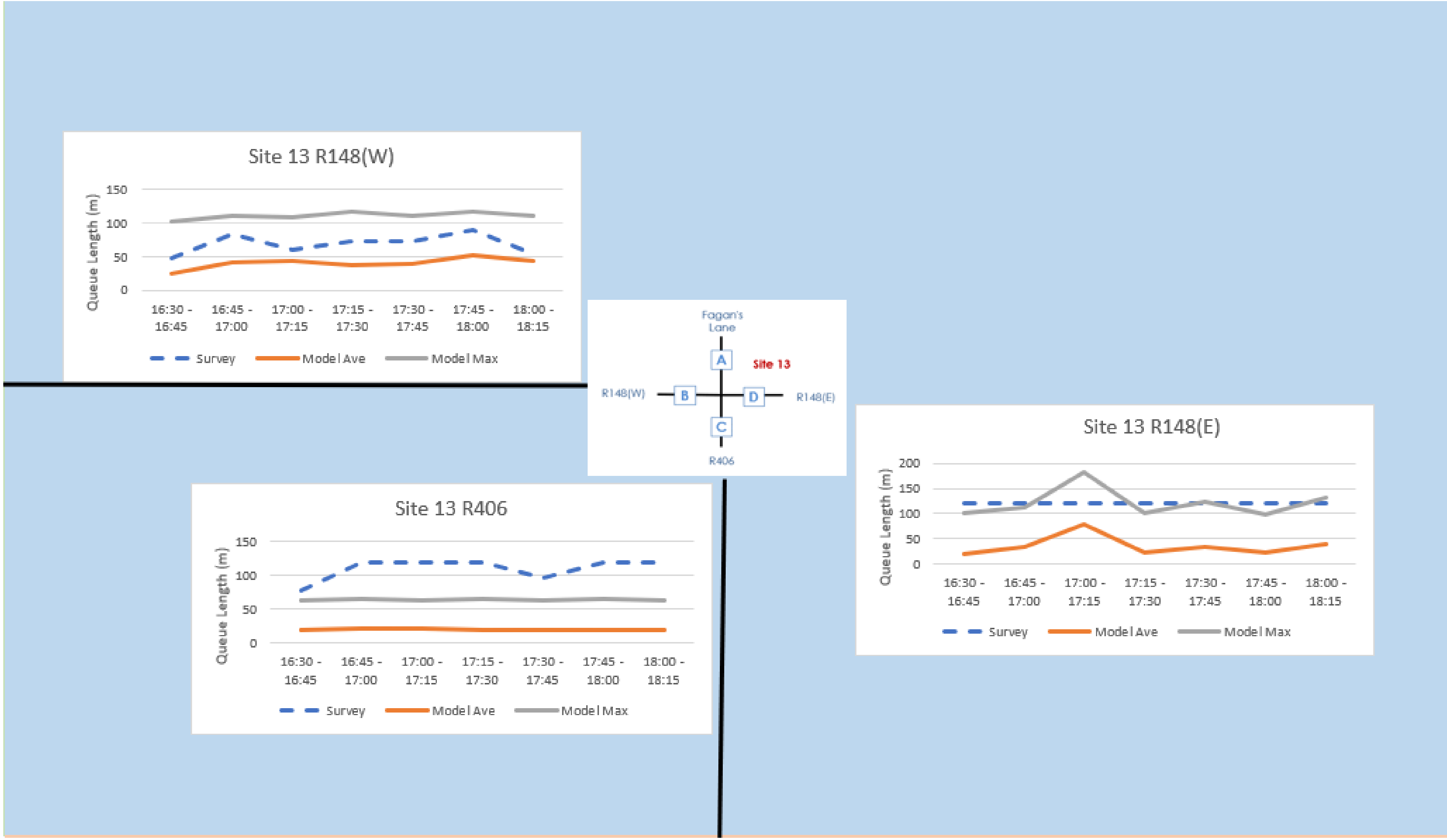









Site 14 R408
Queue Length (m)
80
60
40
20
0
16:30 - 16:45
16:45 - 17:00
17:00 - 17:15
17:15 - 17:30
17:30 - 17:45
17:45 - 18:00
18:00 - 18:15
Survey
Model Ave
Model Max
Site 14 R148(N)
Queue Length (m)
200
150
100
50
0
16:30 - 16:45
16:45 - 17:00
17:00 - 17:15
17:15 - 17:30
17:30 - 17:45
17:45 - 18:00
18:00 - 18:15
Survey
Model Ave
Model Max
R148(N)
A
Site 14
R408
B
D
R148(E)
C
Canal Place
Site 14 Canal Place
Queue Length (m)
80
60
40
20
0
16:30 - 16:45
16:45 - 17:00
17:00 - 17:15
17:15 - 17:30
17:30 - 17:45
17:45 - 18:00
18:00 - 18:15
Survey
Model Ave
Model Max
Site 14 R148(E)
Queue Length (m)
150
100
50
0
16:30 - 16:45
16:45 - 17:00
17:00 - 17:15
17:15 - 17:30
17:30 - 17:45
17:45 - 18:00
18:00 - 18:15
Survey
Model Ave
Model Max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Queue Length (m)
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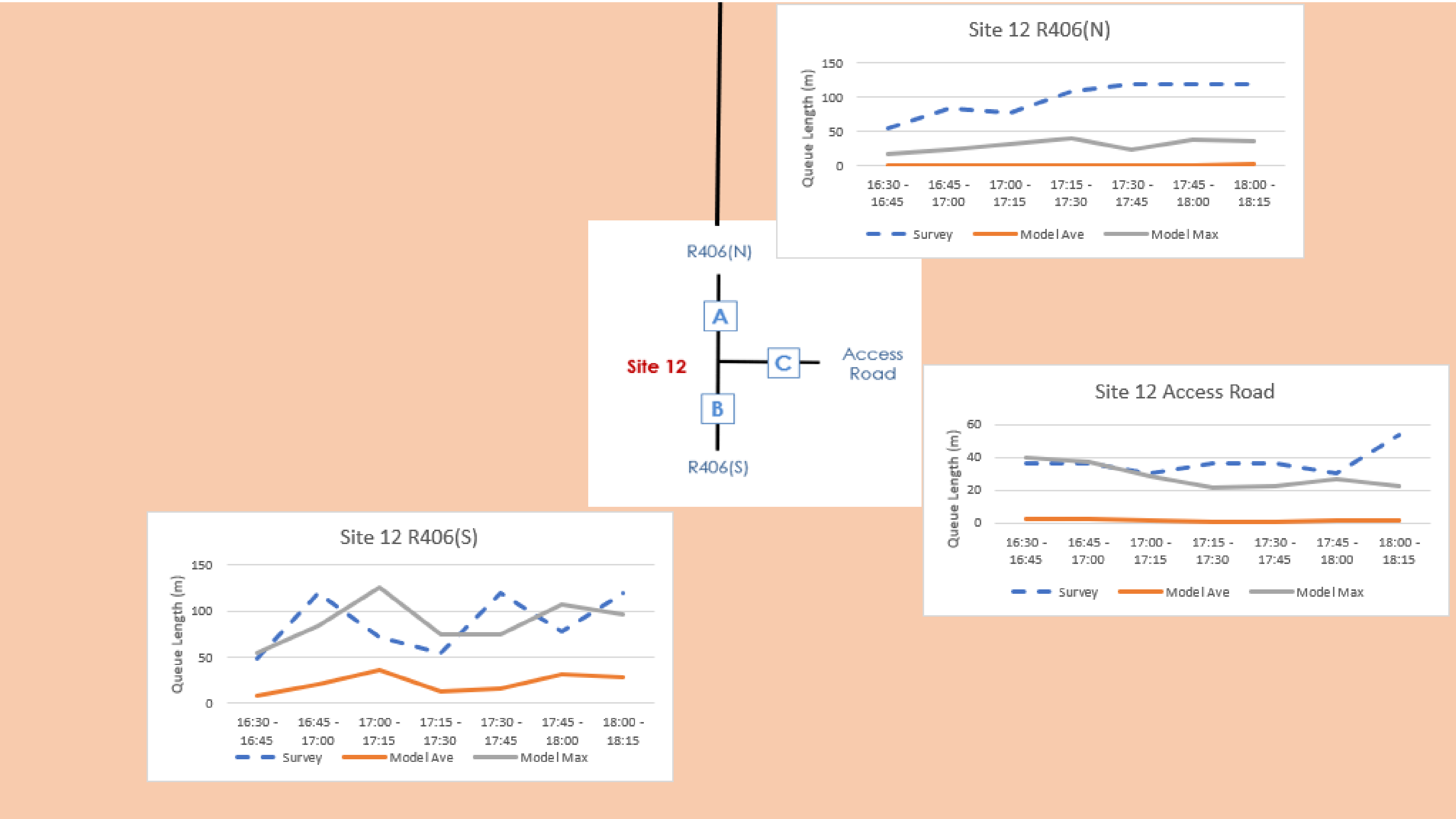
100
50
0
16:30 - 16:45
16:45 - 17:00
17:00 - 17:15
17:15 - 17:30
17:30 - 17:45
17:45 - 18:00
18:00 - 18:15
Survey
Model Ave
Model Max
Fagan's Lane
A
Site 13
R148(W)
B
D
R148(E)
C
R406
Site 13 R148(E)
Queue Length (m)
200
150
100
50
0
16:30 - 16:45
16:45 - 17:00
17:00 - 17:15
17:15 - 17:30
17:30 - 17:45
17:45 - 18:00
18:00 - 18:15
Survey
Model Ave
Model Max
Site 13 R406
Queue Length (m)
150
100
50
0
16:30 - 16:45
16:45 - 17:00
17:00 - 17:15
17:15 - 17:30
17:30 - 17:45
17:45 - 18:00
18:00 - 18:15
Survey
Model Ave
Model Max


Site 12 R406(N)
Queue Length (m)
150
100
50
0
16:30 - 16:45
16:45 - 17:00
17:00 - 17:15
17:15 - 17:30
17:30 - 17:45
17:45 - 18:00
18:00 - 18:15
Survey
Model Ave
Model Max
R406(N)
A
Site 12
C
Access Road
B
R406(S)
Site 12 Access Road
Queue Length (m)
60
40
20
0
16:30 - 16:45
16:45 - 17:00
17:00 - 17:15
17:15 - 17:30
17:30 - 17:45
17:45 - 18:00
18:00 - 18:15
Survey
Model Ave
Model Max
Site 12 R406(S)
Queue Length (m)
150
100
50
0
16:30 - 16:45
16:45 - 17:00
17:00 - 17:15
17:15 - 17:30
17:30 - 17:45
17:45 - 18:00
18:00 - 18:15
Survey
Model Ave
Model Max

F.4 PM Queue Length Summary Table

PM Peak - Queue length (meters)					
Junction	**Arm**	**Time**	**Survey**	**Model Average**	**Model Max**
Site 15 - Junction North	**Arm A**	16:30	54	12	61
		16:45	66	19	80
		17:00	24	15	72
		17:15	120	16	82
		17:30	120	17	78
		17:45	66	18	72
		18:00	60	15	66
	ARM B	16:30	66	46	131
		16:45	120	96	203
		17:00	96	102	234
		17:15	120	138	260
		17:30	120	125	264
		17:45	18	167	288
		18:00	120	177	300
	ARM C	16:30	42	11	127
		16:45	24	27	150
		17:00	0	27	163
		17:15	24	20	143
		17:30	18	17	142
		17:45	24	31	168
		18:00	24	21	148

Site 14 - Four arm West	**Arm A**	16:30	120	37	172
		16:45	42	53	181
		17:00	120	46	170
		17:15	102	48	171
		17:30	120	51	181
		17:45	120	53	182
		18:00	54	52	178
	ARM B	16:30	42	10	55
		16:45	54	19	70
		17:00	54	15	55
		17:15	54	11	54
		17:30	60	14	66
		17:45	54	15	65
		18:00	54	15	68
	ARM C	16:30	54	3	21
		16:45	36	3	26
		17:00	66	3	22
		17:15	18	3	25
		17:30	30	3	23
		17:45	24	4	25
		18:00	18	3	21
	Arm D	16:30	42	18	111
		16:45	42	21	109

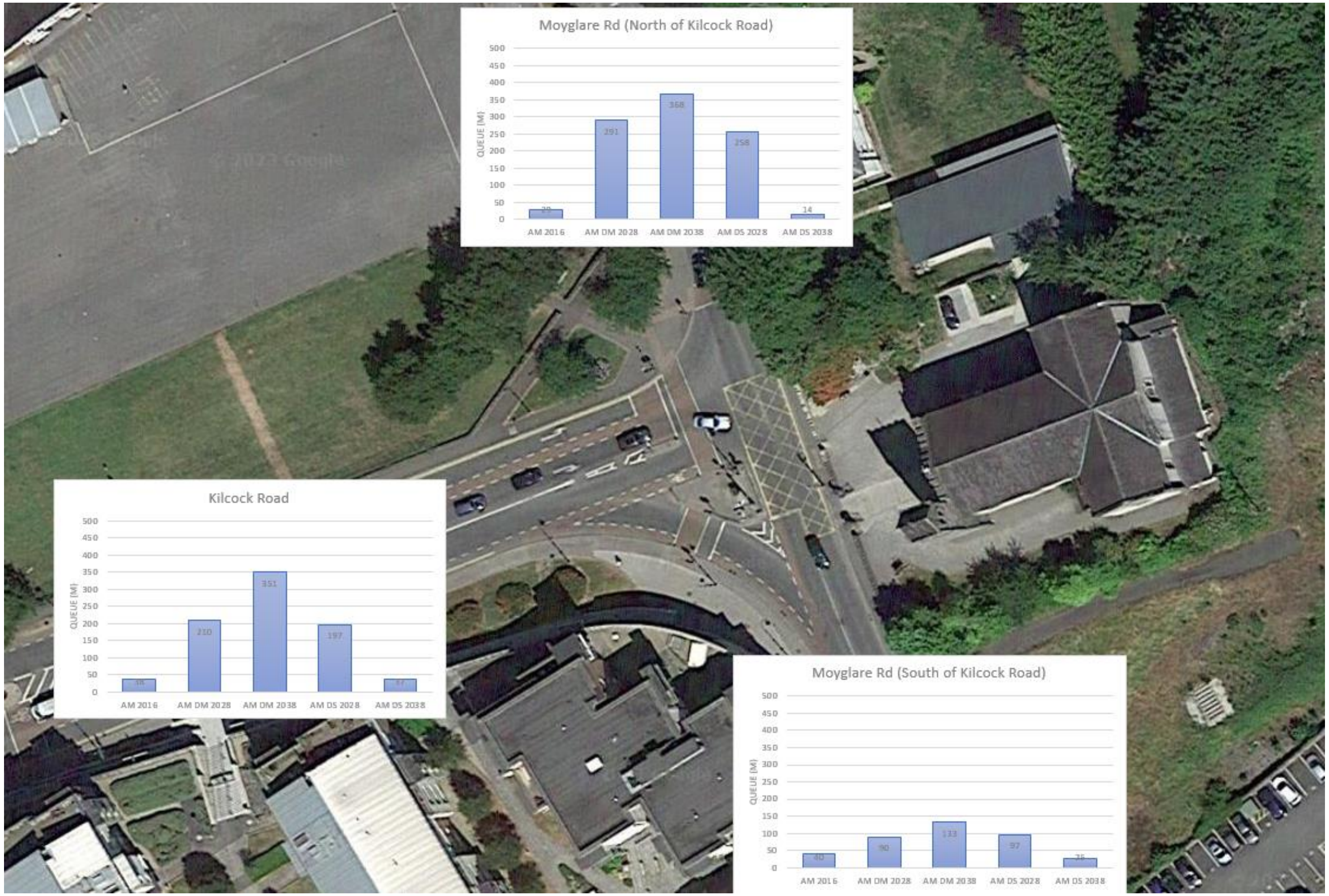
		17:00	36	20	107
		17:15	48	16	98
		17:30	30	17	107
		17:45	24	26	112
		18:00	36	25	113
Site 13 - Four arm Main Street	**ARM B**	16:30	48	25	101
		16:45	84	41	111
		17:00	60	43	108
		17:15	72	38	116
		17:30	72	40	111
		17:45	90	52	116
		18:00	54	43	111
	ARM C	16:30	78	19	64
		16:45	120	21	66
		17:00	120	20	63
		17:15	120	19	65
		17:30	96	19	64
		17:45	120	19	66
		18:00	120	20	64
	Arm D	16:30	120	21	102
		16:45	120	34	113
		17:00	120	78	183
		17:15	120	23	100

		17:30	120	35	124
		17:45	120	22	99
		18:00	120	40	131
Site 12 - Glenroyal Hotel	**ARM A**	16:30	54	0	17
		16:45	84	0	23
		17:00	78	1	31
		17:15	108	1	39
		17:30	120	1	23
		17:45	120	1	37
		18:00	120	1	36
	ARM B	16:30	48	8	54
		16:45	120	20	84
		17:00	72	36	127
		17:15	54	13	74
		17:30	120	16	74
		17:45	78	32	106
		18:00	120	28	96
	Arm C	16:30	36	2	40
		16:45	36	2	37
		17:00	30	2	28
		17:15	36	1	22
		17:30	36	1	23
		17:45	30	1	27

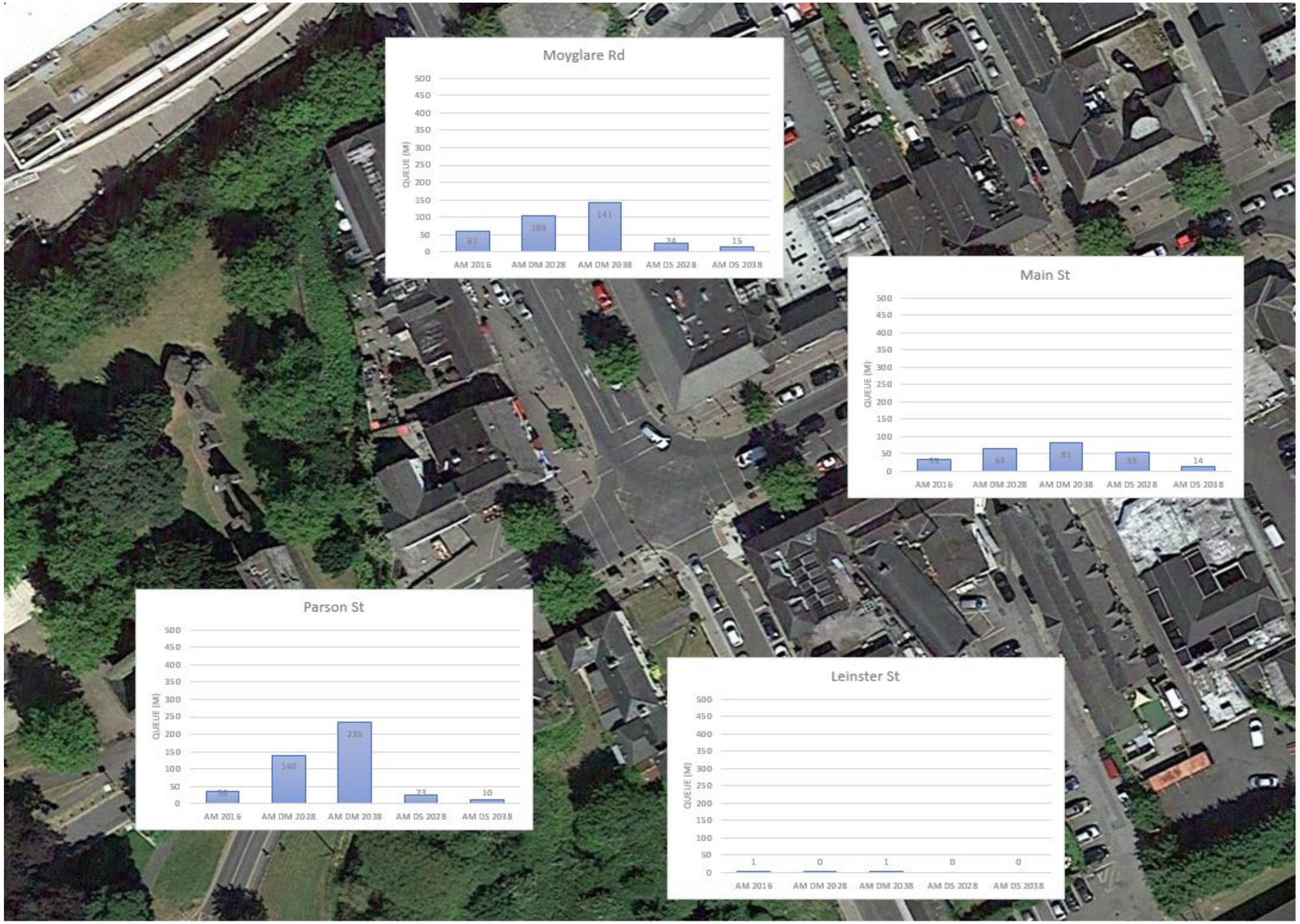
		18:00	54	1	23

Appendix G - Scenario Test Queue Lengths

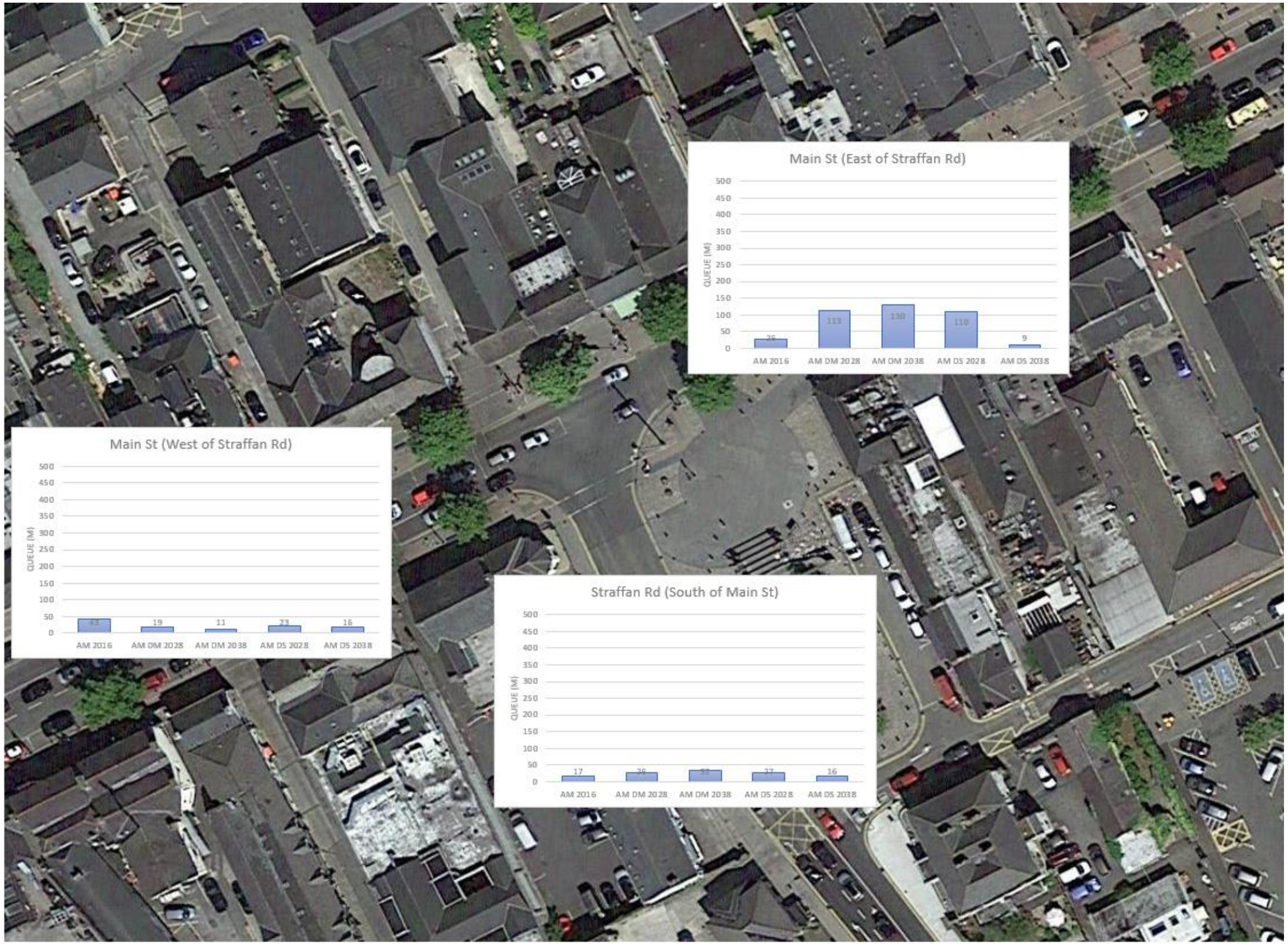
AM Queue Analysis Kilcock Road / Moyglare Road (AVERAGE)



AM Queue Analysis Parsons Street / Main Street / Leinster Street / Moyglare Road (AVERAGE)



AM Queue Analysis Main Street / Straffan Road (AVERAGE)



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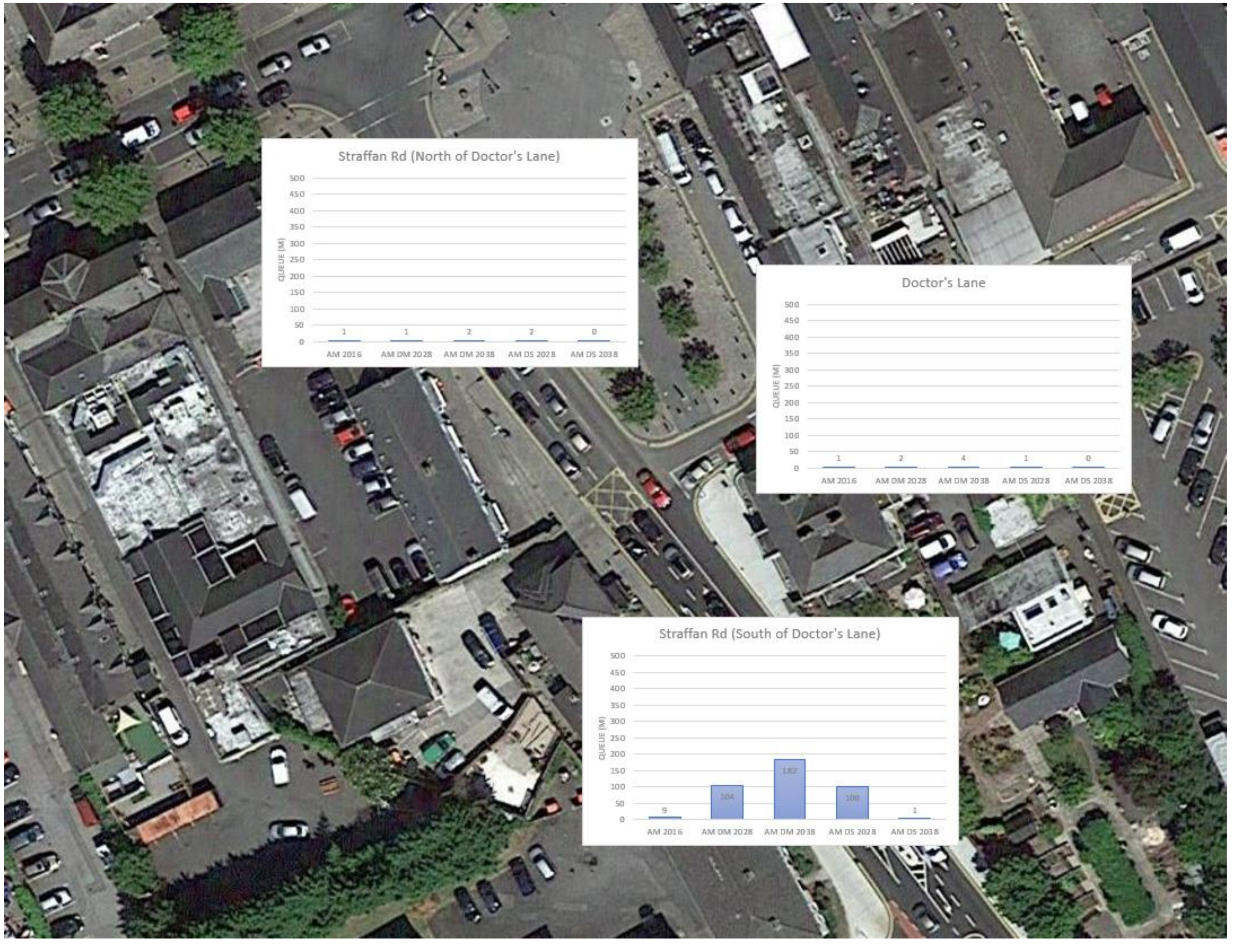

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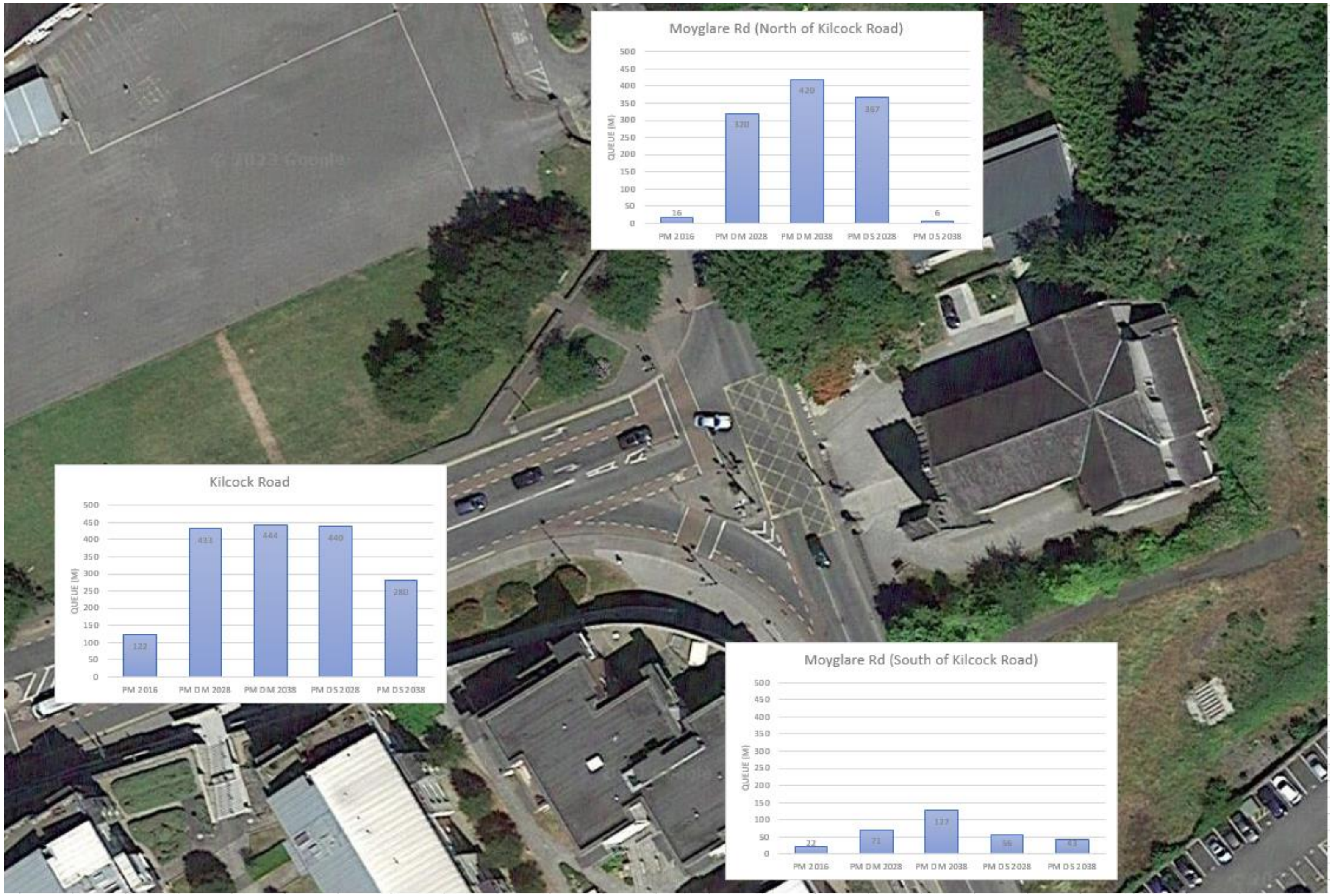

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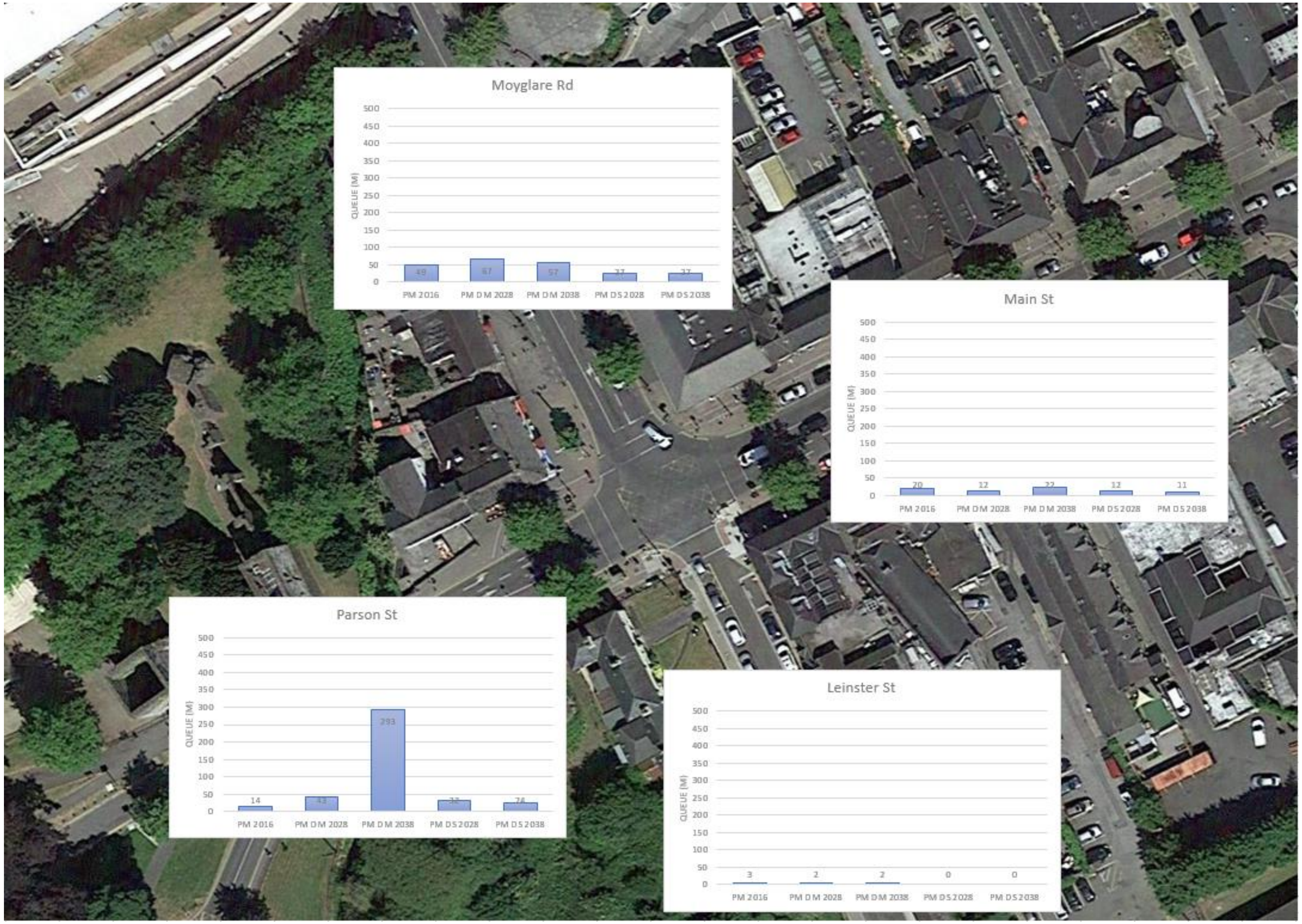

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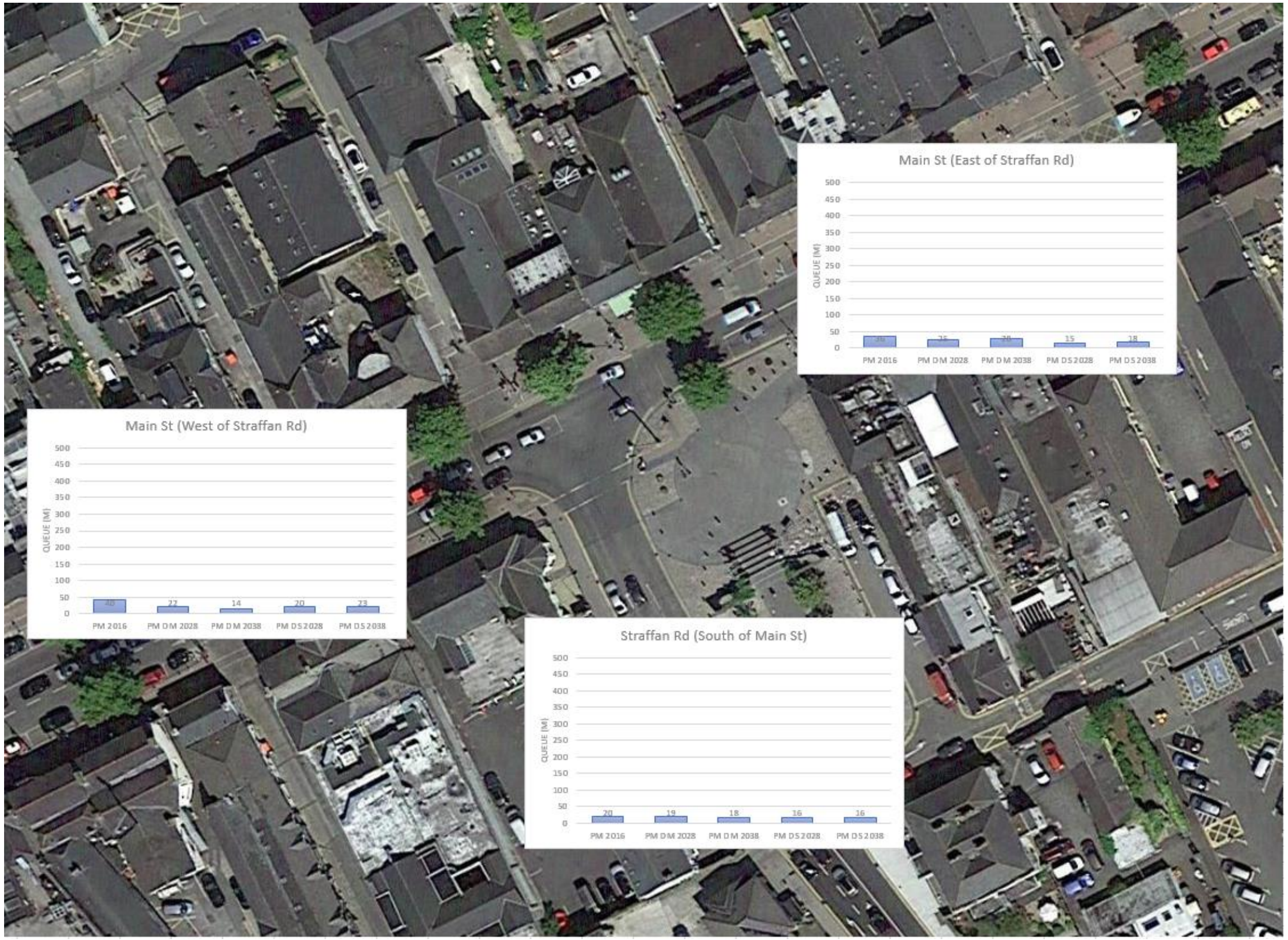
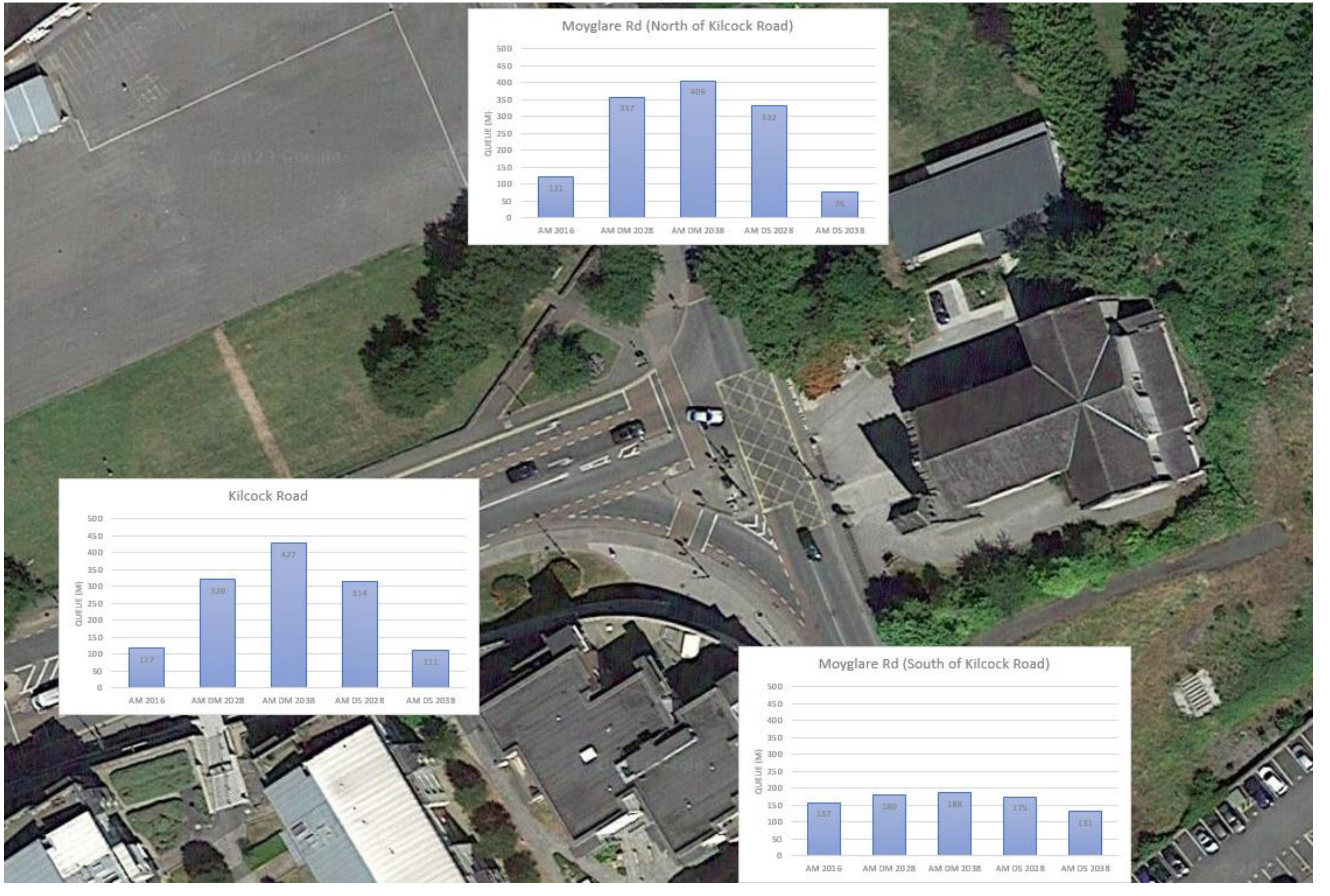


PM Queue Analysis Strafe Road / Doctor’s Lane (AVERAGE)

AM Queue Analysis Kilcock Road / Moyglare Road (MAXIMUM)



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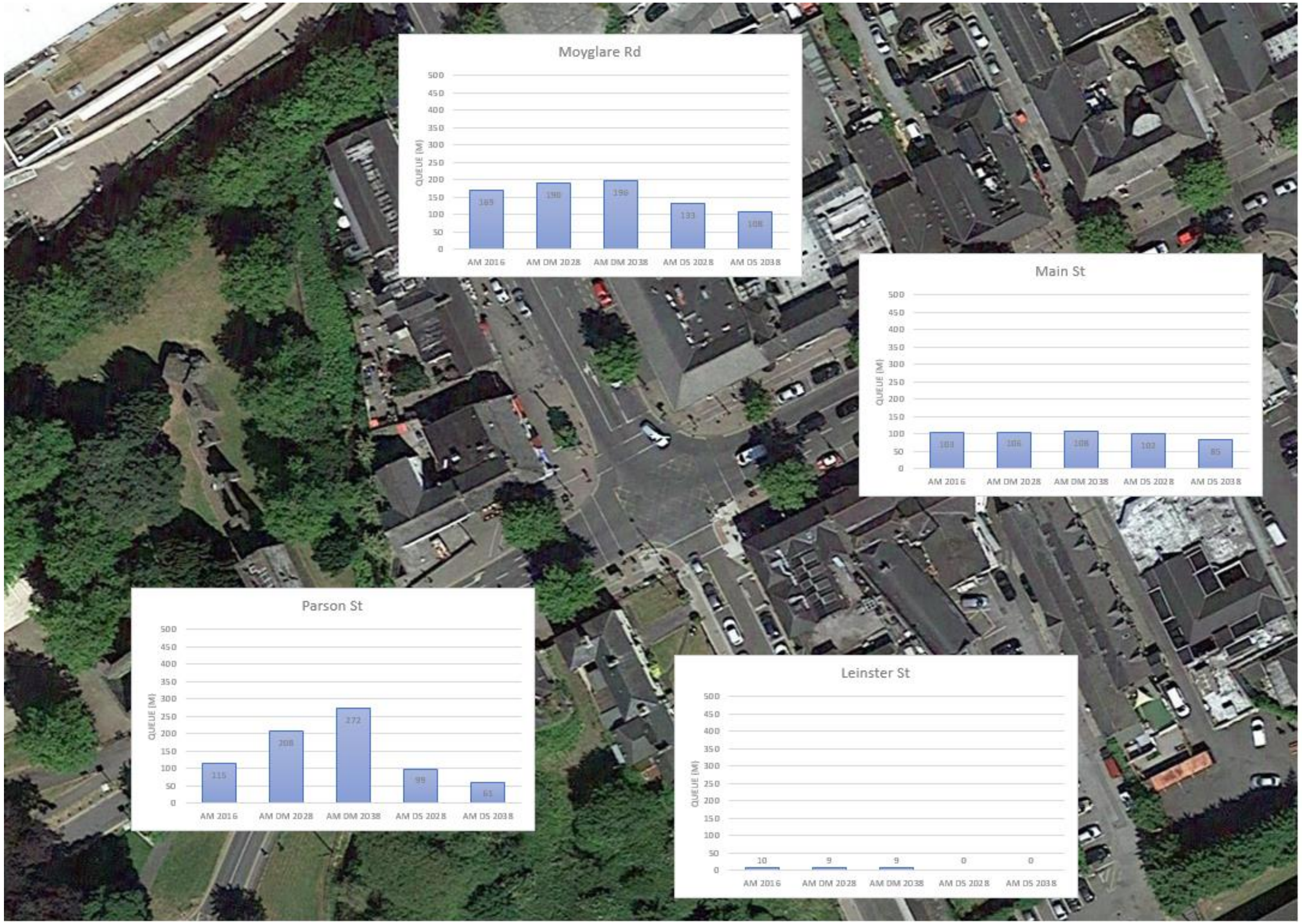

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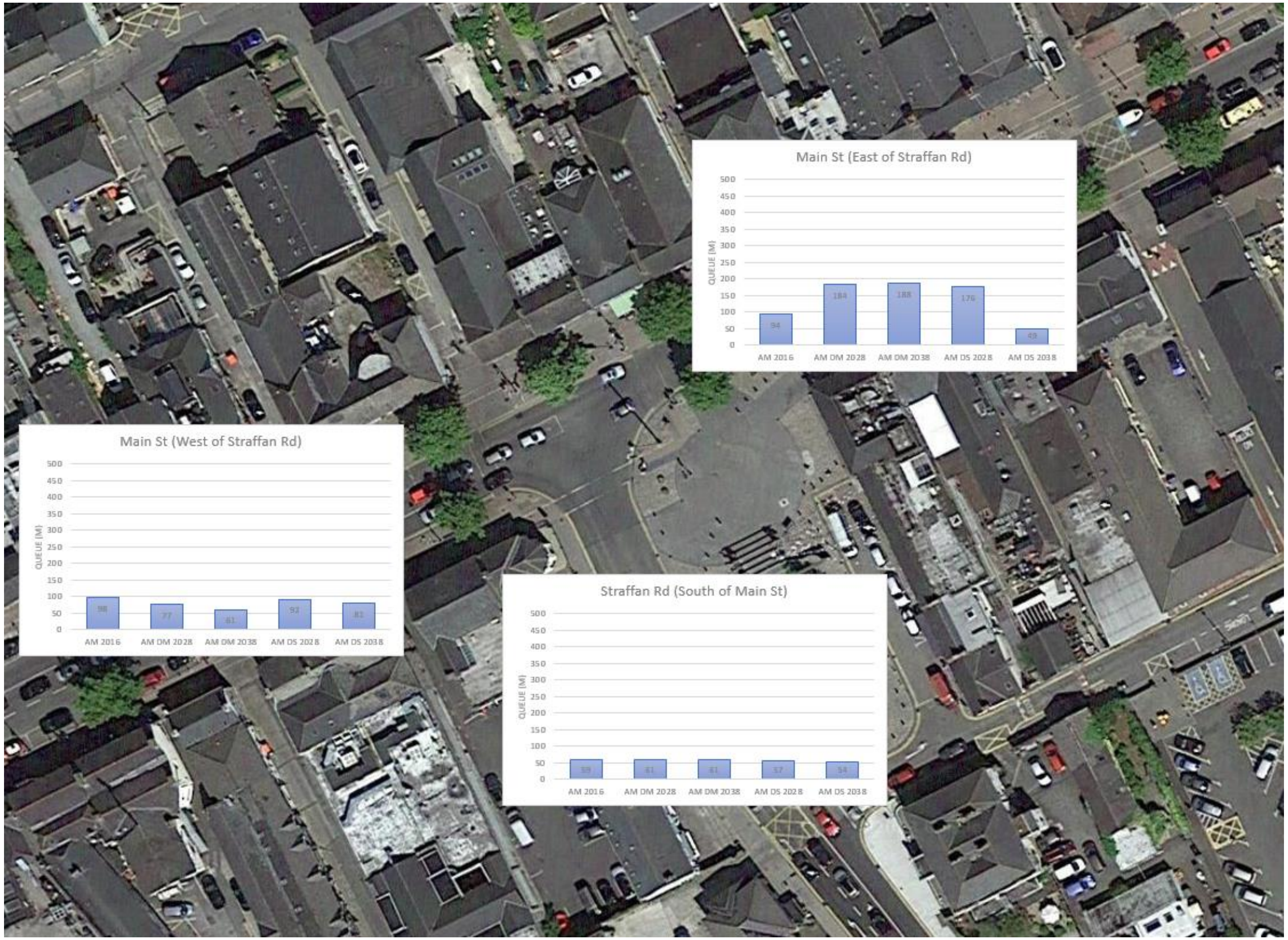

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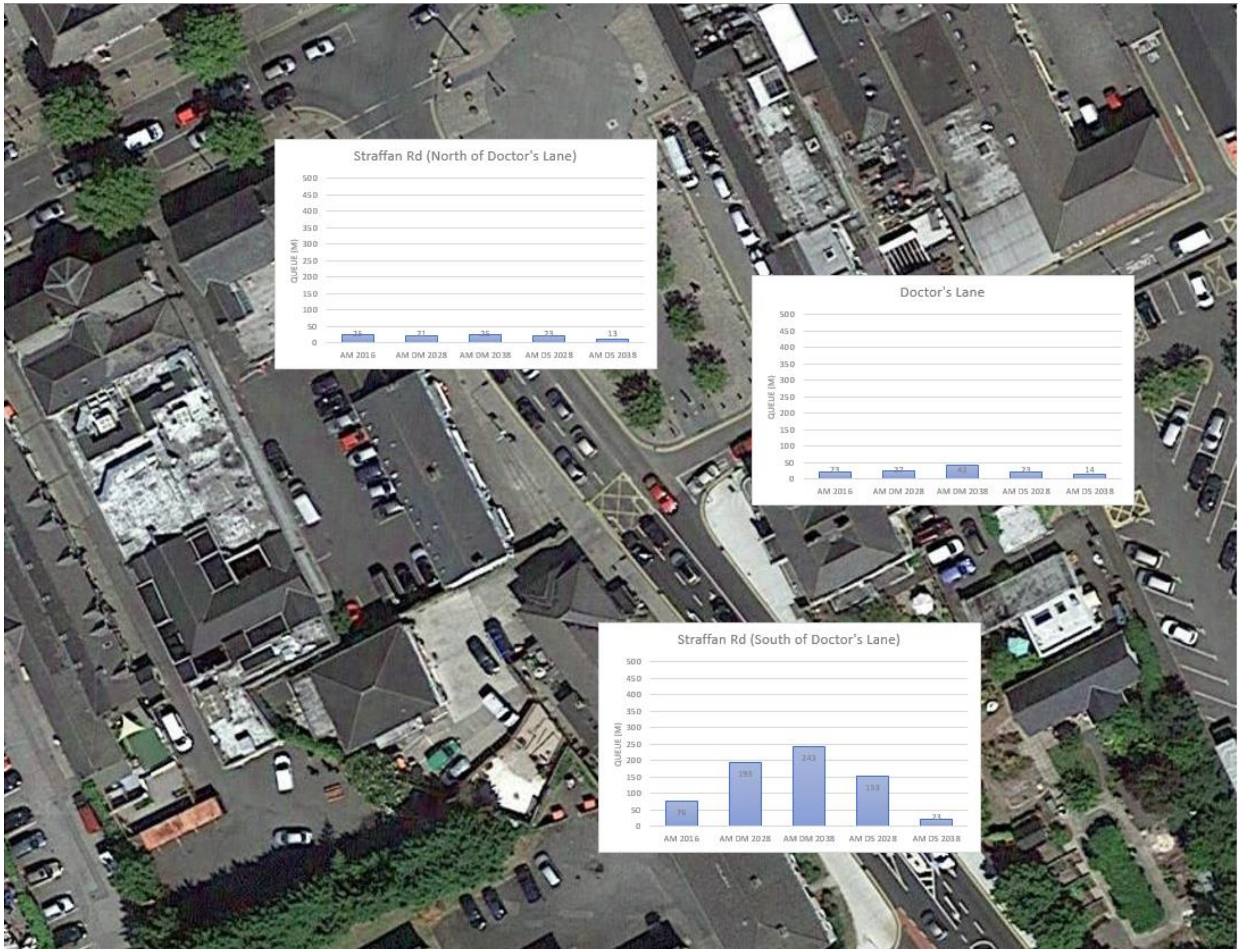

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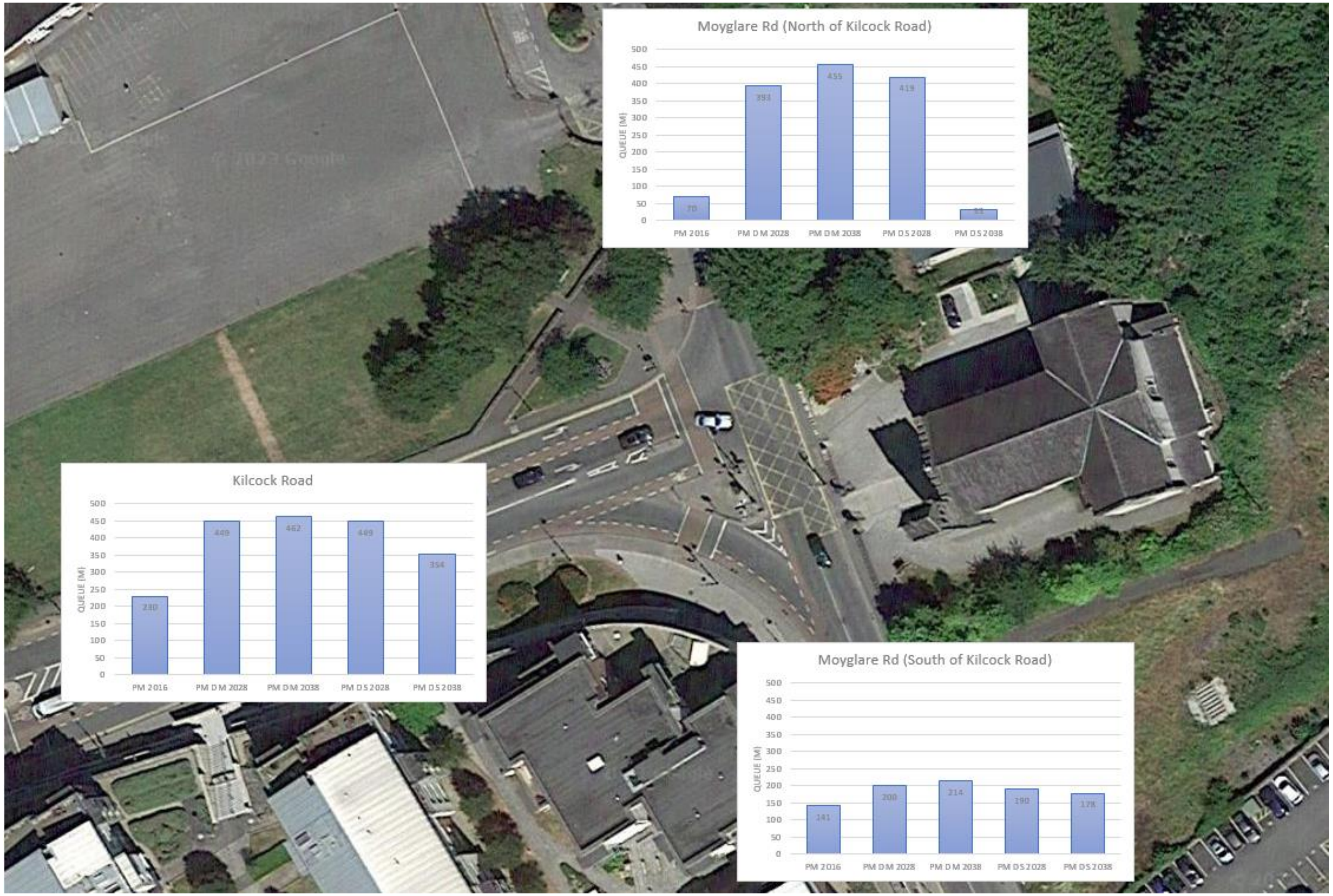

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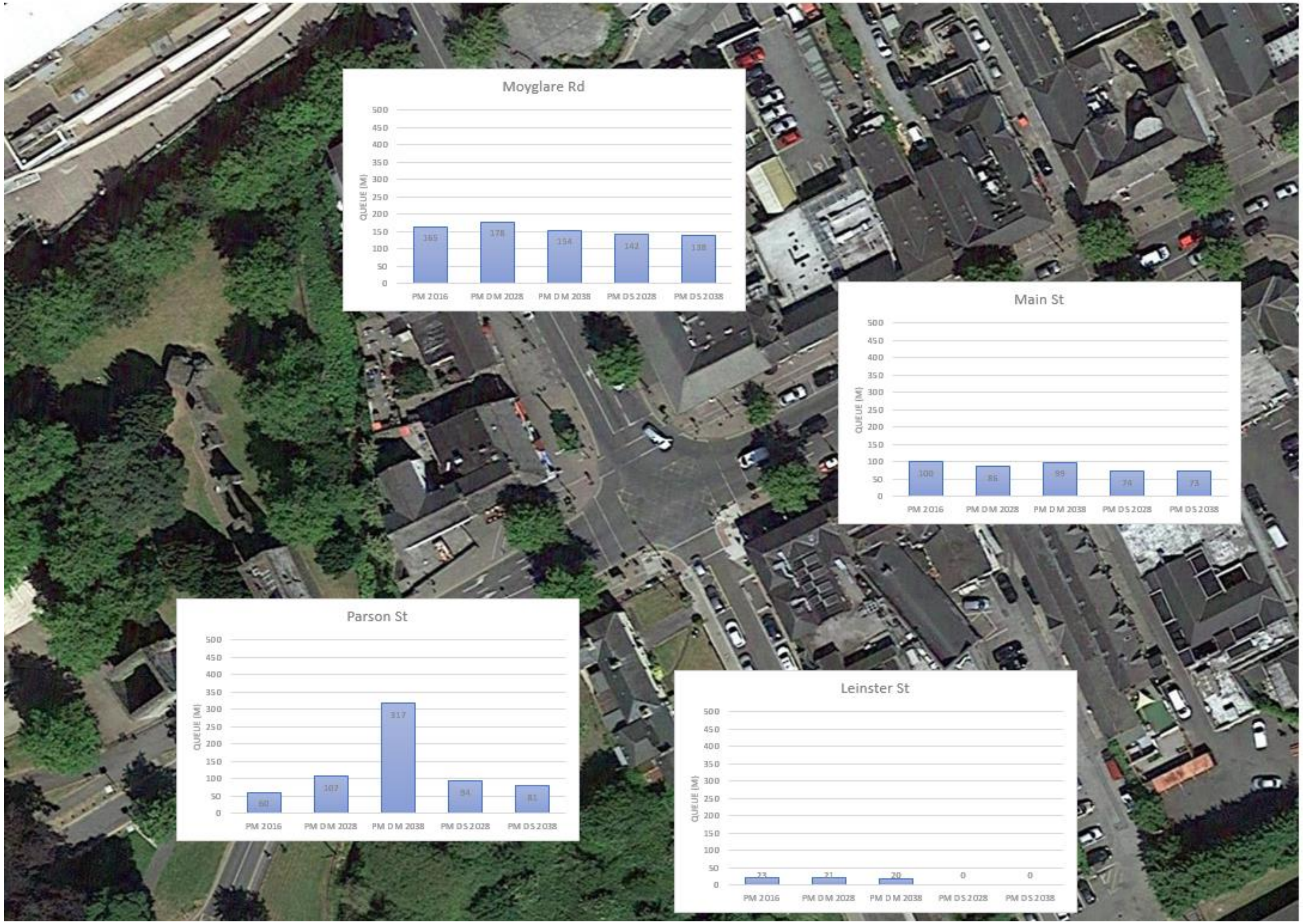

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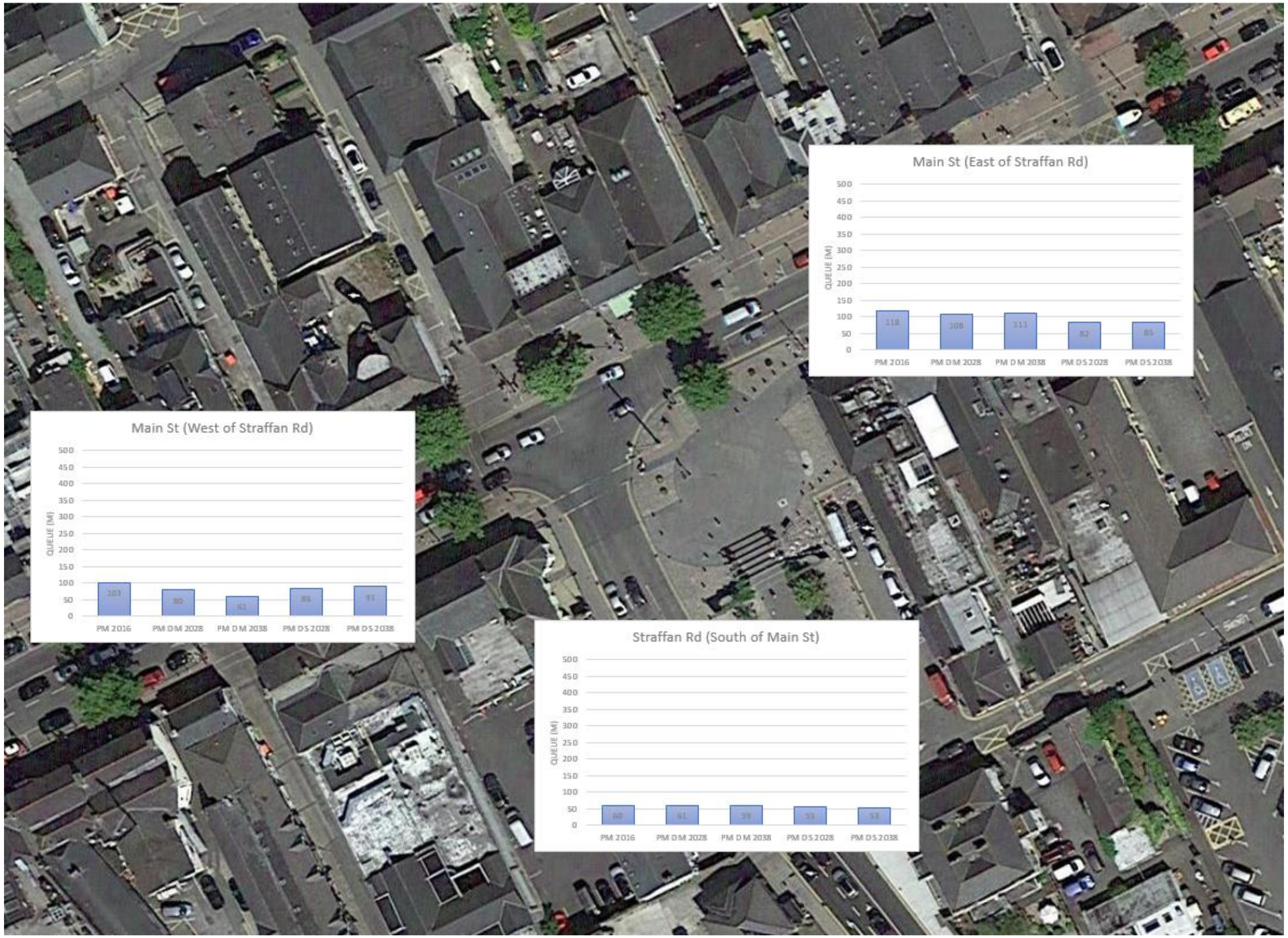
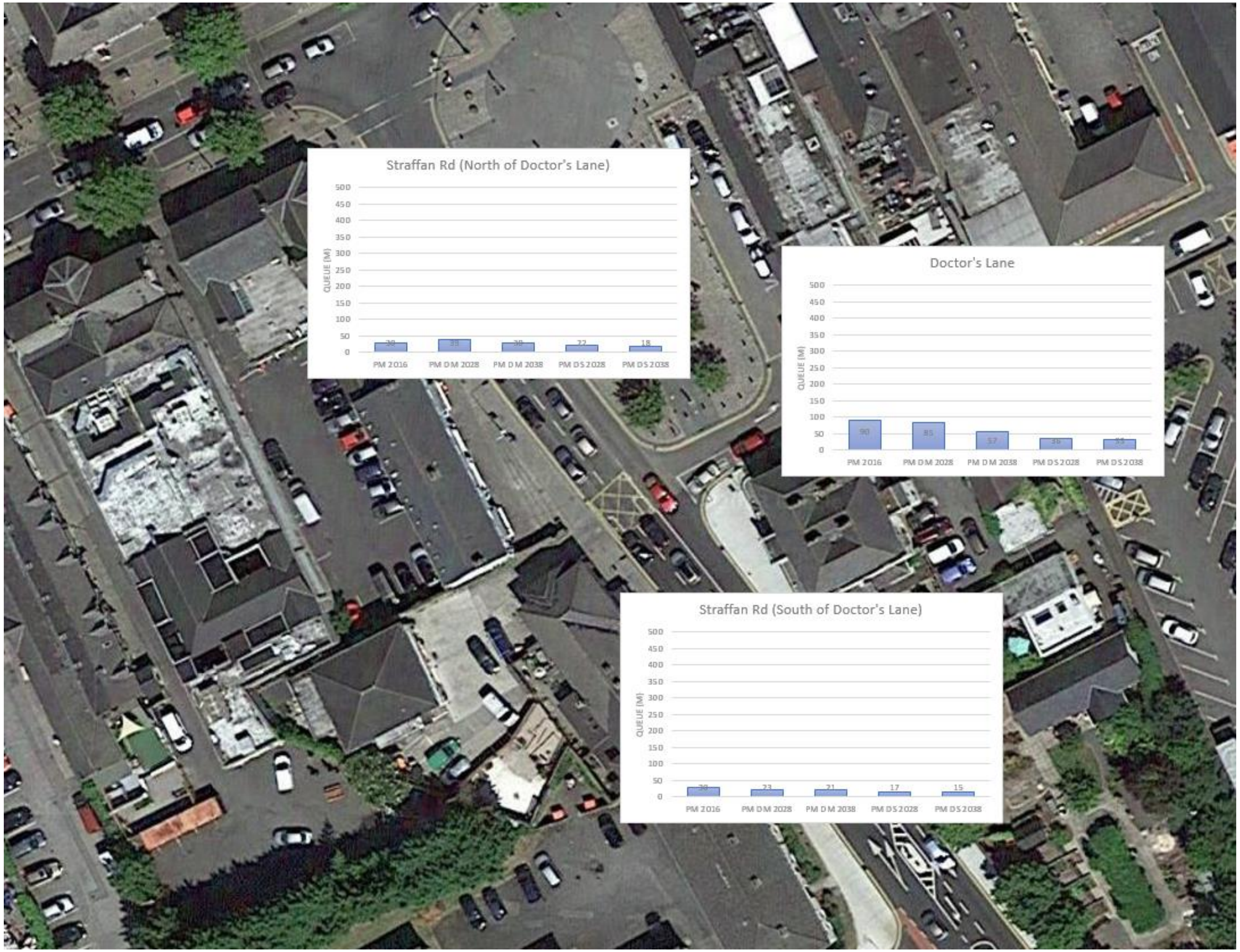


PM Queue Analysis Straffan Road / Doctor's Lane (MAXIMUM)


Straffan Rd (North of Doctor's Lane)
QUEUE (M)
500
450
400
350
300
250
200
150
100
50
0
22
18
PM 2016
PM DM 2028
PM DM 2038
PM DS 2028
PM DS 2038
Doctor's Lane
QUEUE (M)
500
450
400
350
300
250
200
150
100
50
0
90
85
57
PM 2016
PM DM 2028
PM DM 2038
PM DS 2028
PM DS 2038
Straffan Rd (South of Doctor's Lane)
QUEUE (M)
500
450
400
350
300
250
200
150
100
50
0
23
21
17
15
PM 2016
PM DM 2028
PM DM 2038
PM DS 2028
PM DS 2038

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Appendix E: Maynooth Decarbonisation Report

AECOM

Maynooth and Environs ABTA: Decarbonisation Report

Kildare County Council

13th April 2023

Delivering a better world

Prepared for:
Kildare County Council

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1. Introduction

Maynooth was selected by Kildare County Council as the pilot 'decarbonising zone' for County Kildare, which means it will be a town where a range of climate change mitigation measures will be introduced to contribute to national climate action targets. As part of the preparation of the Maynooth and Environs Area Based Transport Assessment (MEABTA), a standalone report on the decarbonisation of transport was commissioned by Kildare County Council (KCC) to support the decarbonising zone and identify additional recommendations which can be integrated into the MEABTA to assist in the decarbonisation of transport and inform KCC reports (for example the Local Authority Climate Action Plan).

The MEABTA is focused on reducing car dependency and promoting modal shift which will be key drivers of transport decarbonisation, while the measures explored in this report are focused on new forms of technology, such as e-vehicles or vehicles sharing schemes, as well as other measures like travel behavioural change programmes to support the MEABTA strategy. It is important to note that this report is focused on the transport aspects of decarbonisation, but KCC will also have to consider the decarbonisation of other sectors such as energy, housing, construction, etc., in order to achieve the goal of a decarbonising zone.

This report contains high level analysis and recommendations across a range of topics which could contribute to the decarbonisation of transport in Maynooth, which are not covered in detail in the main MEABTA report. At the end of the report, the recommendations from the decarbonisation report are summarised as measures to be integrated into the different modal strategies (e.g. walking, cycling, etc.) in the MEABTA along with an appropriate phasing.

The decarbonisation report is structured as follows:

- **Section 2**: This section contains a policy review covering national, local and decarbonisation policy to set the context for the Maynooth decarbonising zone.
- **Section 3**: This section summarises the approach to transport and development in the ABTA, in particular how it aims to aid modal shift and promote sustainable travel modes through an integrated approach.
- **Section 4**: This section explores the potential for different measures to support the decarbonisation of transport in Maynooth, such as shared mobility, micromobility, mobility hubs, electric vehicle charging, and behaviour change programmes.
- **Section 5**: This section provides a summary list of the recommendations in this report which can be adopted as transport measures in the MEABTA.

2. Policy Context

This section reviews the policy context for the Maynooth decarbonising zone in respect to transport.

2.1 National Policy Review

2.1.1 Climate Action Plan 2023

The Climate Action Plan 2023 (CAP23) sets out a pathway towards achieving a 51% reduction in carbon emissions by 2030. The transport sector represents about 18% of Ireland's carbon emissions nationally. Under the sectoral emissions targets agreed in July 2022, the transport sector must reduce its emissions by 50% compared to 2018 levels by 2030. The transport focus in CAP23 is on the need for consistent, coordinated, and systemic action by Government and Local Authorities and particular attention is given to spatial and land-use planning.

The plan notes that the role of local authorities is critical to delivery of climate action and that local authorities will need to take account of sustainable accessibility and connectivity in all plan-making and consenting decisions, including Development Plans, Area-based Plans and individual development consents. The CAP23 notes that meeting the 2030 transport abatement targets will require 'transformational change and accelerated action' across all key decarbonisation channels. Targets previously published in CAP21 have been revised to meet the higher level of ambition. Some of the key targets for 2030 are outlined below:

- 20% reduction in total vehicle kilometres (kms)
- 20% reduction in total car kms
- 20% reduction in 'commuting' car kms
- 25% reduction in daily car journeys
- 50% increase in daily active travel journeys
- 130% increase in daily public transport journeys
- EV share of total passenger car fleet of 30%
- 845,000 private EVs

The 'Avoid-Shift-Improve' framework has been applied to categorise most actions in the plan, with others falling into a 'horizontal' category which covers governance and accelerated implementation, communications and haulage and logistics. The transport chapter is also guided by five key principles to be embedded across the identified measures, which include:

- Systems innovation
- Just transition
- Accelerated implementation
- Communication and citizen engagement
- Enhanced governance, particularly at local authority level.

Actions are set out for 2023, 2024 and 2025, including 67 different actions for 2023. One of the many actions of particular interest from the perspective of this report is the preparation of a National Demand Management Strategy (DMS) for publication in 2023. This will consider a broad range of measures required, their relative impacts in terms of demand reduction and wider economic impacts, and their sequencing/timing in parallel with the delivery of improved sustainable mobility alternatives.

Potentially effective measures noted include: removing free workplace parking; increased parking charges; introduction of congestion and road user charging; and increased fossil fuel prices. It is mentioned that demand management will also be supported by road space reallocation and other planned measures, such as shared mobility and mobility-as-a-service. Another relevant action of the CAP23 which is listed under the ‘Enhanced Governance and Accelerated Implementation’ heading is to ensure Local Authority Climate Action Plan Guidelines include specific actions and indicators in respect of accessibility, modal shift and active travel.

Some of the other transport actions within CAP23 which have particular relevance to the specific topics discussed in this report are outlined in later sections of this report.

2.1.2 Sustainable Mobility Policy

The Department of Transport’s National Sustainable Mobility Policy, published in April 2022, sets out a strategic framework to 2030 for active travel and public transport to support Ireland’s overall requirement to achieve a 51% reduction in carbon emissions by 2030. Sustainable mobility is defined in the policy as: ‘Connecting people and places in a sustainable way by supporting:

- Safe, accessible, comfortable and affordable journeys to and from home, work, education, shops and leisure;
- Travel by cleaner and greener public transport; and
- A shift away from the private car to greater use of active travel and public transport.

The policy approach set out to achieve a more sustainable transport sector is based on the ‘Avoid-Shift-Improve’ principle which encompasses measures to reduce the frequency and distance of trips, move towards more environmentally friendly modes of transport, and promote efficient fuel and vehicle technologies.

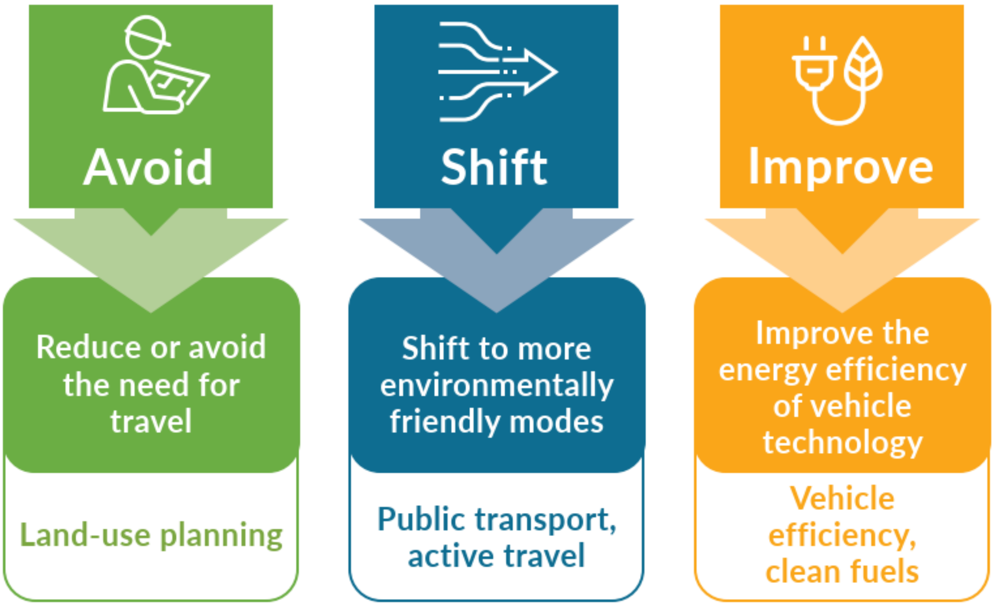

Figure 2-1 Avoid-Shift-Improve Principle (Sourced from Sustainable Mobility Policy)

The policy is guided by these three key principles which are underpinned by ten high-level goals. There are five goals under the **'Safe and Green Mobility'** principle, including:

1. Improve mobility safety;
2. Decarbonise public transport;
3. Expand availability of sustainable mobility in metropolitan areas;
4. Expand availability of sustainable mobility in regional and rural areas; and
5. Encourage people to choose sustainable mobility over the private car.

There are three goals under the **'People Focused Mobility'** principle, including:

6. Take a whole of journey approach to mobility, promoting inclusive access for all;
7. Design infrastructure according to Universal Design Principles and the Hierarchy of Road Users model; and
8. Promote sustainable mobility through research and citizen engagement.

There are two goals under the **'Better Integrated Mobility'** principle, including:

9. Better integrate land use and transport planning at all levels; and

10. Promote smart and integrated mobility through innovative technologies and development of appropriate regulation.

Most of the goals are highly relevant to the MEABTA. Goal 9, which aims to 'support compact growth and transport-orientated development through better integrated land use and transport planning' is of particular relevance. The importance of integrated land use and transport planning and how the MEABTA seeks to achieve this is discussed further in Section 3.1.

Goal 7 references Universal Design Principles and the internationally recognised 'Hierarchy of Road Users' model which is shown in Figure 2-2. Universal design is defined by the National Disability Authority as an environment designed so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size, ability or disability. The Hierarchy of Road Users model seeks to prioritise walking and wheeling above other modes. These principles will need to be considered by KCC when seeking to implement transport changes in Maynooth, including some of the measures discussed in this report.

For example, it will be important to consider and mitigate against potential negative impacts to pedestrians, particularly those with mobility impairments, when delivering new electric vehicle charging points, cycle parking and shared mobility schemes such as e-scooters or bike-share.

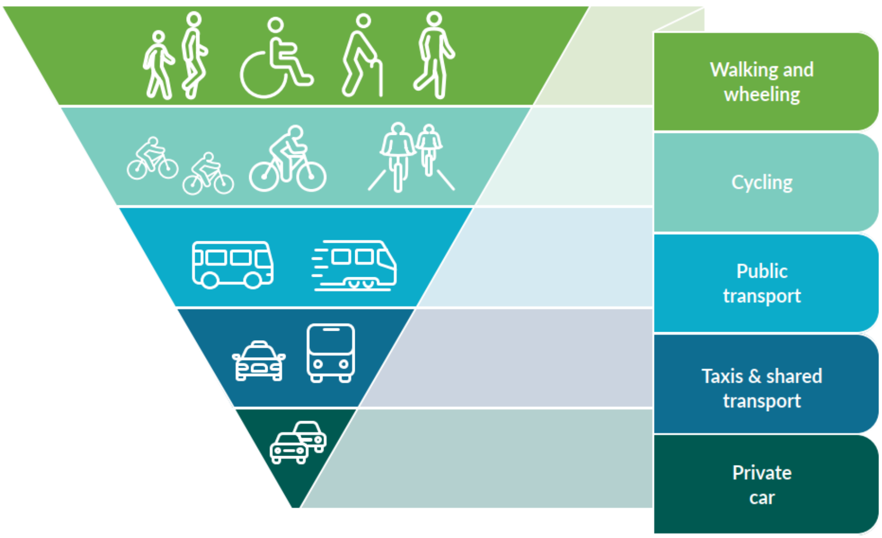

Figure 2-2 Hierarchy of Road Users Model

2.1.3 Section 28 Guidelines - Sustainable Compact Settlement Guidance (SCSG)

The Sustainable Mobility Policy notes that the Department of Housing, Local Government and Heritage intend to publish 'Sustainable Compact Settlement Guidelines' which will supersede existing 2009 Sustainable Residential Development in Urban Areas Guidelines for Planning Authorities. The new guidance will place a renewed emphasis on compact growth and on achieving a greater intensity of uses in central locations and in close proximity to high quality public transport services.

Public consultation on the draft guidelines is currently targeted to take place in Q1 2023[1]. Submissions made during the public consultation period will be reviewed and where appropriate, amendments will be made to the published Draft. The guidelines will then be finalised and published. Once issued, Planning Authorities and An Bord Pleanála will be required to have regard to the Guidelines in carrying out their functions. The guidelines will address key issues in relation to density, land use and transport, place-making and quality design.

2.2 Local Policy Context

2.2.1 Kildare County Development Plan 2023-2029: Strategic Vision and Aims

The Kildare County Development Plan 2023-2029 (CDP) came into effect on 28th January 2023. The Strategic Vision for the County is set out in the Plan:

'To build on the strengths of the county in order to improve the quality of life of all residents, through the creation of high-quality job opportunities, by the provision of high-quality residential development supported by high quality community and social infrastructure, through the provision of a high-quality sustainable transport network, by healthy placemaking and transformational regeneration. The vision for County Kildare also supports the transition to a low carbon climate resilient environment, by embracing inclusiveness, enhancing our built environment and enshrining the importance of conserving, restoring and protecting Kildare's biodiversity for future generations.'

Each chapter of the CDP identifies an 'Aim' supported by policies, objectives, actions and targets (as appropriate). There are ten overarching guiding principles set out for the County. The first four of these have particular relevance for the MEABTA and the requirement to decarbonise transport in Maynooth:

- (i) To develop a county that is resilient to climate change, plans for and adapts to climate change and flood risk, facilitates a low carbon future, supports energy efficiency and conservation, and enables the decarbonisation of our lifestyles and economy

- (ii) To ensure the compact growth and regeneration of lands within all settlements across the Settlement Hierarchy

[1] https://www.kildarestreet.com/wrans/?id=2023-01-24a.658&s=sustainable+compact+settlement#g660.r

- (iii) To promote the sustainable development of communities by locating residential, employment, social and community facilities in close proximity to each other.

- (iv) To support national investment in public transport services to achieve the better integration of land uses and high-quality public transport provision and to reduce car dependency throughout the county.

The CDP notes that KCC is currently preparing a Sustainable Energy Climate Action Plan (SECAP) which will include targets to reach the county's climate change goals over the short, medium and longer term. When published, the targets identified in the SECAP may be incorporated into the County Development Plan by way of a statutory variation.

2.2.2 Kildare County Development Plan: Sustainable Mobility

Chapter 5 of the CDP focuses on Sustainable Mobility and Transport. The overarching aim of the CDP with regard to transport is to

'Promote and facilitate ease of movement within and through County Kildare, by integrating sustainable land use planning and a high-quality integrated transport system; and to support and prioritise investment in more sustainable modes of travel, the transition to a lower carbon transport system, and the development of a safer, efficient, inclusive, and connected transport system'.

The urgent need to transition to more sustainable modes of transport is acknowledged in the Chapter. It is stated that KCC will endeavour to deliver a reduction in private car usage broadly in line with the 51% reduction in emissions by 2030 target set out in the Climate Action and Low Carbon Development (Amendment) Bill 2021.

There are numerous specific objectives and actions associated within each Transport and Mobility Policy. All of the Transport and Mobility policies (excluding aviation related policies) are outlined below. Some of the specific objectives and actions associated with topics covered in this report are separately noted within the relevant chapters of this report.

- **TM P1**: Promote sustainable development through facilitating movement to, from, through and within the County that is accessible to all and prioritises walking, cycling and public transport.

- **TM P2**: Prioritise and promote the development of high-quality, suitable, safe and sustainable walking and cycling pathways and facilities, both inter-county, intra-county (in consultation with all relevant stakeholders including neighbouring local authorities) and within the towns and settlements of County Kildare within a safe road/street environment that will encourage a shift to active travel that is accessible for all, regardless of age, physical mobility, or social disadvantage, subject to all relevant and cumulative environmental assessments and planning conditions.

- **TM P3**: Promote the sustainable development of the county by supporting and guiding national agencies in delivering major improvements to the public transport network and to encourage a shift from car-based travel to public transport that is accessible for all, regardless of age, physical mobility, or social disadvantage.

- **TM P4**: Ensure ongoing competitiveness and the efficient movement of people and goods in the county through the improvement and expansion of the road and street network within the county to support economic development and provide access to new and existing communities, employment areas and development, all while prioritising sustainable modes of transport. New roads and other transport infrastructure projects should first be subject to the undertaking of a feasibility assessment. Where feasibility is established, a Corridor and Route Selection Process will be undertaken where appropriate, for relevant new road infrastructure in two stages", Stage 1 – Route Corridor Identification, Evaluation and Selection and Stage 2 – Route Identification, Evaluation and Selection.

- **TM P5**: Work with Transport Infrastructure Ireland in accordance with the Spatial Planning and National Road Guidelines for Planning Authorities (2012) to develop and operate the national road network through the County and to ensure that the carrying capacity, efficiency and safety of the network and associated junctions is protected, maintained and improved and to prevent development that could hinder the future upgrading of national road network routes and interchanges.

- **TM P6**: Maintain and improve the capacity, safety and function of the regional road network (as finance becomes available) and to ensure that it is planned for and managed to enable the sustainable economic development of the county and wider area while encouraging a shift towards more sustainable travel and transport in accordance with the Core Strategy, the Spatial Planning and National Roads Guidelines (2012) and the Draft Transport Strategy for the Greater Dublin Area 2022-2042.

- **TM P7**: Ensure that the safety and capacity of the local road network is maintained and improved where funding allows and to ensure that local streets and roads within the county are designed to a suitable standard to accommodate sustainable modes of transport and the future needs of the county. These roads and streets should be appropriately designed for all road users regardless of age, physical mobility, or social disadvantage.

- **TM P8**: Ensure that streets and roads within the county are designed to balance placemaking and movement to prioritise sustainable modes of transport and to provide a safe traffic calmed street environment in accordance with the principles set out in the Design Manual for Urban Roads and Streets (2019) while meeting the needs of road users of all ages and abilities.

- **TM P9**: Effectively manage and minimise the impacts of traffic in urban areas and prioritise the movement of pedestrians, cyclists and public transport particularly at key junctions, while maximising the efficient use of existing resources.
- **TM P10**: Balance the demand for parking against the need to promote more sustainable forms of transport, to limit traffic congestion and to protect the quality of the public realm from the physical impact of parking, while meeting the needs of businesses and communities.
- **TM P11**: Ensure street lighting is provided in accordance with Kildare County Councils 'Street Lighting and Planning Guidance' policy document in either draft or adopted form. The document outlines the general principles and requirements for street lighting in the county.

The chapter sets out modal shift targets for trips to work and to education for the lifetime of the CDP. However, these are described as 'Interim targets' until completion of the Sustainable Energy Climate Action Plan when a review will occur. It should be noted that the total for the interim target mode shares is above 100% in both cases, for instance 115% for the work mode share target and 130% for the education mode share target. These targets will likely be revised to fix this issue in later revisions.

Table 2.1 Journeys to Work Mode Share Targets for Kildare CDP

Mode of Travel	2016 Baseline	Interim Target Mode Share
Walking	6%	20%
Cycling	1%	10%
Bus	5%	13%
Train	5%	14%
Car Share	4%	8%
Car (+ motorbike, scooter, van and lorry)	74%	50%
Working from Home	4%	No specific target

Table 2.2 Journeys to Education Mode Share Targets in Kildare CDP

Mode of Travel	2016 Baseline	Interim Target Mode Share
Walking	28%	50%
Cycling	2%	15%
Public transport	20%	25%
Car (+ motorbike, scooter, van and lorry)	50%	40%

2.2.3 Meath County Development Plan 2021-2027

Maynooth Environs (the Moygaddy lands) in County Meath will be included in the cross boundary Joint Local Area Plan and it forms part of the study area for the MEABTA. The location of Maynooth Environs to the north-east of Maynooth is shown in Figure 2-3 for context.

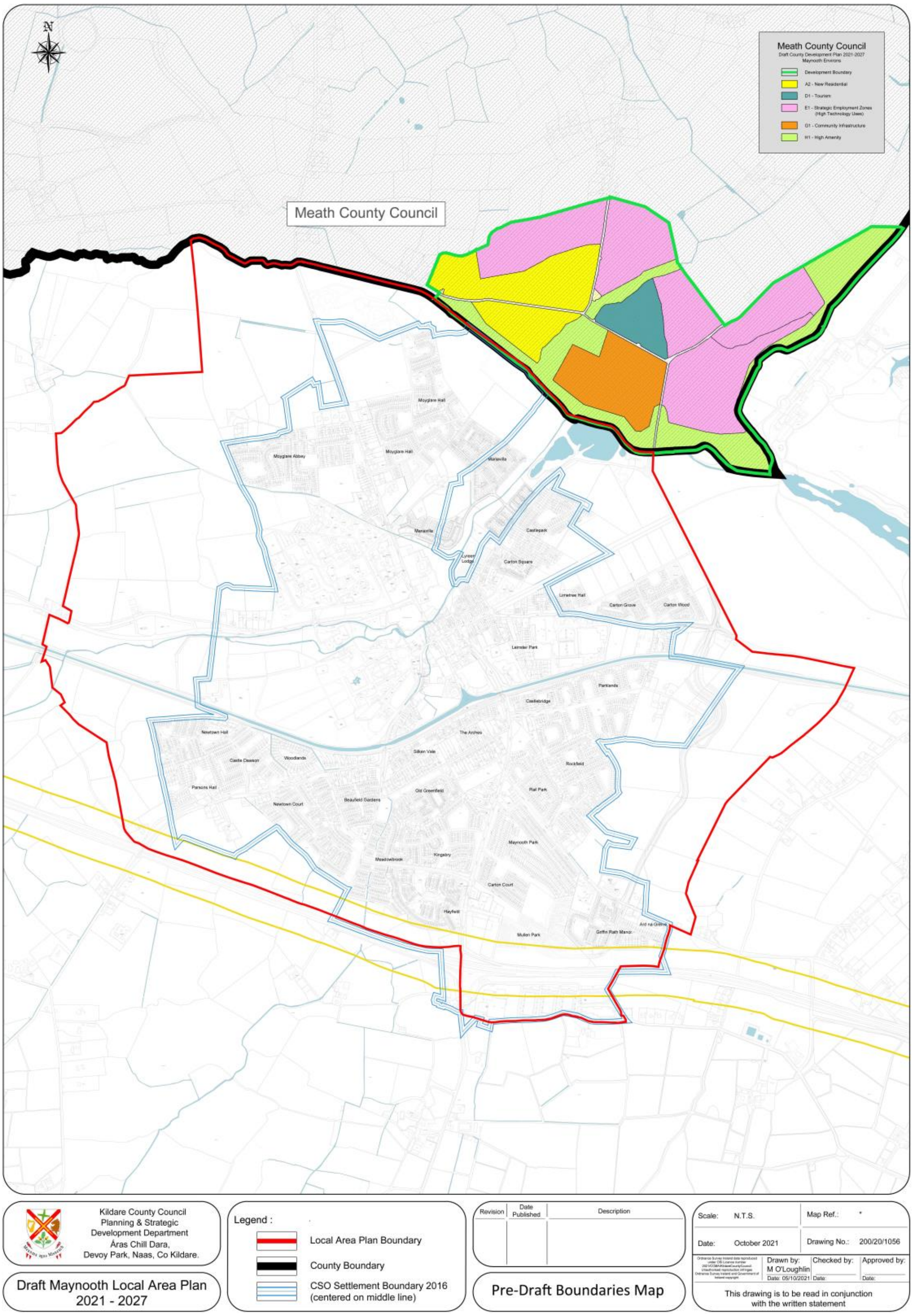

Figure 2-3 Location of Maynooth Environs (Moygaddy lands)

The Meath CDP contains a vision for Maynooth Environs to develop in partnership with the existing town in County Kildare and integrate with the town's existing urban area. It envisages that the Environs will be a focal point for science and technology employment and notes that the intention is to create a unique employment hub centred on a high tech/bio tech campus within the lands, supported by a 'live work' community with a mixture of residential, employment, community and tourism zoning. The Core Strategy Household Allocation in the Meath CDP for Maynooth Environs for the period 2020-2027 is 500 units and the population projection for 2027 is 1,000.

There are a number of transport related objectives in the CDP related to the Maynooth Environs area, covering aspects such as the preparation of Masterplans, the delivery of the Maynooth Outer Orbital Relief (MOOR) Road, the requirement for a Mobility Management Plan for the development, the delivery of improved active travel connections to Maynooth Town Centre, the delivery of cycle infrastructure generally, the provision of a permeable network that encourages the use of alternative modes of transport.

The written statements for all settlements in the Meath CDP contain mode share targets for 2026. However, the targets set for Maynooth Environs are unchanged compared to the 2016 Modal Share. The targets are as follows:

- Walking – 2%
- Cycling – 3%
- Bus – 6%
- Rail – 12%
- Car – 73%

The Movement Strategy for County Meath as a whole is contained in Chapter 5 of the CDP. The strategic aim is to 'create attractive efficient compact settlements which reduce the need to travel and improve the quality of life for inhabitants'. The Vision is to 'provide safe, efficient and accessible transport networks which meet both local needs and wider regional and national strategic aims'. The Plan notes that maintaining and improving transport networks remains a priority and also states that achieving sustainable patterns of transport in accordance with national and regional policy will enable settlements to function more efficiently and effectively.

The Plan contains four policies related to the integration of land use and transport planning, the first of which is to 'support and facilitate the integration of land use with transportation infrastructure, through the development of sustainable compact settlements which are well served by public transport, in line with the guiding principles outlined in RPO 8.1 of the Eastern and Midlands Regional Assembly (EMRA) Regional Spatial Economic Strategy (RSES) 2019-2031'.

The Plan also contains numerous specific policies and objectives related to all of the main modes of transport, including more sustainable modes such as cycling, bus and rail which are too numerous to list here. The transport chapter also contains a short section related to Climate Change. In this section the Plan notes that providing more sustainable travel choices to residents is a strategic priority that should reduce transport carbon emissions while delivering a number of key economic, social and community benefits. It also notes that a focus on residential development in sustainable locations in existing settlements is essential to deliver a reduction in emissions.

2.3 Decarbonising Zones Policy Review

The 2019 Climate Action Plan introduced a requirement for each local authority to 'identify and develop plans for one Decarbonising Zone' (DZ) within their administrative area. Maynooth was selected as the DZ for County Kildare by Kildare County Council in April 2021.

The Climate Action and Low Carbon Development Amendment Act 2021 subsequently introduced a requirement for local authorities to prepare plans for a period of five years referred to as 'Local Authority Climate Action Plans' (LA CAP) which will specify the mitigation and adaption measures to be adopted by local authorities. The LA CAPs are to be prepared within twelve months from when the minister formally issues a request to the sector to prepare the plans. They will have to be consistent with national climate plans and will include both mitigation and adaption measures.

The 2021 National Climate Action Plan integrates the development of DZs as part of the statutory guidelines for LA CAPs. Local authorities will therefore take forward their Decarbonising Zone (DZ) as part of their LA CAP.

The Department of Communications, Climate Action and Environment is currently finalising guidelines detailing the approach Local Authorities are to take in the development and implementation of LA CAPs, including DZs. A draft version of these guidelines was published in September 2022 for consultation.

A DZ is defined in the draft guidelines as 'a spatial area identified by the local authority, in which a range of climate mitigation, adaptation and biodiversity measures and action owners are identified to address local low carbon energy, greenhouse gas emissions and climate needs to contribute to national climate action targets'.

DZs intended to act as a demonstration and test bed of what is possible for decarbonisation at local and community levels, fostering a flexible, incremental and community-driven approach. The range of projects proposed should be specific to the emissions and climate characteristics of the spatial area and identify appropriate project partners and sponsors. The measures will address a variety of areas which include:

- Electricity sourcing
- Heat management
- Reducing needs for travel and shifting travel modes towards active and public transport,
- Enhanced building energy efficiency
- Carbon sequestration
- Energy storage and management systems.

The Maynooth and Environs ABTA (MEABTA) and this report are focused on transport (the third item above) and do not address other aspects of decarbonisation or climate adaption measures.

The guidance describes key stages for developing the DZ, informed by the place-based and systems-thinking approach to generate locally tailored policy and assist in the delivery of climate action. The five key stages are shown in Figure 2-4.

Figure 2-4 Stages to Development of the DZ

The actions included in the DZ are expected to be prioritised based on justification from the evidence, using the SMART methodology and assigned with key performance indicators (KPIs) to reflect the performance of their delivery. The format of actions for the DZ is expected to be consistent with the format of actions in the remainder of the LA CAP.

Commitment to implementation is expected to form an integral part of the plan-making process and local authorities are expected to outline their commitment to implementation as part of the LA CAP, including the relevant structures established, partnerships with key stakeholders, details of organisational governance arrangements etc. During the implementation stage, there will be requirements to track progress through KPIs and to engage with a number of different reporting avenues.

The second stage in the guidelines includes undertaking a Baseline Emissions Inventory (BEI). A suggested methodology in Annex C of the draft guidelines is referred to, which is described as a ‘Bottom-up Spatially-led’ approach. Within this guidance it is acknowledged that transport sector emissions are the most difficult to model.

The establishment of a Baseline Emissions Inventory for transport emissions in Maynooth and estimating the potential impact of the implementation of proposed measures and recommendations do not form part of this report. This may form part of the LA CAP (of which the DZ will be one component) in future.

It should also be noted that according to the CAP23, the guidelines for LA CAPs will include a requirement for specific actions and indicators to be included in respect of accessibility, modal shift and active travel.

3. Integrated Transport and Development Approach

This section outlines the approach to development in the MEABTA to support transport decarbonisation as well as exploring the potential for the ten-minute settlement concept and low car developments in the Maynooth DZ. The integrated nature of the transport strategy is also highlighted in respect to the approach taken to promote modal shift to sustainable travel modes.

3.1 Approach to Development Planning

This section explains the importance of integrated land-use-transport planning, explores the ten-minute settlement content and outlines the potential for low car development approaches in Maynooth.

3.1.1 Importance of Integrated Land-Use-Transport Planning

Land-use and transport are highly related in a process known as the land-use transport feedback cycle, which is shown in Figure 3-1. This cycle means that when transport improvements promote growth, the development results in the need for more transport improvements to cater for extra demand, which leads to additional transport capacity promoting growth again as the cycle repeats.

Appreciating the importance of this cycle is a vital part of understanding the need for an integrated approach to land-use-transport planning as part of Area Based Transport Assessments. ABTAs and Local Area Plans can be used to strategically locate new transport infrastructure in areas where the promotion of development growth will have the best chance of encouraging modal shift and sustainable travel models.

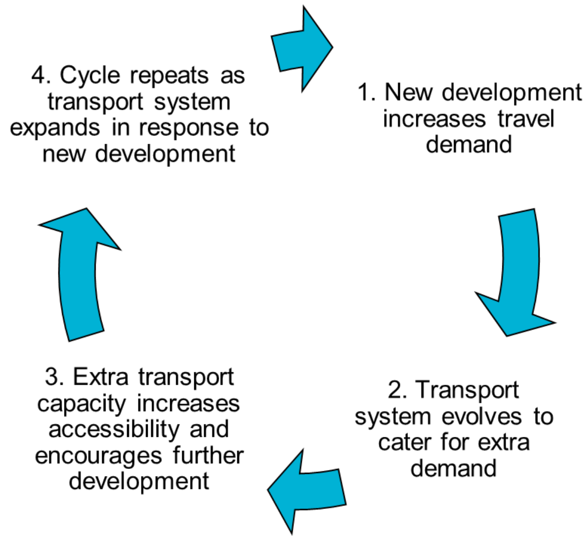

Figure 3-1 Land Use Transport Feedback Cycle

The population of Maynooth and Environs is expected to nearly double over the next twenty years in order to meet the growth targets defined in National, Regional and County level planning policies. Further details of the growth which is anticipated in Maynooth are provided in the main ABTA report. Significant growth in population and employment, as well as the anticipated increase in the numbers of students attending Maynooth University will put significant pressure on the transport network, requiring careful land-use-transport planning to ensure this growth can be accommodated as part of a strategic plan which will promote sustainable travel and limit car dependency as much as possible.

As part of the MEABTA development process, a detailed land-use modelling assessment took place to identify the preferred land-use scenario which has the best potential to promote sustainable travel while also achieving national and regional policy goals. The land-use assessment involved testing four different land-use scenarios for Maynooth and then identifying the most positive aspects of each scenario to create the preferred scenario for future expansion. The four land-use scenarios were assessed on the basis of:

- A GIS assessment which quantified the area of development in hectares located in zones which were classified as good or bad for the promotion of sustainable travel.
- Future year transport modelling in VISUM to show the impact of growth on the road network when population/economic growth is focused in the north, west, east or south.

The preferred land-use scenario was further refined in a series of modal split sensitivity tests which tested the impact on the future transport network if -5%, -10% or -15% modal shift occurred from the private car to sustainable travel modes. The conclusion of this process was the selection of a preferred land-use scenario and the adoption of -10% car modal shift as the target for 2038 in Maynooth. Further details of the land-use assessment process are provided in the main ABTA report.

The land-use assessment process ensured that future population and employment growth is located in areas which are most likely to facilitate sustainable travel, which the MEABTA could then capitalise on by proposing integrated walking, cycling, public transport and road measures to connect these growth areas to Maynooth’s retail, education, service and employment trip destinations. The preferred land-use growth scenario in Maynooth focuses the majority of new growth into the lands west of the town as these areas will be closest to the proposed Maynooth West train station and they have the greatest potential to promote sustainable travel. There will be some consolidation of the urban fringe in the south-east with the development of the railpark site in close proximity to the Eastern Ring Road. Throughout the existing urban area, densification will be achieved through in-fill development where land is available. Additional growth is also included in the preferred land-use scenario in Moygaddy in County Meath. This is a requirement of the RSES and Meath CDP and is outside the jurisdiction of KCC.

This integrated approach to land-use and transport planning will maximise the potential for sustainable travel from a spatial perspective, which can be further enhanced by the requirement for mixed-use and dense development in the Local Area Plan zoning and planning conditions. Denser development will ensure that higher levels of public transport frequency are viable, while mixed-use development means that services and employment are closer to people's homes and easier to reach by active modes. An integrated approach to land-use and transport such as this will ensure that the land-use-transport feedback cycle is utilised to a positive end to encourage modal shift, rather than older planning approaches which were more reactive to traffic problems (e.g. increasing road capacity to 'solve' congestion) and inadvertently encouraged induced demand and growth in urban sprawl areas.

3.1.2 The Ten-Minute Settlement Concept

3.1.2.1 Definition of the Ten-Minute Settlement

The RSES for the Eastern and Midland Region contains a series of guiding principles regarding the integration of land use and transport. One of these is to support the '10 minute settlement' concept, which is defined as having a range of community facilities and services accessible in short walking and cycling timeframes from homes or accessible by high quality public transport to these services in larger settlements.

The Kildare CDP 2023-2029 contains a more detailed description of the 10-minute town concept which is described as a 'key aim' of the CDP. It notes that the 10-minute town/settlement concept provides for settlements to be designed to reduce the overall need to travel while also allowing for active modes to become realistic alternatives to the car for short trips. It represents the practical implementation of principles relating to people-centred urban design and healthy placemaking while also aligning with requirements for compact growth.

It is noted that the concept can be achieved in existing settlements through urban design interventions to improve walkability and enhance the public realm. In new developments, the implementation involves incorporating features such as permeability and high-quality active mode links, in tandem with the development of improved levels of social infrastructure, neighbourhood centres/local shopping and local employment opportunities. Elsewhere in the CDP, it is noted that the delivery of the 10-minute settlement concept will be supported with higher densities at appropriate locations. The ten-minute walking distance mentioned in the section of the CDP focused on the 10-minute settlement is 'approximately 800m in distance'. According to 'Get Ireland Walking', a person can walk 1km in ten minutes at a brisk pace or twelve or thirteen minutes at a moderate pace. The CDP also notes that within urban areas in Ireland cyclists typically travel between 15 and 20km/h, which translates to between 2.5km and 3km in ten minutes.

While the RSES and the Kildare CDP focus on the ten-minute settlement concept, a very closely related concept which has become popular worldwide in recent years is the '15-minute city'. A recent report by the international design studio Hassell written for Irish Institutional Property (IIP), titled ‘Close to Home’ explores what the 15-minute city means, why it matters and public perceptions in Ireland of the required conditions for 15-minute cities. Some of the benefits noted are that people benefit from greater access to services and social opportunities while the environment benefits from more efficient land, material and energy use. The ‘enabling ecosystem’ (Figure 3-2) for the 15-minute city includes medium-to-high population density, amenity-richness and excellent walking, cycling and public transport networks.

The Hassell/IIP report notes six core aspects of life that the 15-minute city sets out to bring closer to home, including education, work, transport, nutrition, health and care and recreation and culture. A YouGov population survey of the Irish population was commissioned to inform the report with regard to the existing experience of Irish people with regard to access to amenities in the six main categories as well as their perceptions of the different conditions that make the 15-minute city possible. Of the six main categories, the survey found:

- 10% of the Irish population can currently walk to all six kinds of amenities within a quarter of an hour.
- If given the choice, 33% say that they would like every type of amenity within a 15-minute walk from home.
- Public transport connections, grocery shops (nutrition), and leisure activities (recreation & culture) are the most popular types of amenities.
- People currently travel furthest for work and if given the choice, only 43% of people who work would want to be able to walk to their place of work in 15 minutes or less.

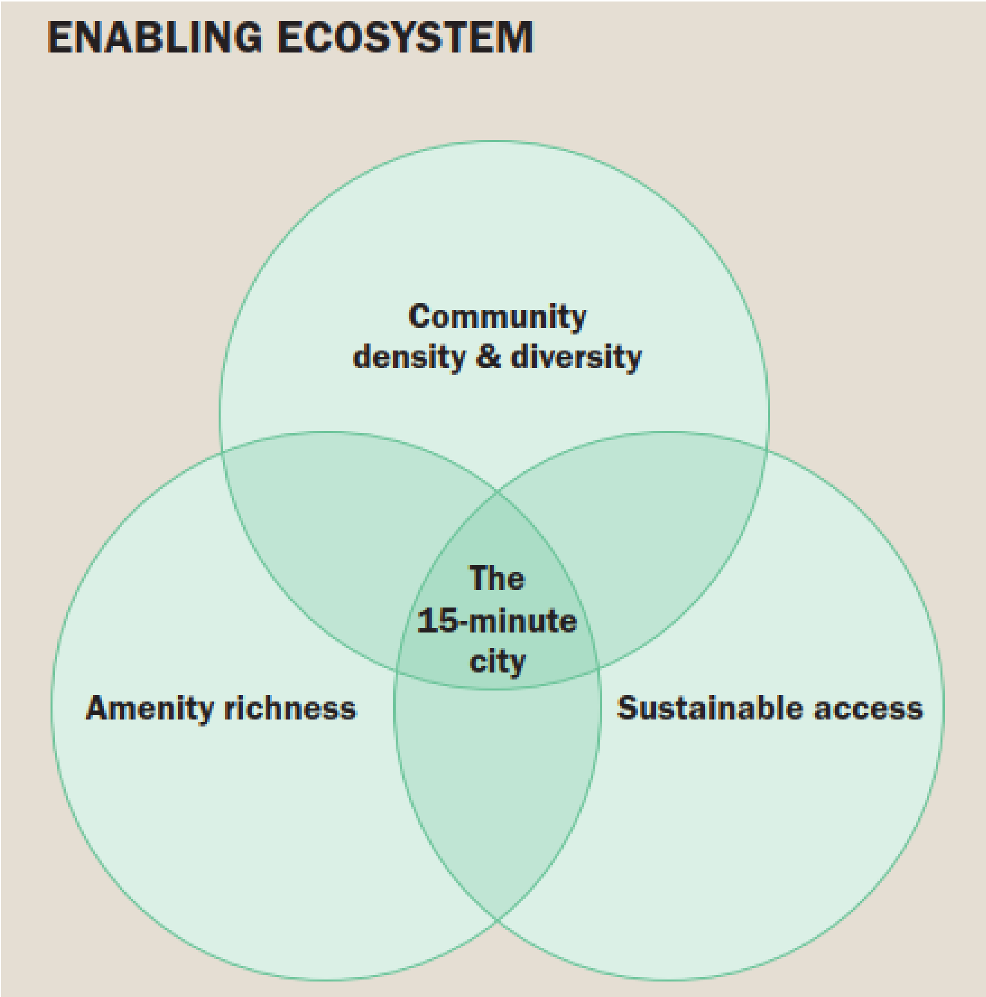

Figure 3-2 Fifteen Minute City – Enabling Ecosystem (Hassell/IIP Report)2

[2] *Source: Close to Home – Exploring 15-Minute Urban Living in Ireland.* [2] October 2021 Written by Camilla Siggaard Andersen (Hassell) for Irish Institutional Property

3.1.2.2 Dublin City Edge Project: 15 Minute Settlement Example Proposed in Ireland

Dublin City Edge project is a vision for the redevelopment of existing industrial/business park areas as new urban centres covering the Naas Road, Ballymount and Park West areas on the western edge of Dublin City (Figure 3-3). This is a joint urban regeneration scheme by Dublin City Council and South Dublin County Council. The plan envisions 40,000 new homes and 75,000 new jobs over 700 hectares, which would make it one of the largest urban regeneration schemes in Europe.

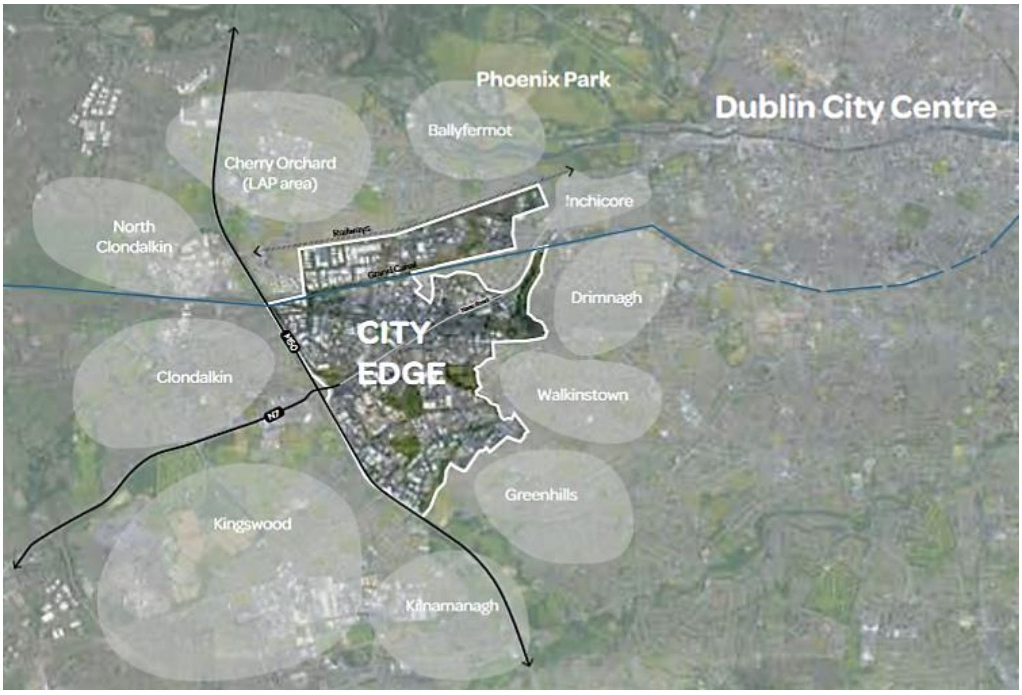

Figure 3-3 Extent of Dublin City Edge Project

The Dublin City Edge project imagines a regeneration of this part of Dublin as a dense, mixed-use, highly walkable community which meets the requirements of the 15-minute city principle, or ‘liveable city’ as the concept is also known. The premise of the 15-minute city principle is that residents are given access to the goods and services they need on a regular basis within a short, safe and convenient 15-minute walk or cycle. The sort of services which should be accessible include grocery shops, childcare facilities, schools, healthcare facilities, parks and public transport as shown in the diagram in Figure **3-4**. The City Edge project proposes five new neighbourhoods based on the 15-minute city principle, connected by a network of greenways, blueways and public transport.

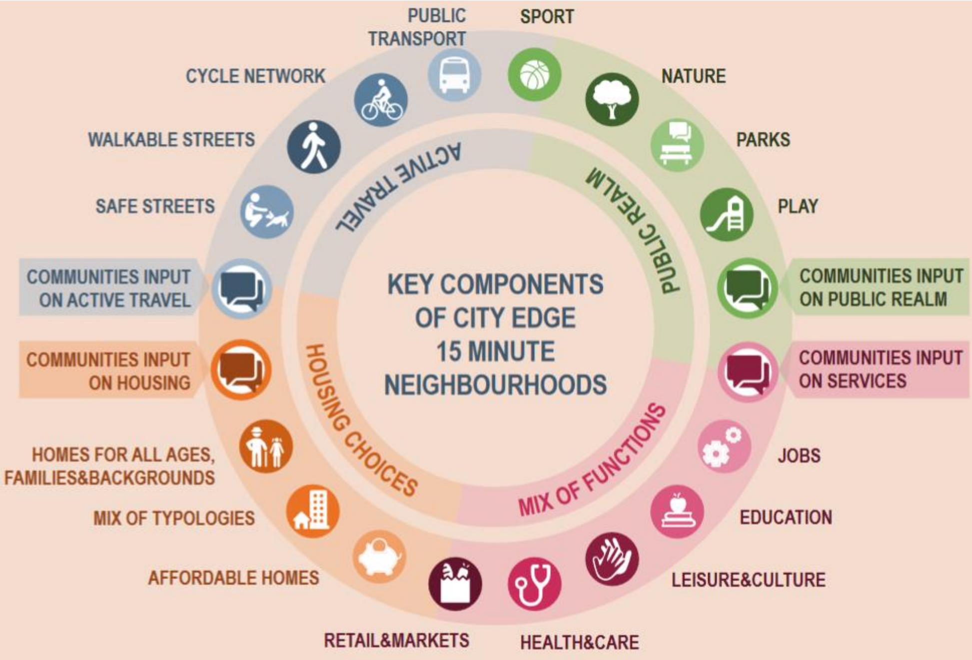

Figure 3-4 Dublin City Edge Project – 15 Minute Settlement Vision (Source: City Edge Project: Strategic Framework)

3.1.2.3 Achieving the 10-Minute Settlement Concept in Maynooth

An important aspect of the work undertaken for the MEABTA is the mapping of existing and future walking catchments for a range of key amenities. As part of the baseline assessment, an accurate path network was developed which covers the MEABTA study area and extends further east and west on the Royal Canal Greenway route. The path network is used to assess the 500m walking distance to bus stops in the study area as well as the 1km walking distance to the town centre (Courthouse Square), supermarkets, the train station, primary schools, secondary schools, Maynooth University (Arts Building) and St. Patrick's College.

To supplement this analysis, walking accessibility was also examined using the ATOS (Accessibility to Opportunities and Services) tool maintained by the NTA. The ATOS analysis encompasses some of the same destinations referenced above, such as schools and supermarkets, and also incorporates some additional amenities and services including General Practitioners and Open Spaces as well as some analysis of access to employment.

The MEABTA proposes a significant number of measures to maximise the permeability of both existing and future areas of Maynooth for active modes. These measures when implemented will shorten walking and cycling distances from many existing and future residences in the study area to many of the important community facilities and services. The 1km catchment analysis and the ATOS analysis shows that although the proposed permeability measures will help to extend 10-12-minute walking catchments, the distribution of existing amenities means that even following the implementation of permeability measures there will still be substantial swathes of Maynooth which are located outside of the 1km walking catchments.

As cycling is much faster than walking, the majority of existing residential areas of Maynooth are already within or very close to a theoretical ten-minute cycling distance of most of the key facilities. The main areas earmarked for new residential development will also be within a theoretical 10-minute cycling distance of most categories of key amenities. However, actual cycling journey times vary throughout the day currently due to congestion and lack of dedicated space for cycling. For example, stakeholders have highlighted that the Moyglare Road shared pedestrian and cycle facility is currently very congested. Safety is also currently a significant barrier with regard to the willingness of residents to cycle or to allow their children to cycle. The delivery of new and improved dedicated cycle facilities throughout the study area is therefore critical to the achievement on the 10-minute settlement concept. Additional public transport services to better connect existing residential areas which are remote from key services and amenities to those destinations are also important.

In addition to retrofitting improved connectivity for sustainable modes within existing areas of Maynooth, it is crucial that new development is well located, that these new development areas are designed to be more compact and permeable than existing areas and that the delivery of new services and amenities is integrated into the planning process for residential development.

Of the three main areas in Maynooth and Maynooth Environs where significant residential development is proposed, the area where walking distances to most amenities will be longest is Maynooth Environs / Moygaddy. This area will not provide convenient access to food retail, high quality public transport or the range of recreational and cultural attractions close to the town centre. The Railpark area in the east of Maynooth is not well placed to provide future residents with convenient access to secondary schools by modes other than cycling. However, the area can provide reasonable access to most other amenities assuming all of the active travel infrastructure proposed in the ABTA is implemented.

The proposed development area in the west of Maynooth offers the greatest opportunity of the major new development areas to achieve the 10-minute settlement concept, assuming that all anticipated supporting infrastructure and amenities are delivered. New development in this area will benefit from proximity to the proposed new western train station, new primary and secondary schools and a new neighbourhood centre which will include a supermarket.

A masterplan should be prepared which can ensure there will be convenient access by sustainable modes from all new residential buildings within the area to these key amenities and services as well as other key amenities which will be planned as part of the development, such as open space. As part of a masterplan process, space should also be allocated for the local provision of other essential services such as GP surgeries and childcare facilities. Assuming connectivity links proposed within the

MEABTA measures are provided, existing residential areas of Maynooth which are currently remote from some types of amenities and services will also benefit from amenities and services which will be provided as part of the new development area in Maynooth west, particularly the proposed new schools.

Despite the anticipated provision of a range of essential services locally within Maynooth west, Maynooth town centre will remain an important destination for residents of the new area. The residential development in Maynooth west will be well within 10-minute cycling distance of the town centre but will not be within 10-minute walking distance and therefore good public transport connectivity and associated priority will also be required.

3.1.3 Recommendations for Low Car Development Approaches in Maynooth

The most significant opportunity to deliver low-car residential development at a large scale in Maynooth is in Maynooth West, where the proposed new train station and scale of the development area presents an opportunity to prioritise active travel and public transport. Key amenities such as a neighbourhood centre, schools, recreational facilities, and childcare should be designed into the development from the beginning and located to support maximum accessibility.

In low car developments in the Maynooth West area, some of the private car parking should ideally be provided in the form of neighbourhood parking not directly adjacent to homes in order to prioritise sustainable modes of transport and other uses of space within the core areas and reduce the attractiveness of using a car for short trips. The cost of parking should also be unbundled from the cost of accommodation so that residents who do not own a car do not have to pay for the cost of providing parking. Designated parking spaces for people with disabilities will still be required adjacent to homes and the design of streets will also have to allow for access for servicing and loading, including emergency services. Within Maynooth west, the lowest parking ratios should be in areas adjacent to the new train station (potentially including some car free developments), while the developments located furthest from the train station will require more parking provision, although this could still take the form of unbundled neighbourhood parking.

A number of sites within the town centre have potential for car free infill residential development. These include a section of the Carton Retail Park lands, sites north of the existing train station accessed from Parson Street and the site opposite Manor Mills Shopping Centre on Moyglare Road. The implementation of public transport priority and active travel measures proposed in the ABTA will mean that in future, movements for private vehicles in the town centre will be greatly restricted and therefore it is important that these sites which are highly accessible for sustainable modes are developed in a way which does not encourage additional car use in central areas. The amenities and public transport services available in close proximity to these sites means they will have strong potential to attract non-car owners.

Proximity to essential amenities and access to high quality public transport and active travel networks, shared mobility options (particularly shared cars) and suitable storage/parking facilities for privately owned cycles at homes and destinations are all important to making a low car or car free development an attractive place to live. The next section of this report discusses how the transport infrastructure measures in the ABTA will facilitate increased use of sustainable travel modes in Maynooth. Other sections of this report discuss considerations regarding the future provision of shared cars, shared micromobility options and cycle and scooter parking solutions.

3.2 Integrated Transport Strategy Development

The MEABTA presents an integrated, co-ordinated approach to guide investment in future transport infrastructure across the study area in the years leading up to 2038. This involves transport measures across all modes of transport (walking, cycling, road, parking, public transport) in addition to measures specifically intended to aid the goal of a decarbonised zone in Maynooth. The overall aim of the MEABTA is to facilitate and drive forward the use of sustainable travel modes by making walking, cycling and public transport safer, faster and more convenient than the private car across Maynooth.

A very significant number of permeability measures are proposed in the walking/permeability strategy and many of these will reduce trip distances for walking and cycling in addition to opening up more pleasant and less congested routes away from busy roads. For example, new connections to the Royal Canal Greenway, including proposed active mode bridges across the Royal Canal and the railway line from residential areas to the south of the railway line will significantly increase the number of people who can use the Royal Canal Greenway for their regular journeys. The proposed Greenway connection to Moygaddy from the Lyreen neighbourhood will offer a much more direct active modes connection between the town centre and Moygaddy compared to routes along existing roads. The walking strategy also contains measure to provide footpaths on existing and new roads where required.

The cycling strategy proposes delivery of a comprehensive cycle network throughout the study area. The proposed future cycle network encompasses the Greenways and other new active mode links identified in the permeability strategy, as well as cycle tracks on most main roads and on future multi-modal links. The cycling strategy also proposes the delivery of inter-urban cycle routes to other towns within reasonable cycling distance of Maynooth.

The central aim of the MEABTA public transport strategy is to make travel by public transport from, to and around Maynooth quicker and more convenient for all users. The strategy does this by placing an emphasis on improving bus movements on the approaches and through the centre of Maynooth and providing for more interchange opportunities across public transport modes. The strategy was developed to integrate with the walking and cycling strategies and make traveling by sustainable means seamless. The roads strategy will help to relocate space in the centre of

Maynooth away from private cars and prioritise its use for sustainable modes with public transport playing a central role.

The MEABTA roads strategy prioritises removing traffic from the town centre to facilitate improvements to walking, cycling and bus infrastructure. The MEABTA proposes a comprehensive network for active modes of travel which will make travel by active modes safer and more convenient, particularly for internal trips. For longer distance travel, the public transport strategy proposes improvements which will make it easier to travel further afield by bus or rail.

A clear example of this co-ordinated approach to strategy development across all modes is the proposal to provide an orbital bypass of the town centre, which will allow for cross-town trips and HGVs to be banned through the town centre of Maynooth, while also facilitating improved bus access. Figure 3-5 shows how the provision of orbital roads will allow continued road access via combined orbital-radial movements to key destinations like the university, while also removing cross-town trips by cars to create a safer environment in the town centre which prioritises pedestrians, cyclists and buses by reallocating space. This integrated approach to transport provision will provide a competitive advantage to sustainable travel modes for local trips while facilitating strategic car and HGV trips where necessary.

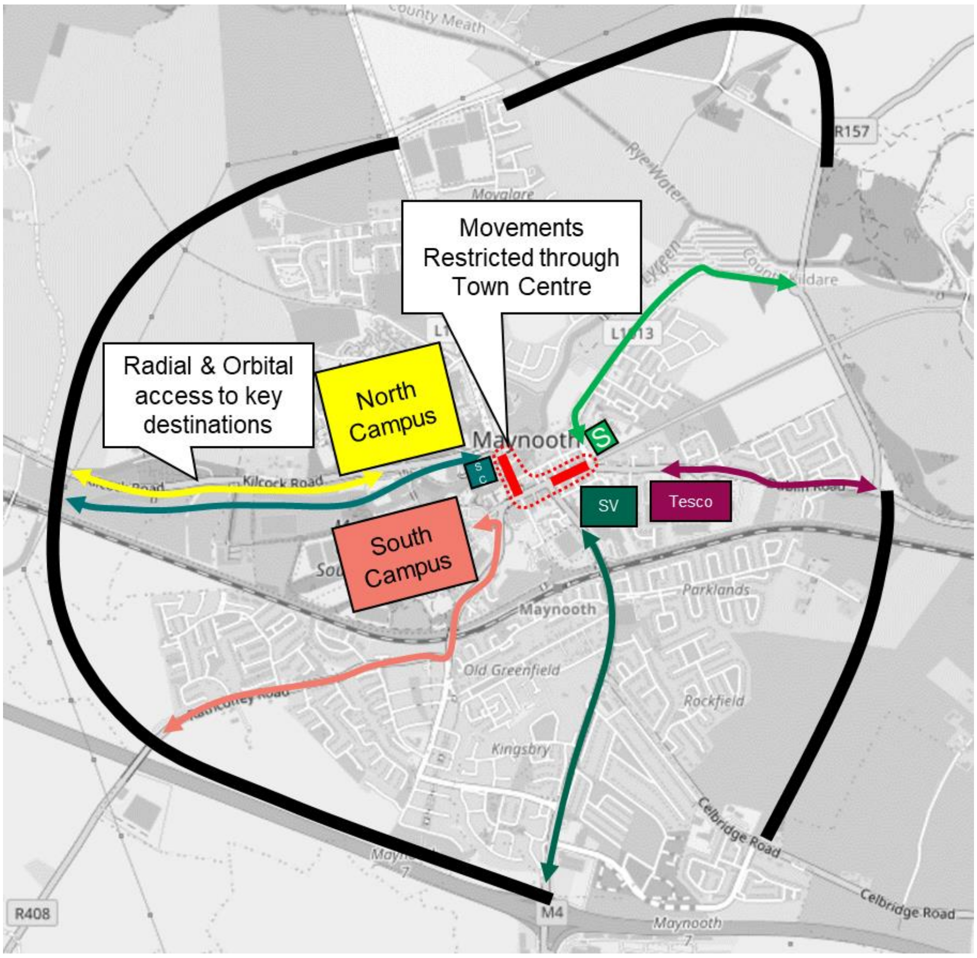

Figure 3-5 Co-Ordinated Strategy for Sustainable Travel Mode Prioritisation in the Town Centre

Another example of the co-ordinated approach to strategy development across different modes of transport are the proposals for Leinster Street. Leinster Street is a very important thoroughfare for walking and cycling in Maynooth as it provides a direct connection between Main Street, the train station, the Royal Canal Greenway and the public park at Harbour Field. The roads strategy proposes that access to Leinster Street from Main Street will become 'emergency vehicle access only' for fire station and garda station vehicle access, using retractable bollards. This will turn the R408/R418 junction into a T-junction and remove traffic from the majority of Leinster Street which will improve the street for walking and cycling. In order to facilitate this change, the roads strategy proposes a new southern road access from Parson Street to Leinster Street car parks. These changes could significantly improve access to the train station for users of active modes of transport, while still retaining access to car parks and access to Leinster Street for emergency vehicles. This series of measures, in combination with proposals to upgrade the existing active modes bridge over the Royal Canal at the train station would make an ideal project as part of the national 'Pathfinder Programme', should the programme open for further applications. The Pathfinder Programme currently encompasses 35 exemplar transport projects to be delivered by local authorities and agencies around the country within the next 3 years[3].

[3] https://www.gov.ie/en/publication/143e3-pathfinder-programme/

4. Exploring Different Measures to Support Transport Decarbonisation

This part of the report contains a number of sub-sections where different approaches to support transport decarbonisation in the Maynooth DZ are considered. This includes reviewing the policy context, exploring the relative merit of each approach or technology and outlining the potential applications in Maynooth.

4.1 Shared Mobility

Shared mobility is a term which refers to transport schemes such as car-share clubs, e-scooter or bike-share schemes and other short-term rental and sharing models to access transport. Shared mobility interventions have significant potential to reduce car dependency and enable modal shift towards sustainable transport models in all types of settlements. In this section, the policy background to shared mobility is explored along with discussion of the different types of shared mobility interventions and their potential for Maynooth.

4.1.1 Shared Mobility Policy Review

CoMoUK (a UK based charity for promoting the social, economic and environmental benefits of shared transport) define shared transport as ‘services that share cars, bike and e-bikes, rides in cars, e-scooters and Digital Demand Responsive Transport Services (DDRT)’. The US based ‘Shared-Use Mobility Centre’ define shared mobility as ‘transportation services and resources that are shared among users, either concurrently or one after another’. According to their definition, this includes public transport; micromobility (bikesharing, scooter sharing); automobile-based modes (carsharing, rides on demand, and microtransit); and commute-based modes or ridesharing (carpooling and vanpooling)’.

It should be noted that for the purpose of this report microtransit/DDRT is not addressed as it is likely to be more relevant to more rural areas of Ireland than Maynooth.

The importance of shared mobility is recognised in key national, regional and local policy documents. For instance, the Sustainable Mobility Policy contains an action (number 87) to: ‘expand shared car, bike and power personal transporters (PPT)[4] services at transport hubs and interchanges’ and commits the NTA to developing a strategy for rollout of expanded shared services during 2023.

[4] PPTs include eScooters and the general characteristics of PPTs set out in a Bill currently before the Oireachtas include that they should only be used by one person at a time, the maximum unloaded weight should not exceed 25 kilograms and the power should be less than or equal to 0.5 kilowatts

4.1.1.1 Climate Action Plan - Shared Mobility Policy

The Climate Action Plan 2023 notes that the recent report undertaken by the OECD and the Irish Climate Change Advisory Council[5] recognises the 'transformative potential of on-demand shared services, including in the area of active travel and micromobility'. It notes that the DoT is committed to 'working closely with shared mobility services providers and partnerships to develop more coherent policy and supports, including technical innovation and the development of appropriate regulation, to scale up shared mobility services around the country'.

The Climate Action Plan also notes that the DoT sees specific benefits in promoting e-bikes and e-cargo bikes in both owned and shared modes and will continue to undertake initiatives to support access to these. Some of the specific actions of most relevance to this report which are set out in the Climate Action Plan 2023 under the heading of 'Smart, Shared and Integrated Mobility' for delivery in 2023 include:

- Expand operation and availability of bike share schemes nationally
- Industry engagement on development of shared mobility policy
- Enact legislation and regulations to permit safe use and design of personal powered transporters on public roads
- Establish a new Unit within the Department Transport to actively engage with shared Mobility Operators/Partnerships, Local Authorities and the NTA to develop and guide policy around Shared Mobility and promote use of Shared Mobility nationally
- Undertake a detailed Scoping Assessment of policy models for the development and management of shared micro-mobility schemes in the Greater Dublin Area, for subsequent nationwide implementation
- Develop incentives to promote access to or purchase of e-cargo and e-bikes as viable alternatives to private car use

4.1.1.2 NTA GDA Transport Strategy - Shared Mobility Policy

The Greater Dublin Area Transport Strategy 2022-2042 contains numerous measures in support of shared mobility, particularly bike share schemes:

- **Measure CYC5 – Bike Share Scheme Expansion:** The NTA, in collaboration with the local authorities, will seek the development of a structured network of coordinated bike share schemes, appropriately serving key urban areas and operating on an integrated basis.

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[5] Redesigning Ireland's Transport for Net Zero: towards systems that work for people and the planet

- **Measure CYC6 – Bike Share Scheme Electrification:** The NTA will support the provision of electric bike share schemes, appropriately integrated in the overall bike share scheme structure for the region.

- **Measure CYC7 – Interoperability between Bike Schemes**: The NTA will seek to put in place interoperability arrangements between bike sharing schemes within the GDA such that the customer of one scheme is enabled to use the bikes of another scheme and will explore the role of Next Generation Ticketing in this regard.

- **Measure CYC10 – Electric Scooters**: Subsequent to the enactment of national legislation, the NTA and local authorities will take into account the growing use of E-scooters and the benefits they may bring, in planning and designing the transport network in the GDA.

- **Measure CYC11 – Other Emerging Personal Mobility Modes**: The NTA, local authorities and Government will monitor emerging trends in personal mobility and respond accordingly in terms of legislation, regulation and infrastructure design.

- **Measure TM9 – Car Sharing:** The NTA will support the local authorities, workplaces and other relevant agencies and companies in the implementation of car sharing initiatives, in particular as part of new housing developments.

4.1.1.3 Kildare County Development Plan – Shared Mobility Policy

The recently published Kildare County Development Plan 2023-2029 also contains a range of specific objectives and actions in support of shared mobility services.

- **TM O17**: Support and facilitate the provision of electric vehicles including electric cars, bikes and scooters as a more sustainable low carbon option to the conventional private motor vehicle.

- **TM O18**: Support action 87 of the National Sustainable Mobility Policy Action Plan 2022-2025. The Council will support the NTA to expand shared car, bike and PPT services at transport hubs and interchanges.

- **TM A11**: Support the development of a model for bike share schemes, the extension of the Dublin Bike Scheme and/or other bike sharing schemes to key settlements and towns and encourage the inclusion of a hybrid electric bike fleet in order to promote the use of the scheme for long-distance commuting.

- **TM O122**: Support car sharing initiatives as part of new housing developments and workplaces.

- **TM O49**: Support the implementation of the Irish Rail Multi-Modal Interchange Strategy to provide for ease of interchange between rail and all other modes, prioritising those that are sustainable – cycling, electric charging and shared mobility.

4.1.2 Car Sharing / Car Clubs

4.1.2.1 Introduction and Types of Car Sharing Services

It is commonly cited that the average private car is parked approximately 95% of the time, which highlights that car sharing has potential to increase the efficiency of car use and reduce the extent to which parked cars take up valuable urban space that could be put to more beneficial uses. Car sharing also allows individuals and organisations to gain some of the benefits of private vehicle use without the costs of ownership.

Instead of owning one or more vehicles, a household or business can access a fleet of shared cars via an on-demand service. Users of a shared car generally pay a fee each time they use a vehicle, usually for the distance or duration of a trip. Car sharing can include three types of service models:

- Return to base services, where a vehicle must be returned to its origin base
- One-way point-to-point, station-based services, where a vehicle can be returned to a different designated station location at the destination rather than returning to base
- One-way, free-floating services, where a vehicle can be returned anywhere within a geographic area

In Ireland, there are only two car share operators, GoCar or Yuko and both only offer roundtrip services. GoCar operate in cities and towns throughout Ireland, while Yuko currently only operates in Dublin. GoCar currently operates three ‘Go Bases’ in Maynooth. These are located at the train station (one car), Maynooth University (one car) and Tesco Extra in Carton Retail Park (one car and one van).

4.1.2.2 Benefits of Car Sharing

Some of the benefits of car sharing which have been identified through academic and industry studies internationally include[6]:

- Sold vehicles or delayed or foregone vehicle purchase
- Increased use of active travel and public transport
- Reduced vehicle kilometres travelled

[6] Shaheen et al., 2019. Carsharing's impact and future. https://www.sciencedirect.com/science/article/abs/pii/S2543000919300356

- Increased access and mobility for formerly carless households
- Reduced fuel consumption and greenhouse gas emissions
- Greater environmental awareness

Car sharing is not typically used for regular commuting, rather it is used by members as a way to get around for a variety of reasons outside of their regular commute. In their information for new potential members, GoCar highlight a variety of trip needs which their current members use the service for, including daytrips, 'the big shop', 'moving stuff', meetings and as a 2nd car for busy families.

CoMoUK, a UK based charity for promoting the social, economic and environmental benefits of shared transport estimated in 2021 that each car club vehicle in the UK replaced approximately 20 private cars, while their membership survey also found that 55% of members agreed their membership allowed them to travel to places which wouldn't be accessible otherwise. The estimate of a single shared car replacing approximately 20 private cars is also used by GoCar.

In a recently published study[7], a team from Trinity College undertook an analysis of data provided by Yuko of the usage of the scheme in Dublin in 2018 with one of the aims being to identify whether users of the scheme are likely to give up their own cars. It was found that a small percentage of users had sold their only car since joining the service and a slightly larger percentage said that they had sold a second car. The authors concluded that despite the low percentages involved, this showed how car sharing may be one of the solutions to reduced carbon emissions and also emphasised that the results should be considered in the context that just over 30% of respondents indicated that they owned a car to begin with. A cluster analysis was also conducted on the survey response data to identify specific groups which were mainly defined by their car ownership status. The non-car owning cluster were more likely to use the service for longer distance trips (e.g. weekends away) and for purchasing groceries or larger items in comparison to the car owning cluster and therefore it was suggested that the service may be suppressing the likelihood of car ownership within this group.

4.1.2.3 Supports for Car Sharing

As noted in Section 4.1.1, the relevant policy documents at national, regional and local level already express support for car sharing. However, any expansion of the current offer within the existing urban area of Maynooth will likely be largely dependent on commercial viability. In the short term, a simple, low-cost action which KCC could take to incentivise the use of existing and future car sharing vehicles

[7] Caulfield and Kehoe, 2021, Usage patterns and preference for car sharing: A case study of Dublin. https://www.sciencedirect.com/science/article/pii/S2213624X20301589

would be to offer free parking in KCC owned pay and display parking spaces for branded car sharing vehicles (e.g. GoCar cars) to increase their appeal.

In the absence of national level public funding for car sharing to improve commercial viability for operators to serve lower demand locations, the most significant opportunities available to KCC to support car sharing will be through the planning system.

Firstly, where ratios of private car parking to dwellings are low, residents are much more likely to adopt other mobility options and therefore the number of parking spaces allowed by KCC in new developments will have an impact on the viability of car sharing. Stakeholders interviewed by CoMoUK in 2021 as part of research on how to cut private car dependency in new developments stated that one private car per dwelling or less is required for car sharing to be feasible. Proposed maximum car parking standards in the Kildare CDP are currently set above this level, however, it is also clearly stated in the CDP that maximum provision should not be used as a target and that lower rates should be considered in the first instance, particularly where such developments are close to and can avail of public transport.

Some shared cars in Ireland have already been introduced as part of residential developments through the planning process. For example, the GoCar website contains a quote from Marlet Property Group who note that the car club approach at their development at Cardiff Lane allowed the developer to reduce the size of the basement required and bring down construction costs and purchase price. GoCar encourage developers to contact them to discuss how car sharing can improve planning applications and note that the inclusion of a car club at the planning permission stage has allowed planners and developers to reduce the level of parking per unit.

It is unclear whether arrangements made to date in Ireland between car club operators, developers and planning authorities have involved the provision of financial support to commercial car club providers, or whether they simply involved the provision of free reserved parking space for the car club vehicles. However, in the UK, it is very common for developers to be required to make financial contributions to car clubs. One example is Leeds City Council, which has developed guidance requesting developers to provide funding for car club memberships at new developments.

- At the Leodis Square apartment block in Leeds which has a ratio of 0.3 parking spaces to units, two car club bays were provided, and a contribution was made to the car club operators. Residents were offered 1 year’s free membership of Enterprise Car Club and £150 drive time.

- At another scheme on the edge of Leeds where two vehicles are being provided, developer funding is providing residents with 2 years membership and £50 driving credit to encourage people to try the scheme.

In addition to requiring developers to provide designated convenient space for car club vehicles within developments, KCC should assess whether there are opportunities to condition developers to financially support car club vehicles for a period of time in large new developments if there is uncertainty as to their commercial viability. This could help to discourage new occupants from acquiring private cars and would allow the viability of a potential new locations for car sharing vehicles to be built up over time with less initial risk to commercial operators.

Integrating car sharing services with other transport services through a single mobility hub or a network of mini hubs may also increase the connectivity, convenience and viability of car sharing. The topic of Mobility Hubs is addressed in more detail in Section 4.2.

4.1.2.4 Summary of Recommendations to support Car Sharing in Maynooth

The key recommendations for supporting an expansion of car sharing services in Maynooth which have arisen from considering the policy context, the review of existing provision and the guidance resources published by CoMoUK (a UK based charity for promoting the social, economic and environmental benefits of shared transport) are summarised below.

- Offer free parking in KCC owned car parking spaces for branded car sharing vehicles (with capped time duration).
- Ensure that maximum residential parking standards in CDP are not treated as targets and that residential developments in areas of Maynooth with good access to public transport are designed to provide fewer car parking spaces, to encourage use of sustainable modes and support the viability of shared cars.
- Require developers to provide reserved space at large new residential developments for shared cars.
- Investigate potential to require developers to financially support the provision of a shared car for a period of time at relevant new developments if there is uncertainty as to the commercial viability of a location for operators.

4.1.3 Shared Micromobility

Micromobility is a term used to refer to a category of transportation modes smaller than a car or public transport, like bikes and electric scooters. Micromobility involves any small, low-speed, human- or electric-powered transportation device, including bicycles, scooters, electric-assist bicycles, electric scooters (e-scooters), and other small, lightweight, wheeled conveyances. Micromobility vehicles such as e-scooters and e-bikes are increasingly being used on Irish roads but the legislative guidance on their use is still evolving and has not been established yet. There is potential for shared forms of micromobility (e.g. e-bike rental schemes) to have an important role in promoting modal shift in places like Maynooth, once the legislative issues have been clarified. This section outlines the legislative background to micromobility in

Ireland, describes the different type of scheme which could be implemented and the implications for Maynooth.

4.1.3.1 Legislative and Regulatory Framework

At the time of writing, e-scooters cannot legally be used on roads in Ireland, as they are classified as mechanically propelled vehicles (MPVs). As part of the Road Traffic and Roads Bill 2021[8], which is expected to be enacted during 2023, e-scooters will be reclassified as 'powered personal transporters' (PPTs). PPTs will have an upper speed limit of 25kph and users will not require insurance, motor tax or a driving license to operate in a public place. Users will be subjected to similar road traffic laws as cyclists – for example, the use of PPTs will only be allowed on roads and cycleways. This new category will also allow for new and innovate micro-mobility vehicles that may need regulation in years to come.

In addition to regulation of e-scooters, the proposed legislation will also clarify the legal position of high-powered and low powered e-bikes. The current arrangements for low-powered, pedal-assist e-bikes up to 250W and speeds of 25kph – that they are treated under road traffic legislation in the same way as pedal cycles will be unchanged. However, high-powered and power-on-demand e-bikes will be considered light mopeds and will require tax and insurance. The passage of the Bill through the remaining legislative stages is subject to the Oireachtas. It is anticipated that the Bill will be enacted in the coming months. Once the Bill has been enacted and the relevant sections commenced, formal drafting of the regulations can be commenced. The introduction of new technical regulations for vehicles is subject to mandatory examination by the European Commission for a minimum of 12 weeks. E-scooters which meet the criteria established in the Bill and subsequent regulations will become legal to use when the regulations are introduced.

At least one operator has already expressed an interest in introducing a shared e-scooter scheme in Maynooth and KCC policy supports the introduction of both e-scooter or bike-share schemes. There is a strong appetite from some key stakeholders in Maynooth to see these schemes introduced. However, work is currently ongoing at a national level to undertake a scoping assessment of policy models for the development of shared micro-mobility schemes in the Greater Dublin Area, for subsequent nationwide implementation. This work when complete can inform the optimal design and governance of any future shared e-scooter and/or bike scheme(s) in Maynooth with regard to factors such as:

- the operational model (e.g., the balance between public and private);
- geographic coverage;

[8] https://www.oireachtas.ie/en/bills/bill/2021/128/

- fleet size and the appropriate ratio of bikes and e-bikes to e-scooters;
- number of operators;
- parking infrastructure;
- funding; and
- governance models with regard to the role of the NTA and KCC in contracting and managing schemes.

Therefore, it is recommended that KCC exercise caution with regard to the potential introduction of any scheme in Maynooth in advance of the national or regional framework being implemented and the respective roles of NTA and KCC are agreed. If there is a strong appetite to introduce a scheme prior to implementation of a national or GDA wide framework, consideration could be given to licensing scheme on a temporary/pilot basis rather than entering into long term multi-annual contracts.

4.1.3.2 Types of ‘On-Demand’ Bike Share

There are a number of different types of on demand/self-service on-street bike share schemes. All of the below scheme types can offer either conventional or electric bikes or a combination of both.

- **One way docked hub schemes** include schemes such as Dublinbikes and TFI bikes. The bikes are placed in fixed docking stations located at regular intervals through the town or city. The bikes can be returned to any station to end the hire. In comparison to newer types of bike share scheme, these schemes can involve significantly higher set up costs due to the on-street infrastructure required. An advantage of docked schemes is that access can be offered via the terminal or keypad on the bike without requiring a smart phone.
- **One way virtual-hub schemes** are similar to one way docked hub schemes but instead of fixed docking stations, virtual geo-fenced hubs are created. The locking technology is on the bike itself. For some schemes, such as the pilot scheme operated by Bolt in Sligo, the virtual docking station consists simply of a geofenced area with marking on the ground. However, a more common model in Ireland is to require the bikes to be locked to public bike stands within the operating area. Within the Bleeper scheme, all of the public bike stands within the operating area are virtual hubs. In other cases, such as Moby in Westmeath, bikes can only be locked at a small number of designated stations.
- **Free-floating dockless schemes** allow bikes to be left anywhere within the scheme operating area without restriction. No schemes operate on this basis in Ireland. An example of a free-floating bike share scheme in the UK is Lime bikes in London. In some London boroughs, Lime bikes must be parked in designated parking bays (within on street markings), while in others, users can park on any street and are just asked to park considerately. This type of scheme result in

bikes being left in places which pose a hazard to other street users and can also cause more challenges for redistribution.

- ‘**Return to Base’ schemes** require bikes to be returned to the same hub they are hired from and these hubs generally have some docks/physical infrastructure. In Ireland, the only current scheme of this type is the eHUBs scheme operated by ESB Networks, Bleeper and Moby. This scheme currently offers 112 bikes across 14 eHub charging stations in the suburbs of Dublin city and offers pay as you go usage tariffs as well as a monthly plan which is very cost effective for frequent users. Users have the option to book a bike in advance. Schemes internationally which offer cargo bikes often use a ‘Return to Base’ model. For example, Cargaroo e-cargo bikes in various cities in the Netherlands as well as in Manchester and Berlin.

4.1.3.3 Impacts of Bike Share

Bike share can complement bike ownership and be a catalyst for lapsed or new cyclists to start cycling again, while shared e-bikes can attract a wider demographic than traditional cycling[9]. The CoMoUK Annual Bike Share User Survey (2021) demonstrates some of the key impacts of shared bike and e-bike schemes[10].

- With regard to modal shift, the CoMoUK survey found that 53% of respondents would have made their last trip by car or taxi had bike share not been available[5]. Bike share also promotes increased public transport accessibility by improving first and last mile connectivity. The CoMoUK user survey in 2021 found that 39% of users used a bus and 28% used a train as part of their overall journey with bike share.

- Bike share has been reported to help improve fitness and wellbeing by encouraging people to cycle more. The CoMoUK survey found that for 61% respondents’ bike share is a source of exercise, while 41% of users stated that they use bike share for the mental health benefits[5]. In addition, 60% users reported cycling more often since they started using bike share schemes. For 49% of respondents, joining a bike share scheme was the catalyst to them cycling for the first time in a year

- E-bikes as part of shared bike schemes have been found to appeal amongst all generations, to help users overcome health difficulties or low fitness levels. The CoMoUK survey found that 50% of respondents use e-bikes to shorten their journey times, 45% use e-bikes to cycle up hills and 42% to avoid getting tired or sweaty from cycling.

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[9] *CoMoUK bike share guidance for local authorities 2022*

[10] *CoMoUK Bike Share Survey 2021*

- Bike share use can often complement ownership. In the CoMoUk survey, 37% own a personal bike as well as using bike share. In some cases bike share use triggers users to go on to buy their own bike – 9% of respondents in the CoMoUk survey said that they had bought a bike since joining. However, 8% had also got rid of a bike and another 8% said their bike was in disrepair.

4.1.3.4 Evidence from Shared E-Scooter Trials in the UK

Shared e-scooters are an increasingly popular part of the shared micro mobility landscape. While e-scooters are not yet legal in Ireland, experience with both private and shared e-scooters elsewhere has highlighted positive impacts but also some negative impacts or concerns, including concerns related to mode shift to a less active mode from active modes and public transport, safety concerns, impacts on vulnerable pedestrians and lifecycle environmental impacts.

A detailed evaluation report on the impacts of shared e-scooters trials in the UK has recently been published by the UK Department for Transport. Shared e-scooter trails were introduced in locations around the UK in 2020 to support a ‘green recovery’ of local travel from the pandemic and enhance public transport capacity. Some key headlines are provided below.

- Over the trial period, an average e-scooter trip length was 2.2km and took 14 minutes. During the trial the average journeys per day per shared e-scooter totalled 2.3. E-scooters therefore acted as a mode of transport in-between walking and cycling in terms of average distance and had a slightly shorter average time duration than both.

- In December 2021 (the end of the post-ride survey period) 42% of users reported that they would have walked if they had not taken an e-scooter on their last trip, 21% of users reported that they would have travelled by private transport (car, van or taxi), 18% would have travelled by public transport, ten percent would have cycled, and nine percent would not have made the journey at all (highlighting the potential widening of opportunities provided by micromobility). At the beginning of the trial period, a higher proportion of users said that they would have walked (51%) and just 12% of users said they would have travelled by private transport.

- According to the demographic survey, e-scooter users were predominantly male (71%) and under the age of 35 (74%). Amongst those who used e-scooters, men and younger people were also more likely to rent e-scooters frequently. Users from ethnic minority groups, and users on low incomes, were also more likely to be frequent users than their counterparts in other demographics.

- For users who took part in an in-depth interview, time and cost savings, convenience and enjoyment motivated them to use an e-scooter. A recurring motivation among female participants was that using an e-scooter was seen as safer than walking home at night in the dark.

- Data highlighted in the report indicates that the frequency of rental e-scooter collisions was higher during 2021 than for pedal cycles (including bicycles and e-bikes), though this was 'likely to be driven in part by the novel nature of the mode'. It is also noted that findings show collisions were more likely to occur among less experienced users, 'making it difficult to make like-for-like comparisons with more established modes'.

- Respondents to a resident survey in areas where e-scooter trials were operating were more likely to perceive e-scooters as a safety risk in comparison to bicycles and e-bikes. Qualitative data suggested this was as a result of dangerous behaviour and pavement riding. Pavement cluttering and parking also remained key issues for the rental schemes and was often identified as a safety risk. The report recommended that changes to how e-scooters should be parked and better enforcement should be considered to address these issues.

- An analysis of the environmental impacts of mode shift from private motor vehicles to rental e-scooters in five case study areas showed that the trials had led to a total reduction of 1.2-1.6 million km of car journeys and 269 to 348 tonnes of CO_2e. However, these estimates only relate to the modal shift from cars and do not account for life cycle emissions, additional trips that would not otherwise have been made and the modal shift from walking and cycling to e-scooter use.

- In interviews with local stakeholders, partnership working (between local authorities, operators, the police and other relevant stakeholders, enabling information sharing to inform decision making), establishing clear governance processes, and being responsive and adaptive to dealing with challenges were cited as contributing to successful delivery.

- The characteristics of local areas (including road design, population density and governance structures), public perceptions related to a new mode of transport and resource constraints within local authorities presented challenges. The need for adjustments over time, which took place across case study areas, suggests that degrees of flexibility may be required when it comes to regulations of rental e-scooter trials, and rental e-scooter delivery models.

4.1.3.5 Considerations for 'On-Demand' Micromobility in Maynooth

As noted in Section 4.1.3.1, ongoing work being undertaken by the DoT and the NTA will inform the optimal design and governance of any future shared bike and/or e-scooter scheme in Maynooth. It is important that future schemes in the GDA are implemented in a coordinated way to avoid a proliferation of individual and unconnected schemes, with individual users potentially requiring to join multiple schemes to provide appropriate coverage to suit their needs.

National policy and the GDA Transport Strategy is strongly supportive of increased deployment of bike share schemes. In comparison to e-scooters, bike share is a more active mode and schemes may attract a wider demographic of users and appear to be associated with fewer safety concerns. Therefore, it is suggested that a fleet ratio target is developed to incentivise any future operators to offer bikes and/or e-bikes and not e-scooters alone.

The CoMoUk guidance for local authorities notes that exclusivity is a key factor to consider in small to medium sized towns and cities, as more than one operator is unlikely to be profitable. This also applies to deployment of an e-scooter share scheme which may impact the sustainability of a bike-share scheme if run by a competing operator. By having one operator, economies of scale can be achieved and competition between the modes can be reduced.

The quality of cycling infrastructure in Maynooth and anticipated timelines for improvement on individual links should be considered when planning the introduction and expansion of any scheme(s) and identifying hubs/station locations. The quality of cycle infrastructure will impact upon the demand for and safety profile of both types of schemes. In addition, the surface quality of the cycle network and road network is particularly important in respect of e-scooters, as e-scooter users will be more tempted to travel on the footpath at locations where the surface of the road or cycle lane is poor. There are also some areas where it may not be desirable to attract additional inexperienced cyclists or e-scooter users in advance of upgrading work taking place. For example, the shared use path on Moyglare Road is already considered by stakeholders to be very congested at school commuting times.

As the topography of Maynooth is relatively flat and distances within the urban area are short, the inclusion of e-bikes as part of a bike sharing scheme is not necessarily essential and it may not be cost effective for bikes to have this capability, unless it is intended to extend the operating area to cover a wider geographic area encompassing Celbridge and Leixlip as part of a larger integrated scheme in the region.

However, e-bikes do increase the accessibility of a bikes share scheme for a wider range of people, including some people with mobility issues. The inclusion of e-bikes would also provide an opportunity for both residents and visitors to Maynooth to experience the benefits of e-bikes, which may prompt some users to invest in their own e-bike for regular trips. A mixed fleet could potentially be considered.

‘One-way’ Bike Share / E-scooter Share Schemes

Residential density, the variety and distribution of trip attractors and trip distances are important factors which will influence the demand for and operational efficiency of future ‘one-way’ scheme(s) in Maynooth. In depth engagement with operators and the NTA would be required to understand the viability of various scheme sizes and extents from a cost and operational perspective. However, a high-level review of potential origin-destination pairs suggests that maintaining a high level of service for a typical bike share and/or e-scooter share scheme in the existing urban area of Maynooth in the short-medium term may be commercially/financially challenging. The potential for a bike share and/or e-scooter share scheme to achieve modal shift away from private car use may also be more limited than in larger urban areas. Some of the reasons for this are outlined below.

Existing residential density in Maynooth is generally low and outside of the town centre, land use is segregated into residential, educational and commercial uses and other uses, there are few mixed areas, which reduces the extent to which bikes/e-scooters are naturally distributed throughout the day by users making different types of trips. The CoMoUK guidance for local authorities on introducing bike share schemes highlights that it is important to ensure that schemes have a dense core with manageable operating costs. Expanding out to less dense areas increases the burden of redistribution costs.

Both bike share and e-scooter share schemes are particularly well suited to last mile trips connecting to/from public transport. Maynooth has a high number of both inbound and outbound train commuters. However, the train station is centrally located and the most significant individual trip attractor for people travelling to and from the train station is Maynooth University.

The centre of the Maynooth University north campus is approximately 1.2km from the train station which is a reasonably comfortable walking distance for most people without mobility impairments. Therefore, the most popular trip for a future bike share and/or e-scooter share scheme is likely to involve university staff and students substituting walking trips to the university for trips using a bike share or e-scooter scheme, rather than modal shift from private cars.

For some commuters, particularly staff who are already car owners, the presence of a bike/e-scooter share scheme may help to make the choice of taking the train instead of driving more attractive. However, these commuters are likely to represent a minority of all commuters who would use the scheme to connect between the train station and the university. Standard on-demand bike share / e-scooter share schemes do not have a mechanism whereby bikes/e-scooters at the train station could be reserved for this cohort or for individuals with mobility issues.

The high volume of people travelling between the train station and the university is likely to present a challenge for the redistribution of assets, as most people commuting to the university would arrive in the morning and not leave again until the afternoon/evening. In the absence of significant redistribution to return bikes/e-scooters to the train station throughout the morning, it is likely that large numbers of scheme bikes or e-scooters may remain on the university campus for much of the day with limited use.

Maynooth Business Campus is another large trip attractor and the distance between the Business Campus and the train station (1.9km) and lack of existing public transport connectivity means that bike share or e-scooters could make a significant contribution to the accessibility of this location by sustainable modes. However, similar issues to the university campus regarding potential underutilisation of assets during the day at this location may apply, as there are no other trip origins or attractors in the vicinity.

A number of other key trip attractors in Maynooth are located even closer to the train station and the main bus stops than the university. For example, the Glenroyal Hotel is just 450m from the train station and the centre of Main Street and Manor Mills Shopping Centre are each around 550m away. Currently, Carton Retail Park is located around 1.2km away from the train station, but if a new link proposed in the permeability strategy from the Royal Canal Greenway to the retail park is delivered, this distance will reduce to under 700m.

Back to Base Schemes

A back to base scheme can be delivered at a smaller scale and does not involve the same redistribution challenges as one-way bike and e-scooter sharing schemes. Back to base schemes, particularly those which provide e-bikes, are often targeted at users who need a bike for a longer period of time, such as people travelling a longer distance and visiting a number of different locations (e.g., attending meetings) and visitors or non-bike owners using a bike for recreation.

There may be potential for a small scale ‘back to base’ bike hire scheme for standard bikes or e-bikes in Maynooth, particularly in the event that a ‘one-way’ bike share scheme is not introduced. Such a scheme could improve accessibility for visitors to Maynooth to destinations which are remote from the train stations and town centre, such as Maynooth Business Campus and the potential new development area Moygaddy. The main advantage of this model, in addition to lower redistribution costs is that scheme users who take a bike to a location outside of the town centre would be able to rely on it still being available to them to return to the town centre / train station.

A type of ‘Back to Base’ scheme which is not currently in place anywhere in Ireland and could potentially have a bigger impact in support reduced car dependency for Maynooth residents are schemes offering e-cargo bikes. As e-cargo bikes are expensive to personally own and require a lot of storage space, the provision of e-cargo bikes as part of a bike share scheme is an ideal means of providing access for individuals and households who would not have a use for an e-cargo bike on a daily basis but would benefit from having access to one for specific trip purposes, such as transporting bulky shopping, or transporting young children to an activity once or twice a week. The availability of such a scheme could play an important role in enabling more individuals and households to live without a car, or to reduce from a two-car household to a single car household.

Some examples of companies offering e-cargo bike rental are Cargoroo which operates in the Netherlands and Manchester and Beryl which operates in London. Cargoroo e-cargo bikes have an open design and include seatbelts for children, while Beryl have a closed top and are suitable for carrying up to 80kg of bulky goods.

Figure 4-1 Examples of shared e-cargo bikes (Back to base schemes)

This type of scheme would ideally be operated from a number of different ‘bases’ in Maynooth, which could potentially include the train stations, a central area within the future Maynooth west residential area and one or more bases at or in between the supermarkets located close to the town centre.

4.1.3.6 Alternative Options for Improving Access to Bikes and Scooters

Bike libraries/ loans for individuals

Bike loans for individuals and households are extremely impactful, low-cost initiatives for enabling people to trial cycling and how it can fit into their lifestyle. Until recently these schemes had been relatively uncommon in Ireland, but they are widespread throughout Europe and the UK. The initiatives are particularly effective for supporting increased use of more expensive types of bikes such as e-bikes, cargo bikes and non-standard cycles as people can be much more willing to make a large investment after they have experienced the benefits these can offer.

Dublin City Council have recently started a trial of an e-bike loan scheme for their staff, which gives participants the opportunity to take a e-bike home for a month. University College Cork have been running a similar initiative since 2020 and according to the coordinator, many participants went on to purchase their own e-bikes through the ‘Bike to Work’ scheme following their trial.

Another pilot project operating in Dublin is an EU funded pilot to loan cargo bikes, e-cargo bikes, e-bikes and folding bikes to parents of young children for a school year. The pilot project is being led by Francesco Pilla, a Professor of Smart Cities at University College Dublin (UCD). The project commenced at one primary school in September 2022, with parents being offered a loan of a bike for the duration of the school year, at no charge. It was recently announced that the project will be rolled out to 20 further primary schools across Dublin by September 2023 through a partnership between the National Transport Authority and UCD[11]. It is hoped that the bike library project will lead to a permanent modal shift for the school run for many

[11]https://www.ucd.ie/newsandopinion/news/2023/march/23/ucdbikelibraryschemeexpandedto20dublinschoolstoencouragesustainabletravel/#:~:text=A%20partnership%20between%20the%20National,school%20year%20at%20no%20charge.

families by allowing families to experience the convenience of using an e-bike, cargo bike or folding bike at no charge, which may encourage them to invest in their own bike subsequently.

While the schemes mentioned above are restricted to employees or families with children attending a particular school, there are numerous international examples of successful schemes aimed at the general public or key target groups, such as people with low incomes, people in particular age groups, people with health conditions etc. There are a wide variety of different operational models and eligibility criteria for these schemes.

Bike loans for businesses

Schemes which provide access to electric bikes, cargo bikes or e-cargo bikes to small businesses can be a useful way of enabling businesses to trial at a low risk the suitability of cycling as a mode to replace delivery/service trips which would otherwise have been taken by car or van. In recent years a number of Dublin local authorities have run pilot projects to provide e-cargo bikes to businesses in conjunction with bike share and bike leasing company Bleeper. The project was subsidised by the local authorities involved, with the e-cargo bikes made available to businesses at a discounted rate of €100 per month and businesses could have their own bespoke branding applied to the bike. Businesses also received a report showing how they utilised the bike and the potential cost and emissions savings to be gained from switching to on a permanent basis.

The trial schemes proved to be extremely popular with businesses, with applications in the Dublin City Council area oversubscribed. In June 2022, Dublin City Council extended the duration of their scheme by six months to offer an additional 10 opportunities to qualifying businesses.

There is an action in the Climate Action Plan 2023 to ‘develop incentives to promote access to or purchase of e-cargo and e-bikes as a viable alternative to private car use’, which suggests there is a possibility that support may be available at a national level for the introduction of trial schemes in the future. Alternatively, if new incentives introduced at national level are focused around discounts on the purchase price or low interest loans, short term trial schemes can complement other incentives by providing opportunities to trial before committing to a large purchase.

4.1.3.7 Summary of Recommendations to support Shared Micromobility in Maynooth

In advance of committing significant public resources to any individual future scheme, it is suggested that the range of models outlined above should be considered to understand the opportunities presented by different models and how each type can contribute to the objectives of reducing car use and increasing accessibility by sustainable modes of travel in Maynooth. The key recommendations regarding shared micromobility which have arisen from considering the policy context, the details of some existing schemes elsewhere and the specific context of Maynooth are summarised below.

- Work with NTA to achieve a coordinated approach to the provision of shared bikes and/or e-scooters in Maynooth and the surrounding region to ensure effective regulation, avoid a proliferation of different unconnected schemes and ensure that potential negative safety and accessibility impacts are minimised.
- Consider the quality of cycling infrastructure in Maynooth and anticipated timelines for improvement on each corridor when planning the introduction and expansion of any scheme(s) and identifying hubs/station locations.
- If supporting a one-way bike share / e-scooter share scheme to operate in the area, consider potential redistribution challenges and how these will be addressed.
- If allowing an e-scooter share scheme to operate in the area, consider introduction of a fleet ratio target to incentivise the operator to offer bikes in addition to e-scooters.
- Work with NTA, operators and developers to seek introduction of an on-demand ‘back to base’ share scheme offering e-cargo-bikes.
- Seek to introduce or support schemes to loan bikes for trial periods to Maynooth residents and to small businesses based in Maynooth, with a particular focus on e-bikes and cargo bikes.

4.2 Mobility Hubs

The term mobility hubs refers to highly visible, safe and accessible spaces where public, shared and active travel modes are co-located alongside improvements to public realm and, where relevant, enhanced community facilities. Mobility hubs bring together shared transport with public transport and active travel in spaces designed to improve the public realm for all. The concept is widely applied in many European and North American cities.

CoMoUK define the key characteristics of a mobility hub as including:

- Co-location of public transport and shared mobility modes
- Provision of facilities other than transport appropriate to the area
- Space designed to reduce private car space and improve the surrounding public realm
- Cycle and walking routes to link into the hub
- Street design which enables easy access for all

- A pillar or sign which identifies the space as a mobility hub as part of a wider network and ideally provides travel information

A concept drawing for a multi-modal mobility hub is shown in Figure 4-2.

Figure 4-2 Multi-Modal Mobility Hub Concept Drawing

The Kildare CDP references the Irish Rail 'multi-modal interchange strategy' which will include the provision of facilities to provide for ease of interchange between rail and all other modes, including cycling and shared mobility. There are opportunities to provide mobility hubs in Maynooth at the existing train station and the future Maynooth west train station. There may also be opportunities to integrate smaller scale mobility hubs into the design of new residential neighbourhoods in Maynooth west. The key success factors to consider in locating a mobility hub are shown in Figure 4-3.

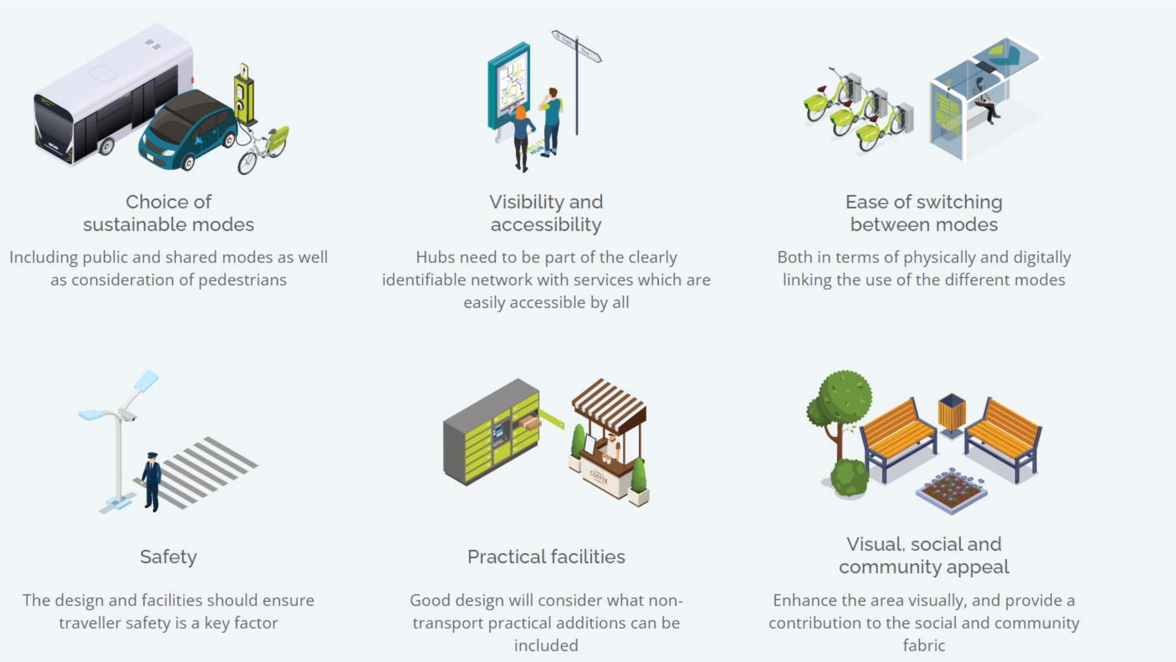

Figure 4-3 CoMoUK Mobility Hub Success Factors

4.2.1 Recommendation to support Mobility Hubs in Maynooth

Seek the provision of mobility hubs at Maynooth train station and the future Maynooth west train station and consider opportunities to require provision of mobility hubs within new residential neighbourhoods. Ensure that when Mobility Hubs are planned, all key success factors, including ease of switching between modes, safety, the availability of practical facilities and visual, social and community appeal are considered.

4.3 Electric Vehicle Charging

4.3.1 Kildare County Development Plan Policies

The Kildare CDP contains two main objectives relating to the conversion of the private car fleet to electric vehicles. TM O116 states that it is an objective of the Council to facilitate, along with the NTA and TII, the conversion of the private car fleet to electric in the following ways:

- *Providing public charging points at key destinations such as public car parks, Park and Ride facilities, on-street in town centres, and public parks;*
- *Ensuring that where car parking is proposed as part of all new developments either public or private, provision is made for all spaces to be dedicated over time to electric cars with provision for charging infrastructure built-in from the outset;*

- *Providing significantly expanded electric car charging facilities at service stations on the national road network;*
- *Ensuring provision is made for fast charging points at service stations and public carparks in order to make provision for a shorter charging time than domestic charging;*
- *Ensuring that charging infrastructure does not encroach on footpaths or otherwise compromise the free movement of pedestrians, cyclists and public transport; and*
- *Ensuring EV charging points are accessible to all, where possible.*

TM O117 states that it is an objective of the Council to support the Government's targets for electric vehicles on roads by

- Prioritising parking for Electric Vehicles (EVs) in central locations
- Supporting the provision of charging facilities on public and private land.
- Applying the requirements of the EU (Energy Performance of Buildings) Regulations 2021 (S.I. 393 2021) for Electric Vehicle charging infrastructure.

Many of the above topics are addressed in the new national policy discussed in Section 4.3.5. However, the idea of prioritising parking for EVs in central locations is not currently national policy. As cost remains a barrier to EV adoption for many households, there is a risk that prioritising parking for EVs may negatively impact social equity and public support for other sustainable transport measures, including more general parking constraint / demand management measures.

4.3.2 Currently Available Vehicle Charging Technology

With more standardised connection points and charge point sockets compared to the early stage of EV technologies, EV charging is now mainly differentiated by power and vehicle battery capacity. Another key factor is whether the electricity supplied to the charge point can be drawn from conventional domestic supply arrangements, or whether a higher connective capacity is required. EV charge points generally fall into two categories: standard charging and fast charging, otherwise known as AC and DC charging. AC charging is associated with slower speeds of EV charging. DC charging is largely associated with faster speeds of charging.

The power level (in kW) of a charge point indicates the maximum amount of energy which could be supplied to a battery pack over the course of one hour.

Table 4.1 Currently Available Vehicle Charging Technology

Charge Point Speed and Type	Power Rating	Time to charge for a 300kM journey[12]
Home (single-phase AC)	3-7 kW	7-16 hours
Standard (three-phase AC)	11-22 kW	2-4 hours
Fast (DC)	Up to 50 kW	70 minutes
High-powered (DC)	> 50 kW	70 minutes or less

EV Charging Infrastructure Strategy 2022-2025 – Appendix B, EV Basics

AC electricity can be used by all speeds of charge points, while DC electricity can only be used by fast or high-powered charge points. In most residential areas, single-phase AC electrical power supplies are most common. For larger industrial or commercial buildings, a higher-power three-phase AC system is often used.

The type of available AC supply determines the type of charge point that can be installed, as charge points that supply electricity significantly above 7 kW (such as 11 kW to 22 kW) generally require a three-phase AC supply. Additionally, most electric cars currently on the market are unable to accommodate more than c. 7 kW on a single-phase AC supply. This means that in residential areas, the most effective types of charge points are the lower wattage 7 kW-11 kW charge points that work best over longer charging timeframes, such as overnight. AC charge points also tend to be more compact in size.

4.3.3 Existing EV Charging Facilities in Maynooth

There are currently eight standard (22 kW) charge points in Maynooth. There are four standard charge points at Tesco in Carton Retail Park (2 outdoor spaces and 2 covered spaces). There are also four standard charge points located at Maynooth University.

4.3.4 Building Regulations for New Developments

Building Regulations in Ireland were updated in November 2022 to require EV charging infrastructure to be installed in new homes to enable future installation of EV charging points. The regulations now apply to:

[12] Also depends on the vehicle's charging capability, the state of charge at commencement of charge, and other factors such as the battery pack and ambient temperatures and driving behaviours.

- New dwelling houses with a parking space located within the curtilage of the dwelling;
- New multi-unit residential buildings; and
- Multi-unit residential buildings undergoing major renovation where the car park is located inside or adjacent to the building, and where renovations include the car park or the electrical infrastructure of the building or car park

For new multi-unit residential buildings or multi-unit residential buildings undergoing relevant major renovation, the infrastructure must apply to each car parking space that is located inside or within the curtilage of the multi-unit building.

In addition, the Energy Performance of Buildings Regulations 2021 standards apply to new buildings other than dwellings. Where there are more than twenty car parking spaces provided, at least one charging point must be provided. Where only one charging point in a car park is provided, it must be located so that it can be used from either a standard car parking bay or from an accessible parking bay.

Standards for EV charging points in new buildings or buildings under renovation may be further revised as part of the EU 'Fit for 55' package, a set of proposals to revise and update EU legislation and to put in place new initiatives with the aim of ensuring that EU policies are in line with EU climate goals.

4.3.5 Electric Vehicle Charging Infrastructure Strategy 2022-2025

The Electric Vehicle Charging Infrastructure Strategy 2022-2025 was published by the Department of Transport in January 2023. The strategy outlines a framework for the delivery of electric vehicle (EV) charge point infrastructure in support of the ambition in the Climate Action Plan that nearly 1 in 3 private cars will be an electric vehicle by 2030. It also recognises that Ireland will need to meet obligations regarding the deployment of charge points under the upcoming Alternative Fuels Infrastructure Regulation (AFIR) at EU level.

In order to coordinate the delivery of the strategy, the Zero Emission Vehicles Ireland (ZEVI) office was established within the Department of Transport in July 2022.

Four main categories of charging infrastructure are identified in the strategy to meet different user needs, depending on the location and time people need to charge their EVs:

- Home/apartment charging
- Residential neighbourhood charging
- Destination charging
- Motorway/en-route charging

National targets for charging infrastructure provision will be set through the AFIR as well as through refuelling requirements mandated for the Trans-European Transport Network (TEN-T). Both the AFIR targets for total publicly accessible charging power output and the TEN-T targets are currently being negotiated. When agreed, they will specify national charge point targets for Ireland, including the numbers and types of charge points required and the types of places they are to be located.

EU Member States are expected to be mandated to ensure that publicly accessible charging stations are deployed, with the required quantity linked to the number of BEVs/PHEVs (1kW of charging per BEV and 0.66kW per PHEV). Member States will also be required to ensure that a minimum coverage of publicly accessible charging points for light-duty vehicles is in place on the national motorway network by the end of 2025. The actual number of publicly accessible chargers required under AFIR therefore depends on several factors such as EV uptake to 2025, the level of BEV versus PHEV uptake and the mix of slow/fast/rapid/ultra-fast chargers.

The strategy is based on a set of five fundamental principles as shown in Figure 4-4.

Figure 4-4 Electric Vehicle Charging Infrastructure Strategy - Fundamental Principles

The additional detail provided in the strategy in respect of Principle 3 and Principle 4 is helpful when considering potential future charging infrastructure requirements for Maynooth. Nationally, home charging is expected to remain the main solution for the majority of EV users. An important reason for this is that lower power charge points can be connected to domestic electricity supplies and electric vehicles can be charged overnight, benefiting from lower electricity prices and reducing pressure on local electricity networks, resulting in more evenly distributed loads across the grid.

There is also the possibility of Vehicle-to-Grid (V2G) energy-management systems which allow plugged-in Evs to act as back-up battery storage and feed energy back into the grid at certain times. The strategy notes that special provisions should be made for people who live in higher-density residential blocks and residential developments with shared parking facilities.

Principle 4 highlights that for some, charging at home will not be an option and that other residential charging solutions should be provided which give the same benefits as the home-charging option, replicating the pattern of charging vehicles at night, during off-peak periods, and at a lower cost. There will be a growing need for publicly accessible residential and on-street (c. 7kW) charge points. Shared-charging solutions, whereby EV owners can rent out the use of their personal home charge point are another potential charging solution for EV owners without access to a driveway.

Other categories of charging solutions noted under the heading of Principle 4 include destination charge points, en-route charge points, fast taxi-charging hubs and publicly accessible heavy-duty vehicle charge points. Of these, only destination charge points and possibly taxi-charging are likely to be of relevance to Maynooth.

Chapter 5 of the strategy sets out the existing and planned Government supports and funding instruments for EV charging infrastructure and also sets out the objective for the delivery of charge point infrastructure by 2025. It notes that the target for publicly accessible charge point infrastructure could be achieved through a number of different scenarios and that the optimum mix will depend on driver needs and the ability to deliver the charge points in a timely manner.

New publicly accessible charge points will have to overcome challenges of site availability, planning, electrical connections, resources and funding. The existing and planned government supports for charging infrastructure which may be relevant for Maynooth are summarised below.

4.3.5.1 Home Charging

The Electric Vehicle Home Charger Grant which provides a grant of up to €600 towards the installation of a domestic charge point is now open to all homeowners, whether they own an electric vehicle or not and since September 2022, it only supports smart chargers.

Since July 2022, the grant has been expanded to include shared parking in apartment blocks and other multi-unit developments in the form of the Apartment Charging Grant. The Apartment Charging Grant is designed for bulk installation of chargers at a single location and provides up to 80% supports for cabling, infrastructure, labour and construction costs. Owners, management companies, housing bodies, local authorities and commercial and private landlords can apply.

Under building regulations, a building containing one or more dwellings which is undergoing major renovations and has more than 10 car-parking spaces, is now required to have ducting infrastructure for each space installed.

ZEVI also intends to work with the private sector to incentivise and popularise the use of 'shared charging' (a person renting out the use of their home charge point to other EV owners) on a wider scale in Ireland.

4.3.5.2 Residential/Neighbourhood Charging

The existing Electric Vehicle Public Charge Point Grant for local authorities will be retired and a new suite of supports for local authorities will be introduced. A key action for all local authorities will be to work with ZEVI to enable and support the delivery of residential area charging networks for residents without access to home or apartment charging solutions. A new suite of co-funding supports for local authorities will include supports for:

- Planning and designing an EV charging network and implementation plan at local and regional levels. The network will comprise both on-street charging in areas where residents do not have access to home charging solutions, and destination charge points at local authority facilities.
- Development of business cases for funding.
- Support for procurement of services.
- Funding of at least 75% for EV charge points that have been identified.

A new Residential Neighbourhood Charging Scheme will be launched by ZEVI to provide EV charging for residents without access to off-street parking. This type of charging will be designed to mimic home charging and will incentivise off-peak charging in a location convenient to the resident's home. Residential charging points delivered under the new scheme will have a charging capacity of 7-11 kW per charging point.

Zevi also intends to work with the car-sharing sector and local authorities to pilot the provision of charging infrastructure to support e-car clubs.

4.3.5.3 Destination Charging

A scheme is proposed for introduction by Q3 2023 to fund the installation of charge points by the public and private sectors at trip-generating locations or destinations.

Installing fast charging infrastructure at locations such as visitor and tourist attractions, retail outlets, car parks, public amenities, hotels and leisure facilities will provide a network of publicly accessible charge points that can be accessed by the surrounding community, tourists and visitors. Some destinations such as hotels, where visitors stay and park for longer durations, would be supported in delivering slower charge points. ZEVI is pursuing a number of strands for this scheme including:

- Main Destination Charging Scheme (both public and private sectors)
- Visitor Sites Scheme (state-owned and commercial visitor locations as well as community centres)
- Sports Centres Scheme (through the Shared Island initiative)
- Community Centres Scheme (Just Transition Fund Scheme, with a focus on destinations in rural areas, the Gaeltacht, and the Islands)
- Car Clubs (charging infrastructure to support e-car clubs)

In all destination charge point schemes, it is anticipated that ZEVI will provide funding for civil and electrics works. Landowners could then consider leasing facilities to a charge point operator for installation, maintenance, and operation of EV infrastructure. Alternatively, they could operate the charge points themselves.

4.3.5.4 Implementation

The Implementation Plan has set a timeline of Q3 2023 for delivery of the first iteration of the National EV Charging Network Plan (Residential & Destination). Specific guidelines for the development of these categories of charging points will be developed. This will include guidance on developing residential and destination charging plans including site-selection, level of charge point cover, and grid connections.

Implementation timelines are set out in the strategy for a number of specific schemes of relevance as outlined below.

- The Shared Island Sports Club Scheme opened for applications in January 2023
- The timeline set for the design of the local authority support package for the Neighbourhood Charging Scheme is Q3 2023, while the Destination Charging Schemes will be launched in Q3 2023.
- The Shared Charging Scheme Pilot supported by Fáilte Ireland is targeted to begin in Q2 2023

- The E-Mobility Hubs scheme, which involves ZEVI working with local authorities and car club providers to develop business cases for funding EV charging infrastructure for e-car clubs and e-mobility hubs and has a timeline of Q4 2024.
- ZEVI also intend to work with the LGMA, local authorities, the private and public sector and SEAI to identify, trial and implement innovative solutions to the provision of charging infrastructure.

The implementation plan also outlines numerous other actions for ZEVI and other stakeholders with regard to policy/strategy deliverables in the areas of accessibility and safety, AFIR implementation and interoperability and governance. These are not discussed here as they are national issues not directly related to the assessment of future EV charging demand in Maynooth.

4.3.6 Future Investment in Electric Vehicle Charging in Maynooth

As outlined in the previous section, the government intend to provide a wide variety of different supports to local authorities, to other public bodies and to the private sector to address the gaps in EV charging infrastructure. Determining an optimum balance of charging infrastructure to be provided in a town or region with regard to charging point numbers, type and location is a complex process. Decisions around the siting and design of EV charging infrastructure should also consider the potential impact on users and the wider public, including issues such as seclusion, lighting, safety and the need to avoid creating new hazards to other road users.

Any new publicly accessible infrastructure provided in Maynooth will play a role in the achievement of the national fleet-based target and the amount of charge points and kW power required nationally to meet the national target will not be finalised until later in 2023. Guidance on developing residential and destination charging plans is also awaited later in 2023. Therefore, when suitable guidelines are made available, KCC will need to work with ZEVI to undertake more detailed analysis of requirements within Maynooth.

4.3.6.1 Destination Charging Points in Existing Areas

Destination charging points can be of any power rating (7kW-100kW), although most destinations are particularly suited to fast charge points and (depending on the duration of stay) high-powered charging points. Government funding will be available for installation of publicly accessible charge points by both the public and private sectors.

Some locations in Maynooth where it is suggested consideration be given to provision of publicly accessible destination charging (including additional or faster charging points at locations which already have some facilities) are outlined below.

- KCC Leinster Street car park
- Carton Retail Park/Tesco

- SuperValu/Glenroyal Shopping Centre
- Glenroyal Hotel & Leisure Club[13]
- Manor Mills Shopping Centre/Dunnes (underground car park)
- Aldi
- Lidl
- Maynooth GAA club and/or Maynooth GAA club training grounds[14]
- Maynooth Train Station

It is suggested that at most of these locations, the provision of fast-charging points is likely to be preferable. However, at the Glenroyal Hotel, slower charge points may be adequate for the needs of overnight guests. At Maynooth Train Station, consideration should be given to dedicating a charging point space to accommodate a car sharing service vehicle. In addition, consideration could be given to dedicating a fast charge point for use by taxis at busy times.

Other locations where charging points may not necessarily be available to the general public but where they are important to accommodate the use of EVs by commuters and visitors include:

- Maynooth University
- St Patrick's College Maynooth
- Maynooth Business Campus

At these locations, standard charging points may be adequate for most needs, as the majority of users would be spending a considerable amount of time at the destination (e.g., spending a day at work or in college, attending a conference or staying overnight in visitor accommodation based on the campus).

4.3.6.2 Residential Charging Points in Existing Areas

A number of residential areas of Maynooth have been identified where individual homes do not have private driveways. Residents of these areas should be provided with an alternative solution which mirrors the benefits of home charging, including enabling users to charge vehicles overnight at lower cost.

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[13] The hotel is adjacent to Glenroyal Shopping Centre but there are separate defined parking areas, both of which are restricted to customers. Hotel guests who are staying overnight will also require more and more varied charging points in comparison to shoppers.

[14] The training grounds lands are understood to be owned by KCC. Note however that there are existing traffic management/safety issues at this location related to the use of the car park for school drop off and collection and if access restrictions are likely to be introduced in future for this reason it would not be an optimal location for a public charge point

In the case of multi-unit developments with dedicated shared parking spaces, the Apartment Charging Grant Scheme may be a suitable means of providing the required charging facilities within developments, particularly if existing shared parking spaces are within the control of a management company. It is suggested that KCC review the list of developments within Table 4.2 and any similar developments within Maynooth to assess whether they would be eligible for this scheme and if appropriate, encourage and support management companies to arrange for the installation of charging infrastructure under the scheme.

Residents of any of the developments which are deemed to be not eligible / suited to the scheme should be considered by KCC when determining the location of proposed charging infrastructure under the separate new Residential Neighbourhood Charging Scheme.

Table 4.2 Residential areas/developments in Maynooth with shared parking areas

Development name/ street name
Lyreen Manor
Moyglare Court
Mill Race Manor Apartments
Apartment blocks in Moyglare Hall Estate
Nagle Court
Parklands Lodge
Griffin Rath Hall
Hayfield
Straffan Close
Straffan Grove
Straffan Green
Straffan Avenue
Straffan Lawn
Straffan Crescent
Straffan Place
Straffan Court

Residents of many streets close to the town centre of Maynooth do not have dedicated shared parking areas and instead can currently access permits to park in public on street parking spaces. KCC should seek to provide these residents with access to charging facilities, either on-street where appropriate (funded by the new Residential Neighbourhood Charging Scheme), or at destination charge points at local authority facilities including KCC car parks on Leinster Street and Doctor's Lane.

Before installing on street charging facilities, consideration should be given to whether other future sustainable transport measures may potentially require existing on street parking spaces to be redesigned or relocated in future, to ensure that investment in EV charging is not wasted and does not create a barrier to improving facilities for travel modes which are given more priority in the Sustainable Transport Hierarchy. For example, the optimum future road layout at Parson Street and Dunboyne Road is currently uncertain and therefore it may be more appropriate for residents in this area to avail of charging points elsewhere at least in the short-medium term than to install on-street charging points in the short term at these locations.

Table 4.3 Maynooth residential streets with on street parking and/or KCC permit parking

Street name
Pound lane
4-7 Leinster Park
Leinster Cottages
Back Lane
3-10 Dunboyne Road
Fagan's Lane
Kelly's Lane
Parson Street

4.3.6.3 En-Route Charging

The EV Charging Strategy envisages that increased provision of publicly accessible high powered (c. >100 kW) charge points will be needed to cater for drivers making longer journeys, such as between cities or along the National Roads Network. However, as the main focus of this type of charging is on the National Road Network and in particular the TEN-T Core Network, it is not considered highly relevant to Maynooth and no explicit recommendations for KCC are made here in this regard.

A private sector operator, such as the owners of one of the existing service stations in Maynooth, may decide to invest in high speed en-route charging if this presents a viable opportunity from a commercial and technical perspective.

4.3.6.4 New Development Areas

The provision of charging points in new developments is regulated nationally and at European level and will continue to evolve. The KCC Planning Department will ensure the most up to date building regulations regarding provision of EV charging infrastructure are applied through the planning process. Compliance will be monitored and enforced in line with all other planning conditions.

4.3.7 Summary of Recommendations Regarding Electric Vehicle Charging Infrastructure

The key recommendations regarding electric vehicle charging arising from the policy context and details about Maynooth outlined in the previous sections are summarised below.

- Ensure the most up to date building regulations regarding provision of EV charging infrastructure at new developments and developments undergoing major renovation are applied through the planning process and that compliance is monitored.

- Seek to provide EV charging points in KCC owned car parks in Maynooth through the Destination Charging Scheme being launched by ZEVI in 2023.

- Work with ZEVI to raise awareness of the Destination Charging Scheme among relevant businesses and organisations in Maynooth when it is launched.

- Work with ZEVI to raise awareness of the Apartment Charging Grant among relevant stakeholders in Maynooth and encourage and support eligible management companies to access the grant and install charging infrastructure.

- Engage with ZEVI and local stakeholders to plan and design an EV charging network and implementation plan, with a particular focus on provision of residential area charging networks for residents without access to home/apartment charging solutions (note that a new suite of co-funding supports for local authorities will be available to support this work).

4.4 Cycle and Scooter Parking

4.4.1 Existing National and Regional Policies

The GDA Transport Strategy notes that the availability of cycle parking at the beginning and end of a journey can greatly influence the decision to cycle. Destination cycle parking can be provided both privately at workplaces and as public cycle parking on-street, in larger off-street facilities and at other destinations such as cultural, leisure or recreational facilities. Where public cycle parking is provided it must cater for the full spectrum of cycles.

The Strategy notes that on-street public cycle parking is often occupied by workers who lack workplace parking and that by promoting workplace parking provision, on-street stands can serve their primary purpose of catering for shorter-term retail, leisure and business use. Additionally in the Strategy, the NTA commits to working with local authorities and transport operators to address the need for sufficient cycle parking at rail stations, transport interchange locations and mobility hubs. The Strategy contains two specific measures regarding cycle parking.

- **Measure CYC5** It is the intention of the NTA to deliver, through the statutory planning process and liaison with relevant stakeholders, high quality cycle parking at origins and destinations, serving the full spectrum of cyclists including users of non-standard cycles.

- **Measure CYC6** Local authorities will prepare public cycle parking strategies in order to ensure that there is sufficient short-stay safe and secure cycle parking available on-street and/or off-street, including spaces for cargo bikes and other non-standard bike designs, in city, town and village centres.

The Sustainable Mobility Plan contains an action for the NTA for 2023 to 'Develop and commence implementation of a programme for secure bicycle parking in key towns and cities plus transport hubs'. The owner of the action is the NTA, with support from local authorities and transport operators.

There are no specific existing national or regional policies regarding the provision of secure parking at destinations or transport interchanges for private e-scooters, which are not yet legal to use in Ireland. However, the GDA Strategy does note that parking infrastructure can be relatively cheap to build and maintain and that their small footprint means otherwise unused spaces could be used productively. Measure CYC12 states that the NTA and local authorities will take into account the growing use of e-scooters and the benefits they may bring, in planning and designing the transport network in the GDA.

4.4.2 Kildare County Development Plan Policies

The Kildare CDP contains two general policies in relation to the provision of cycle parking on street and as part of new residential and commercial developments.

- **TM A17** Prepare cycle parking strategies and investigate the appropriate locations for cycle parking facilities within the county in order to ensure sufficient cycle parking on-street in towns and villages, in accordance with the NTA's Draft Greater Dublin Area Transport Strategy and Cycle Network Plan (2021). The locations of such facilities can be identified where appropriate through the Local Area Plan process.

- **TM O38** Support the development of accessible and barrier free cycling as a practical transport choice by providing secure, well-designed and well- lit cycle parking facilities, including electrical and cargo/delivery bicycle parking in towns, at public service destinations and in all new residential and commercial developments in accordance with cycle parking design guidelines; The National Cycle Manual (NTA, 2011 – or the pending update), The Draft GDA

Cycle Network Plan (NTA, 2021) and the Standards for Cycle Parking and Associated Cycling Facilities for New Developments document (Dun Laoghaire Rathdown County Council, 2018).

The Development Management Standards also contain several references to cycle parking and bicycle storage and contains a table detailing the minimum number of spaces to be provided at each type of new development.

- The Planning Authority requires the provision of a minimum level of secure cycle parking facilities in association with new development and changes of use. This is consistent with the objectives and policies of the National Sustainable Mobility Policy (2022) and the Draft GDA Cycle Network Plan (NTA, 2021). New cycle parking shall be designed in accordance with the National Cycle Manual (2011 and any subsequent updates). Where the provision of cycle parking facilities is intended for use by the staff of a particular development, stands should be covered, well-lit and located within the curtilage of developments to ensure security and supervision. Cycle stands for use by visitors should be located to maximise convenience to the entrance of buildings, and positioned so as to ensure safety, security and supervision. The cycle parking standards set out in Table 15.4 shall be taken as minimum standards.

4.4.3 Destination Cycle Parking

The policies in the CDP, alongside other existing and forthcoming national guidance should help to ensure that adequate cycle parking is provided as part of new developments. However, based on the survey conducted in October 2021 as part of the baseline study for the MEABTA, there is also a need to significantly enhance cycle parking provision at all types of destinations within the existing urban area of Maynooth.

The most basic requirements of all cycle parking facilities are that they should be capable of supporting the frame of the cycle and preventing it from falling over; protecting the cycle against theft and allowing the cyclist sufficient room to position and lock the cycle. In addition, consideration should be given to protection against weather, lighting, ease of access and additional requirements at public transport.

4.4.3.1 Train Station

Existing cycle parking at Maynooth Train Station consists of a set of stands which are partially sheltered (the shelter has a roof but no sides). The stands are lower than usual and spaced quite closely together. During site visits it was observed many cyclists opted to use railings beside the canal instead of the formal cycle parking. There are also a small number of secure lockers operated by BikeLocker.ie but these must be reserved and paid for by individuals on an ongoing/long term basis.

As a train station is a place where train passengers need to leave bikes for an extended period of time which potentially includes overnight, it is recommended that a much more secure and weather protected cycle parking option is required at both the existing train station and the future train station for regular commuters.

One option is to provide an access-controlled hub for registered users similar to those provided at many train stations in the UK and throughout Europe. Access would be controlled using a fob or swipe card and all users would have to register and pay a small fee.

Figure 4-5 Altrincham Interchange Bike Hub

A potential alternative to the provision of a secure accessed controlled space would be the provision of smart bike racks. One company manufacturing such solutions, bikeep, claim that with over one million uses of their products, there have been no bike thefts. The system they offer locks the bikes from the wheel and the frame and it can be opened with an app or contactless card. It includes distress signal forwarding which can alert local security in the event of an attempted theft. The advantages of this system are that it is more secure than using standard individual locks, it reduces the need for users to carry heavy individual locks and it is easier and cleaner to use. If a smart parking option was chosen instead of an access-controlled area, this would need to be provided in conjunction with sufficient weather protection.

Figure 4-6 bikeep Personal Bike Parking Station

In addition to a secure hub or smart parking option, there will also be a need to provide ample free and sheltered standard cycle parking facilities for more casual users.

4.4.3.2 Bus Stops

Most current bus stops in Maynooth do not have cycle parking and are unlikely to be suitable locations to accommodate any significant quantity of cycle parking from a space or security perspective. Improved cycle parking provided at the train station could be used by some people accessing buses at Straffan Road. It is also suggested that consideration be given to providing a secure hub or sheltered ‘smart’ cycle parking within Carton Retail Park. This would enable people from many different parts of Maynooth to efficiently access buses on Dublin Road, particularly if the proposed entrance to the retail park from the Royal Canal is provided. For example, someone living in Newtown Hall, an existing residential development on the west side of Maynooth adjacent to the Royal Canal could quickly cycle along the Royal Canal to Carton Retail Park and then catch a bus going to Intel in Leixlip.

4.4.3.3 Town Centre

There is some provision of public cycle parking on Main Street. As part of future upgrades on Main Street, there will likely be potential to expand the number of spaces available. Consideration could also be given to providing a small secure hub at an off street location, such as Doctor’s Lane car park, to provide a more secure and weather protected cycle parking option for people working in the Main Street area who do not have cycle parking at their workplace.

4.4.3.4 Retail Destinations

Cycle parking at most of the key retail destinations in Maynooth including Carton Retail Park, Manor Mills Shopping Centre, Glenroyal Shopping Centre, Lidl and Greenfield Shopping Centre is either missing or very poor quality. All such retail destinations should offer convenient customer cycle parking in a prominent area as well as more secure longer stay cycle parking for staff.

Sometimes it is possible for a local authority to condition improved cycle parking provision at a privately owned existing site through the planning system when other work is being undertaken. However, where no such work is planned and considering the urgency of reducing car dependency in Maynooth, it is suggested that KCC could consider directly funding or part funding improved provision of cycle parking at these sites.

4.4.3.5 Education Destinations

A survey of cycle parking at schools in Maynooth was undertaken as part of the baseline assessment in 2021. The survey found that cycle parking availability and quality at schools was mixed and that additional provision and/or replacement of existing provision with higher quality facilities was required at most schools. As this survey is now out of date and some schools will now have improved cycle parking provision, it is recommended that KCC should engage with schools to get an up-to-date understanding of current provision and requirements. Schools may be able to access funding for improved cycle parking through the Safe Routes to School (SRTS) Programme operated by the Green-Schools Programme in partnership with the NTA. Alternatively, KCC may be able to directly support the provision of improved cycle parking.

Due to the size of the Maynooth University campus, it was not possible to survey the provision of cycle parking as part of the baseline assessment. During consultation undertaken to inform the baseline assessment, university management noted that there are plans to provide more covered and locked cycle parking on campus but that due to low mode share for cycling, bike theft has not been a major issue historically and existing cycle parking was undersubscribed. Maynooth University is currently in the process of developing a new Strategic Plan for the campus for the years 2023-2028 and it is assumed that consideration of future cycle parking requirements will form part of this work. As part of the planning process for new developments on the Maynooth University campus, KCC should ensure that adequate high quality cycle parking facilities and other ‘trip end’ facilities such as showers are provided as part of the development or are already available in a suitably close location.

4.4.3.6 Other Destinations

There is a need to replace poor quality ‘wheel grip’ stands at the Glenroyal Hotel with higher quality cycle parking and to provide high quality cycle parking at other leisure destinations throughout the study area, such as the Maynooth GAA training grounds. Similar to retail destinations, KCC could consider funding part of the cost of new infrastructure in order to incentivise delivery in the short term.

4.4.4 Residential Cycle Storage

4.4.4.1 New Developments

The Development Management standards in the CDP contain standards regarding the quantity of cycle parking to be provided as part of new developments, including residential developments. For apartments, one space per bedroom is required as well as one visitor space per two apartments. Terraced/townhouse schemes should provide bicycle storage through incorporation of a utility/store room accessed from close to the front of the house, provision of access to the rear of houses or provision of sheltered parking at a public, well-lit and secure space. The provision should be detailed in all applications for multi-unit development.

There is relatively little detail in the current CDP standards regarding the design of residential cycle parking, although the standards developed by Dun Laoghaire Rathdown County Council in 2018 are referenced, as well as the National Cycle Manual. The standards to be applied should be kept under review and consideration should be given to updating the standards in the CDP following the publication of the forthcoming update to the National Cycle Manual if appropriate.

Planners should ensure that cycle parking provided as part of new residential developments can accommodate all types of cycles, particularly cargo bikes. Planners should also consider security issues, convenience and the likelihood that some individuals will want to own multiple cycles when assessing proposals for cycle parking provision as part of new residential developments. The DLR standards note that small apartment blocks may best be served by the provision of secure cages assigned to individual dwellings within a communal area at ground level, or the provision of store rooms/lockers close to entrances with internal and external accesses.

4.4.4.2 Existing Developments

There are many existing dwellings in Maynooth which do not have access to suitable dedicated cycle parking or to a side entrance which could enable access to and from a shed placed in the rear garden. Some of the areas in Maynooth where there are a substantial number of such dwellings include:

- The Straffan Wood area in the south of the town, west of Straffan Road, where there are large numbers of terraced houses and some apartments
- The Newtown Hall area in the west where the majority of houses are terraced
- The southern part of the Old Greenfields area, where the majority of houses are terraced
- The western part of Pound Lane in the town centre, where the is a row of terraced houses
- Moyglare Court apartments
- Mill Race Manor apartments

In addition to the above, the availability of dedicated cycle parking at Lyreen Manor, the large apartment development adjacent to Manor Mills Shopping Centre could not be determined.

It is suggested that KCC should assess whether there is any interest from residents in the above areas in using a Bike Bunker which would be procured/provided by KCC, with residents paying an annual fee for access. Dublin City Council have offered this service for a number of years as a pilot project at a small scale and are currently in the process of expanding the service, with an intention to procure approximately 350 bike bunkers.

Figure 4-7 Cyclehoop Bikehanger

Another solution to residential cycle parking in residential areas where there are large front gardens/driveways is to allow individual residents to install their own dedicated cycle storage units in the front gardens. Even where households have a side access, having access to cycles at the front of a house is significantly more convenient and increases the likelihood of an individual choosing to cycle rather than drive for any particular trip.

In addition, not all residents with rear gardens and a side access have a secure shed or the possibility to install one, while some residents with mobility issues or non-standard cycles may struggle with wheeling a bike through a narrow passage. Examples of domestic cycle storage units are shown in Figure 4-9. At locations where there is space within the front garden of an individual dwelling to install a cycle storage unit, it is suggested that this should be viewed favourably, and that consideration should be given to making such installations except from any formal requirement for planning permission. However, they should not be installed in situations where they would lead to the increased use of the public road for private car parking.

Figure 4-8 Bike Shel[15] and BikeBunker Locker[16]

4.4.5 Destination E-Scooter Parking

E-scooters are highly transportable with various designs enabling rapid folding and easy carriage and this means that the provision of secure dedicated parking infrastructure for e-scooters is less critical than the provision of improved cycle parking, particularly while the number of users remains low.

However, there are potential health and safety and public transport capacity impacts associated with large numbers of commuters taking e-scooters on busy public transport services at peak times. E-scooters being moved around indoors in crowded spaces may also present a hazard at some other locations such as on the university campus. In addition, the number of e-scooter users in Maynooth will likely increase significantly over time following legalisation.

Secure e-scooter parking facilities which are sheltered from weather should be provided at the existing and future train stations and on the university campus at a minimum. If dedicated e-scooter parking is not provided, there is a risk that e-scooters will take up valuable cycle parking space and this would be an inefficient use of this space given the different in size between e-scooters and cycles. Consideration should also be given to providing some dedicated sheltered e-scooter parking in the town centre as businesses based in older buildings on the Main Street and surrounding area may lack the space to provide suitable storage facilities for staff and customers.

It may be necessary to provide a number of different options to suit different types of users, their duration of stay and security requirements and their willingness to pay or not for e-scooter parking. Some users may simply want to avail of a rack which they can use their own lock to lock their scooter to, as shown in Figure 4-9.

[15] http://www.bikeshel.com/

[16] https://cycle-works.com/products/bikebunker/

There are also an increasing range of ‘smart’ products available which can increase convenience and security for users, such as the docked parking station developed by bikeep (

Figure 4-10 bikeep dock based e-scooter parking). The bikeep product is aimed at shopping centres, office buildings and universities, has a built-in locking bar, can be locked via an app or contactless card and can be managed remotely (open / close / reserve).

Figure 4-9 Basic e-scooter parking stands (Pittman.ie)

Figure 4-10 bikeep dock based e-scooter parking

4.4.6 Summary of Recommendations Regarding Cycle and Scooter Parking and Storage

The key recommendations regarding cycle parking and e-scooter parking which have arisen from considering the policy context, existing facilities in Maynooth and examples of solutions deployed elsewhere are summarised below.

- Work with Irish Rail and NTA to significantly enhance cycle parking options at Maynooth Train Station and provide a higher security option, in addition to sheltered standard cycle parking.

- Seek to expand provision of public cycle parking on Main Street as part of future upgrades and consider provision of a small secure cycle parking hub at an off-street location in the town centre for use by town centre workers.

- Work with landowners to seek provision of a secure cycle parking option within Carton Retail Park lands which could be used by people accessing bus services on Dublin Road.

- Work with businesses, sports clubs, schools and other relevant destinations to secure delivery of a sufficient quantity of high-quality cycle parking and ensure cycle parking is prominent and visible. Consider part funding new infrastructure to incentivise private sector stakeholders to invest in upgrades in a timely manner.

- Assess interest in the Bike Bunker concept among residents of areas where there are clusters of dwellings without access to suitable cycle storage solutions and seek to provide the facility where interest exists.

- Support residents to install secure front garden cycle storage solutions in suitable areas.

- Following legalisation of e-scooters, seek to provide dedicated e-scooter parking solutions on Main Street and work with stakeholders to encourage provision of suitable facilities at other destinations, particularly the train station and Maynooth University.

4.5 Bike Maintenance Facilities

There is potential for bike repair stations and cleaning stations to be installed in Maynooth at key destinations. These could benefit residents and commuters as well as leisure users including visitors undertaking longer leisure cycling trips along the Royal Canal Greenway.

Cycle repair stations are standalone units equipped with the tools people need to fix, tune and repair the most common mechanical problems. An air pump is an important aspect and can be installed either as an integrated component of a bike repair station as shown in Figure 4-11 or as a standalone facility as shown in Figure 4-12.

Although some cycle repair stations have been installed outdoors elsewhere in Ireland, manufacturers recommend that the facilities should be installed indoors or under cover to protect against rust.

Figure 4-11 Cycle Repair Station (Pittman.ie)

Figure 4-12 Public bike pump (Pittman.ie)

A less commonly available related facility in Ireland which would also help to support cycling in Maynooth is a bike cleaning station. Examples of bike cleaning stations are shown in Figure 4-13 and Figure 4-14. In addition to looking better and ensuring that dirt does not transfer to a user's clothes, regular cleaning helps to prevent wear and tear caused by the build-up of dirt and debris on components. Dirt and debris can also obscure reflective surfaces which reduces the visibility of a bike at night. A bike cleaning facility could be particularly valuable for Maynooth residents who do not have a convenient means of cleaning their bike at home, such as residents of apartments and terraced housing who do not have easy access to a private back garden with outdoor tap, as well as visitors passing through Maynooth. The provision of a custom designed facility with appropriate drainage also reduces the chance of grease and cleaning fluids impacting the environment.

Figure 4-13 Cycle Wash Station (Reddit user[17])

[17] https://www.reddit.com/r/bicycling/comments/vs6166/there_is_a_freeoffcharge_bike_cleaning_station/

Figure 4-14 Cycle Cleaning Station (www.ibombo.eu/)

4.5.1 Recommendations for the Provision of Bike Maintenance Facilities

The existing Maynooth train station and future Maynooth west train station would be ideal locations for the installation of bike repair stations and bike cleaning facilities, as these locations can be conveniently accessed from the Royal Canal Greenway and have high footfall which will increase public awareness of the availability of these facilities. The facilities can be installed in conjunction with other facilities such as cycle parking.

Other potentially suitable locations in Maynooth for the installation of maintenance facilities could include Maynooth University and large retail destinations which have good passive surveillance and the potential to attract high numbers of cycling trips, such as Carton Retail Park. As in the case of upgrades to cycle parking, KCC could consider directly funding or part funding the provision of cycle maintenance facilities at privately owned sites.

4.6 Education and Behaviour Change

4.6.1 Rational for Sustainable Travel 'Soft Measures'

Travel habits, routines and attitudes are often deeply ingrained. Small investments in 'soft' measures can complement wider investment in infrastructure and transport services and help people to consider their ingrained travel habits, develop more positive attitudes to sustainable travel modes and overcome barriers to change.

The Climate Action Plan 2023 notes that achieving a shift to zero-or low-carbon emission transport modes will require unprecedented levels of public buy-in and engagement. It commits Government to developing a strong communications campaign to communicate the climate, well-being and other benefits of a widespread shift from private car dependency to sustainable mobility.

As the details of this future national Climate Action and Sustainable Mobility Communications Strategy are not available, it is not clear what the role of local authorities will be or how the Government intend to support local authorities to communicate with residents in their areas. However, as most travel is local and the context for travel is different in all areas, a generic national communications campaign will not be sufficient to support modal shift in Maynooth and there will likely be a need for KCC to engage with Maynooth residents and commuters regarding sustainable travel on an ongoing basis and in more varied and effective ways than has historically been the case.

There are numerous different theoretical models to understand what makes an effective behaviour change programme, all of which point to the need for a variety of different types of interventions which target different levers for change. One simple model is the ‘Four Es’ Model used by the UK Department for Environment, Food and Rural Affairs and shown in Figure 4-15. This focuses on the need to enable, encourage, and engage people and communities, and recognises that government needs to lead by example.

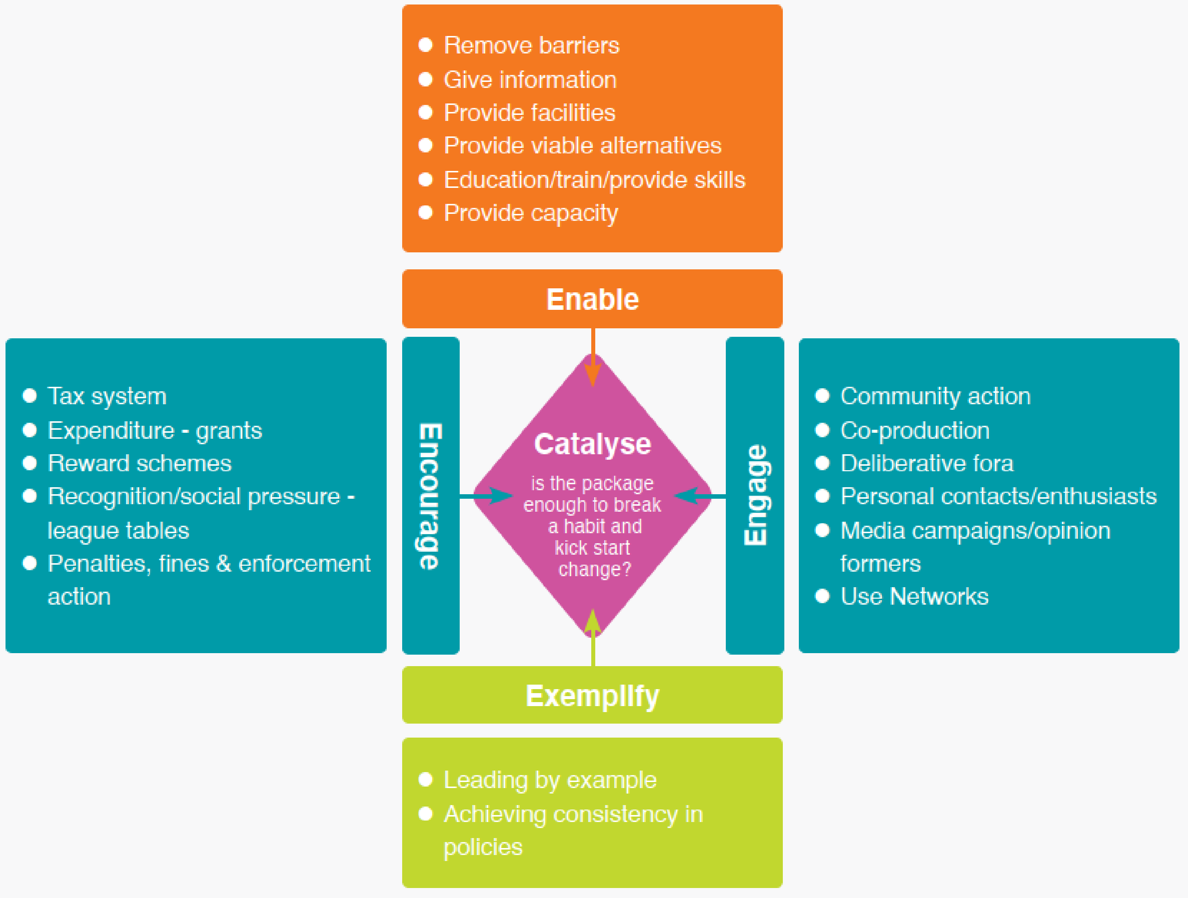

Figure 4-15 DEFRA 'Four Es' Model of Behaviour Change[18]

4.6.2 Existing Policies and Initiatives

There are a number of policies in the KCC CDP which express support for measures to promote sustainable travel modes in workplaces, schools and multi-unit developments.

- **TMO6** Support and encourage employers to develop and implement Workplace Travel Plans based on the NTA's Workplace Travel Plans: A Guide for Implementers (2013) in order to promote more sustainable travel options
- **TM O39** Promote and encourage the use of the Toolkit for School Travel (2019) by teachers, parents and others and promote and encourage, in consultation with the Department of Education, substantial changes in relation to the items that learners are expected to bring to and from school daily to encourage more learners to cycle to school.

[18] Image sourced from DfT/Sustrans report 'A moment of change – Guidance for local authorities on promoting an active return to work'

- **TM A25** Require all multi-unit developments and schools to submit mobility management plans and travel plans, including an assessment of the public transport capacity in a manner consistent with existing NTA guidance and to implement mobility management initiatives to minimise the impact of new developments on the road and street network of the County.

However, there does not appear to be any specific commitment in the current CDP for KCC to directly implement or financially support travel behaviour change initiatives and communications campaigns locally. It is recommended that KCC consider doing this and whether specific staff with specialised skills can be dedicated to or appointed for this purpose, as is common in local authorities throughout the UK.

4.6.3 Existing National Programmes

The NTA Smarter Travel Workplaces and Smarter Travel Campus programmes are national voluntary behaviour changes programmes supporting employers and third level institutions to implement Travel Plans. Organisations with more than 250 employees can become a Partner organisation and avail of supports with undertaking travel surveys, developing an Action Plan and promoting walking, cycling, public transport and carpooling.

Partner organisations can participate in annual awards events, seasonal promotions and seminars and networking opportunities. Campuses are also encouraged and supported to promote sustainable travel as part of the curriculum within relevant courses, and both students and lecturers can submit entries to the ‘Smarter Travel Campus Awards’ which recognise relevant coursework completed in areas such as event management, multimedia, and graphic design. Maynooth University is a long-term participant in the Smarter Travel Campus programme. Maynooth University was also awarded a Green Campus Flag by An Taisce in 2018.

The Green Schools Programme is an international environmental management and education programme for schools, known internationally as ‘Eco-Schools’. In Ireland, the programme is delivered by An Taisce. The programme aims to make environmental awareness and action an intrinsic part of the life and ethos of a school, to extend learning beyond the classroom and to involve the wider community, including the local authority, the media and local business. Schools must work on a theme for at least one school year and complete all essential elements of the programme for that theme to be awarded a Green-Schools flag.

To maintain Green Flag status, the flag is then renewed every two years under a different theme. Travel is the fourth theme of the programme. Schools working on the Travel theme conduct a review of current travel patterns and issues at their school and create an Action Plan. When creating their Action Plan, schools set travel targets with the aim of increasing the number of pupils walking, cycling, scooting, carpooling, using public transport and using park ‘n’ stride for the journey to school.

Participating schools are encouraged to organise regular ‘WOW’ (walk on Wednesday) and ‘COW’ (cycle on Wednesday) events throughout the year, as well as walking buses and ‘Park ‘n’ Stride’ events. Four key ‘call to action’ events are celebrated annually with schools as part of the Travel theme, including ‘The Big Travel Challenge’ in February, ‘National Scoot to School Week’ in March, ‘National Walk to School Week’ in May and ‘National Cycle to School Week’ in June.

In Maynooth, Gaelscoil Uí Fhiaich have already achieved their Travel Flag and Maynooth Educate Together are currently working to achieve it. Most other schools are involved in the Green Schools Programme in some way or have been in the past, but do not appear to have formally worked on the travel theme to date. However, engagement with schools as part of the stakeholder consultation for the MEABTA highlighted that all schools are committed to promoting sustainable modes of travel to their pupils and are very supportive of infrastructure improvements in Maynooth to enable more of their pupils to safely use active travel modes.

4.6.4 Recommendations for Education and Behaviour Change Initiatives

There will be a need for KCC to work with Government and local stakeholders to support the future Climate Action and Sustainable Mobility Communications Strategy. KCC should also seek to support existing national programmes which involve schools and Maynooth University where possible.

There are a vast range of different interventions and changes which have been implemented elsewhere in Ireland and/or overseas which would potentially be beneficial in Maynooth. It is not possible to discuss these comprehensively within the scope of this report. It is also not clear at the present time what resources are likely to be available in future within KCC to implement such initiatives, although in general behavioural change interventions are low cost in comparison to major capital investments in transport infrastructure which they complement. A very brief overview of some potential ideas is provided below.

- Ensure all language and imagery used for project materials and communications for active travel schemes, or wider schemes with an active travel element, will help to increase representation and reduce alienation of under-represented groups
- Deliver promotional material to residences in areas which will benefit from permeability improvements – show how trip distance to key destinations will reduce / has reduced
- Implement attractive way finding signage and branding which shows distances and active travel times to key destinations, as well as other branding such as roundels painted on the ground on cycle routes which help promote legibility and active travel
- Improve the provision of information regarding available public transport options (particularly on street and at mobility hubs such as the train stations)
- Design and implement gamification initiatives which use technology to incentivise greater use of sustainable travel modes. In the UK, companies such

as BetterPoints Ltd and Intelligent Health Ltd ('Beat the Street' game) work with local authorities to develop bespoke programmes for to increase the use of sustainable travel modes

- Incentivise and monitor the use of sustainable travel modes among KCC staff for both commuting and business purposes where possible (leading by example)
- Organise come and try it opportunities for electric bikes, cargo bikes, adapted cycles for people with disabilities, electric cars, shared transport/mobility hubs etc.
- Organise loan schemes for individuals and/or businesses to borrow bikes for longer periods of time to assess the potential benefits (particularly useful for cargo/e-cargo bikes, e-bikes and adapted cycles)
- Offer / subsidise cycle training and bike maintenance training for adults
- Advise businesses and employers on providing safe and secure cycle storage and other relevant facilities for their staff and consider subsidising this infrastructure for existing developments if necessary
- Offer mobility credits for people that move into new residential developments – e.g. Leap card with free travel for a month / bike share scheme credit etc.
- Ensure destination cycle parking is prominent and visible, particularly visitor cycle parking. (Note this contradicts a current recommendation in CDP that cycle parking at shopping centres should be 'discrete')
- Organise fun and social events in Maynooth for different target groups – e.g. family cycles, leisurely led cycle rides for adults, led walks etc.

5. Summary of Decarbonisation Report Recommendations

Table 5.1 summarises the recommendations made throughout the decarbonisation report which will be integrated into the MEABTA across the transport strategies for different modes (e.g., walking, cycling, parking, etc.) In line with the phasing used in the main Maynooth and Environs ABTA report, the measures have been phased according to short/medium/long term categories.

These measures are additional supplementary measures to support transport decarbonisation within the Maynooth DZ, particularly in respect to new forms of e-mobility and shared mobility technologies. But it is important to note that the focus of transport decarbonisation in the MEABTA will still be on modal shift from car use to walking, cycling and public transport or demand management, which the additional measures from the decarbonisation report will support as part of the integrated MEABTA strategy.

Table 5.1 Decarbonisation Report Recommendations for the MEABTA and Phasing

Proposed Measure / Recommendation	Suggested Timescale for commencement (Short/Medium/Long term)
Seek to deliver low car residential development in the western part of Maynooth and car free residential development at key infill sites close to the town centre.	Medium-Long Term
Ensure that maximum residential parking standards in CDP are not treated as targets and that residential developments in areas of Maynooth with good access to public transport are designed to provide fewer car parking spaces, to encourage use of sustainable modes and support the viability of shared cars.	Short term
Require developers to provide reserved space at large new residential developments for shared cars.	Short term
Investigate potential to require developers to financially support the provision of a shared car for a period of time at relevant new developments if there is uncertainty as to the commercial viability of a location for operators.	Medium term
Offer free parking in KCC owned car parking spaces for branded car sharing vehicles (with capped time duration).	Short term

Proposed Measure / Recommendation	Suggested Timescale for commencement (Short/Medium/Long term)
Work with NTA to achieve a coordinated approach to the provision of shared bikes and/or e-scooters in Maynooth and the surrounding region to ensure effective regulation, avoid a proliferation of different unconnected schemes and ensure that potential negative safety and accessibility impacts are minimised.	Medium term
Consider the quality of cycling infrastructure in Maynooth and anticipated timelines for improvement on each corridor when planning the introduction and expansion of shared bike or e-scooter scheme(s) and identifying hubs/station locations	Medium term
If supporting a one-way bike share / e-scooter share scheme to operate in the area, consider potential redistribution challenges associated with each station and how these will be addressed.	Medium term
If allowing an e-scooter share scheme to operate in the area, consider introduction of a fleet ratio target to incentivise the operator to offer bikes in addition to e-scooters.	Medium term
Work with NTA, operators and developers to seek introduction of an on-demand 'back to base' share scheme offering e-cargo-bikes	Medium-long term
Seek to introduce or support small scale bike loan schemes for individuals/households and small businesses with a particular focus on e-bikes and e-cargo bikes to enable participants to 'trial' these options for an agreed period of time	Short term
Seek the provision of mobility hubs at Maynooth train station and the future Maynooth west train station and consider opportunities to require provision of mobility hubs within new residential neighbourhoods. Ensure that when Mobility Hubs are planned, all key success factors, including ease of switching between modes, safety, the availability of practical facilities and visual, social and community appeal are considered.	Medium-long term
Ensure the most up to date building regulations regarding provision of EV charging infrastructure at new developments and developments undergoing major renovation are applied through the planning process and that compliance is monitored.	Short term
Seek to provide EV charging points in KCC owned car parks in Maynooth through the Destination Charging Scheme being launched by ZEVI in 2023.	Short term

Proposed Measure / Recommendation	Suggested Timescale for commencement (Short/Medium/Long term)
Work with ZEVI to raise awareness of the Destination Charging Scheme among relevant businesses and organisations in Maynooth when it is launched.	Short term
Engage with ZEVI and local stakeholders to plan and design an EV charging network and implementation plan, with a particular focus on provision of residential area charging networks for residents without access to home/apartment charging solutions (note that a new suite of co-funding supports for local authorities will be available to support this work).	Short term
Work with ZEVI to raise awareness of the Apartment Charging Grant among relevant stakeholders in Maynooth and encourage and support eligible management companies to access the grant and install charging infrastructure.	Short term
Work with Irish Rail and NTA to significantly enhance cycle parking options at Maynooth Train Station and provide a higher security option, in addition to sheltered standard cycle parking.	Short term
Upgrade Main Street cycle parking as part of future redesign of the street and consider potential to provide a small secure hub at a nearby off-street location to improve the cycle parking options available for people working in the Main Street area.	Medium term
Work with landowners to seek provision of a secure cycle parking option within Carton Retail Park lands which could be used by people accessing bus services on Dublin Road.	Short-medium term
Work with businesses, sports clubs, schools and other relevant destinations to secure delivery of high-quality cycle parking facilities and ensure cycle parking is prominent and visible. Consider part funding new infrastructure to incentivise private sector stakeholders to invest in upgrades in a timely manner.	Short term
Assess interest in the Bike Bunker concept among residents of areas where there are clusters of dwellings without access to suitable cycle storage solutions and seek to provide the facility where interest exists.	Short term
Support residents to install secure front garden cycle storage solutions in suitable areas.	Short term
Following legalisation of e-scooters, seek to provide dedicated e-scooter parking solutions on Main Street and work with stakeholders to encourage provision of suitable facilities at other destinations, particularly the train station and Maynooth University.	Short term

Proposed Measure / Recommendation	Suggested Timescale for commencement (Short/Medium/Long term)
Work with Irish Rail and NTA, Maynooth University and businesses to secure delivery of bike repair and/or cleaning facilities in prominent locations throughout Maynooth.	Short term
Work with Government and local stakeholders to support future Climate Action and Sustainable Mobility Communications Strategy.	Short term
Seek to appoint or dedicate staff with specialised skills to focus on delivery of behaviour change and communication initiatives and resource implementation of suitable initiatives.	Short term
Ensure that improvements for sustainable modes of travel are communicated and celebrated in an attractive and inclusive way.	Short term
Implement measures to improve legibility of active travel routes and public transport options.	Medium term
Organise fun events, gamification initiatives and free or subsidised training opportunities to promote the use of sustainable travel modes.	Short term
Incentivise and monitor the use of sustainable travel modes among KCC staff for commuting and business purposes (leading by example).	Short term
Organise ‘come and try it’ opportunities and loan schemes for different types of micro mobility vehicles.	Short term
Continue to require preparation of MMPs for new developments and seek to enhance monitoring of MMP implementation at existing and new developments and to increase support for implementation of initiatives and delivery of ‘trip-end’ facilities at workplaces, schools and Maynooth University.	Short term

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Appendix F: A3 Versions of MEABTA Maps

Appendix F : A3 Maps

MEABTA Vol. 2

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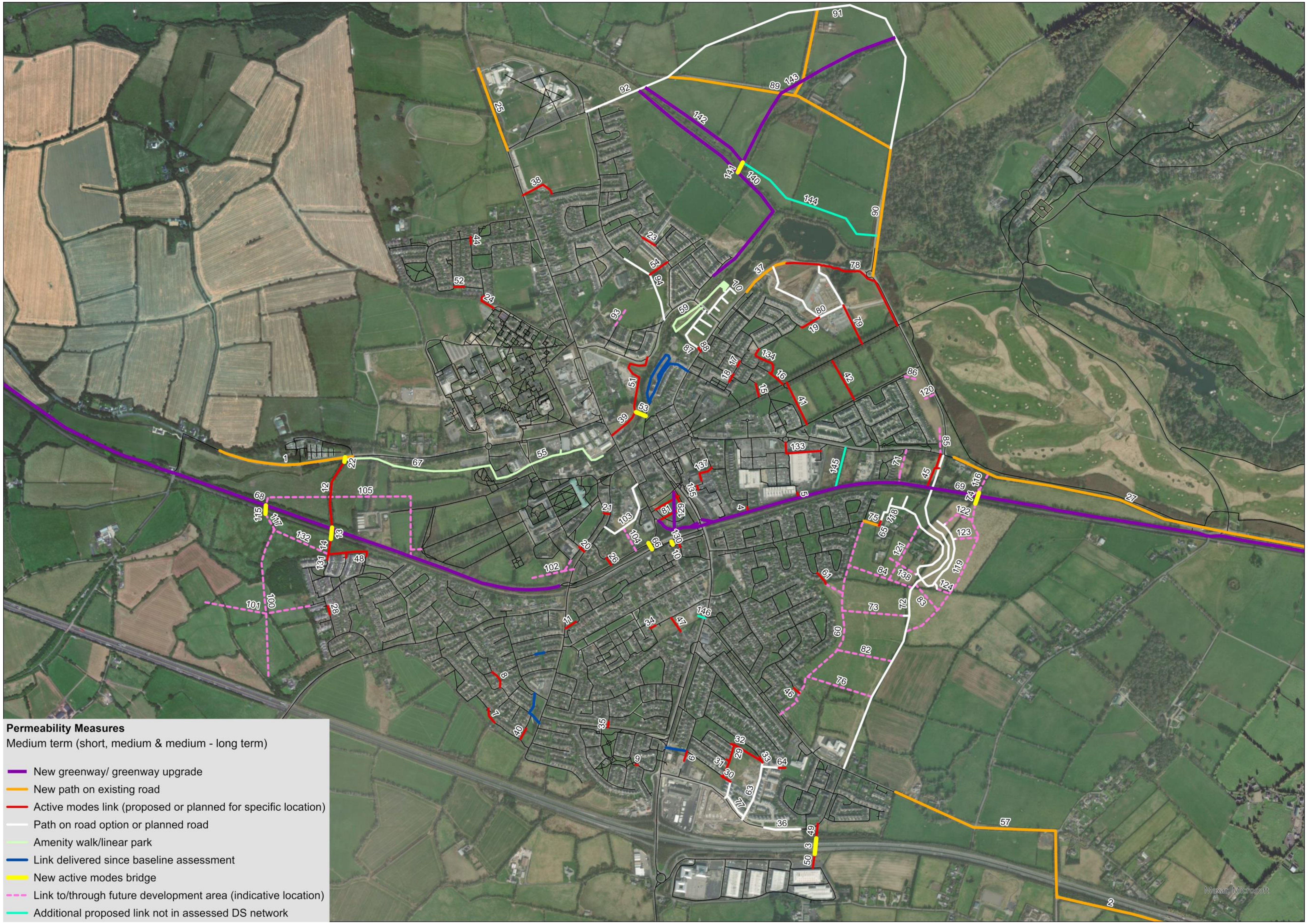
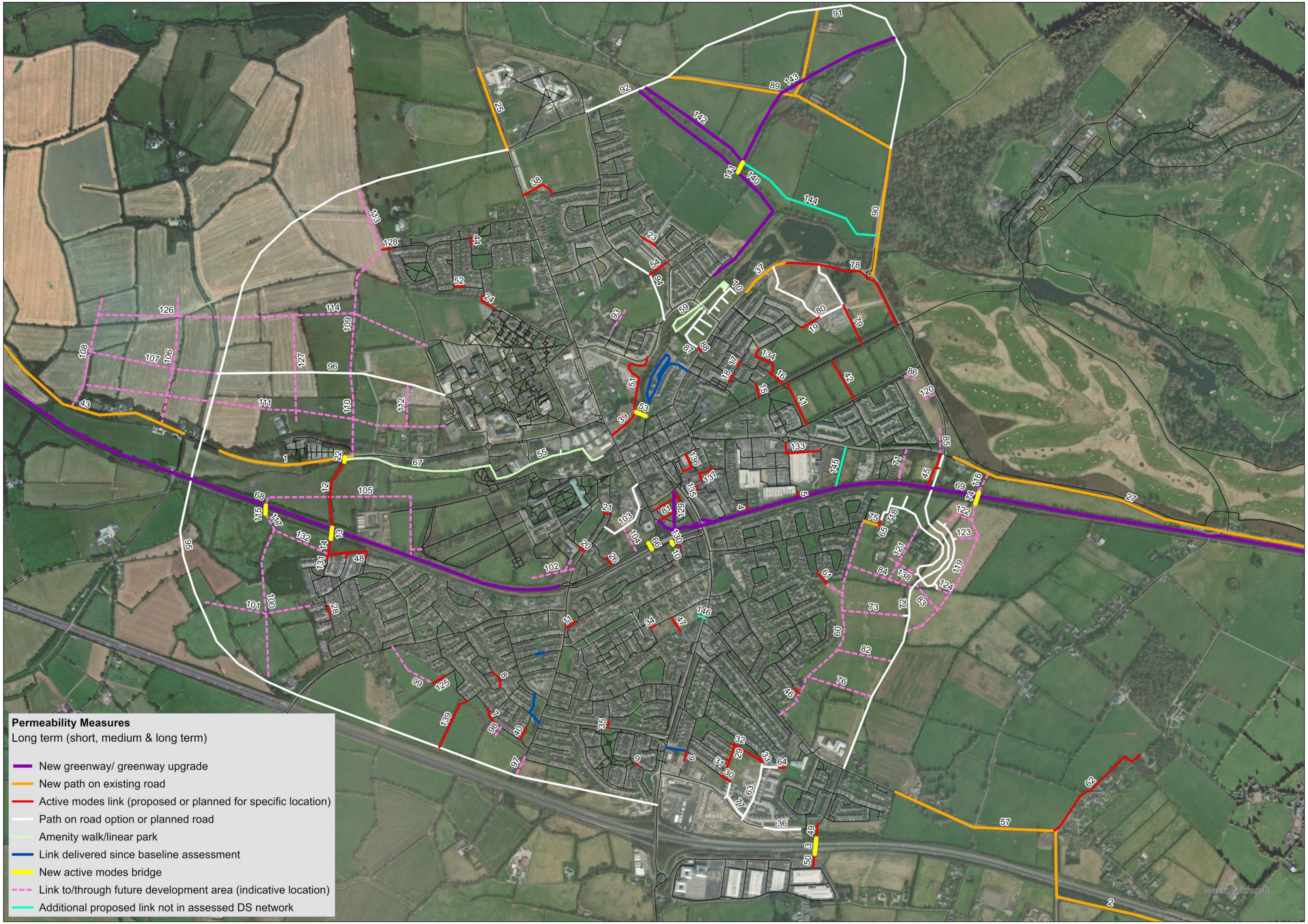
1. Permeability Strategy: Short Term, Medium Term and Long Term

Permeability Measures
Short term (short & short - medium term)
New greenway/ greenway upgrade
New path on existing road
Active modes link (proposed or planned for specific location)
Path on road option or planned road
Amenity walk/linear park
Link delivered since baseline assessment
New active modes bridge
Link to/through future development area (indicative location)

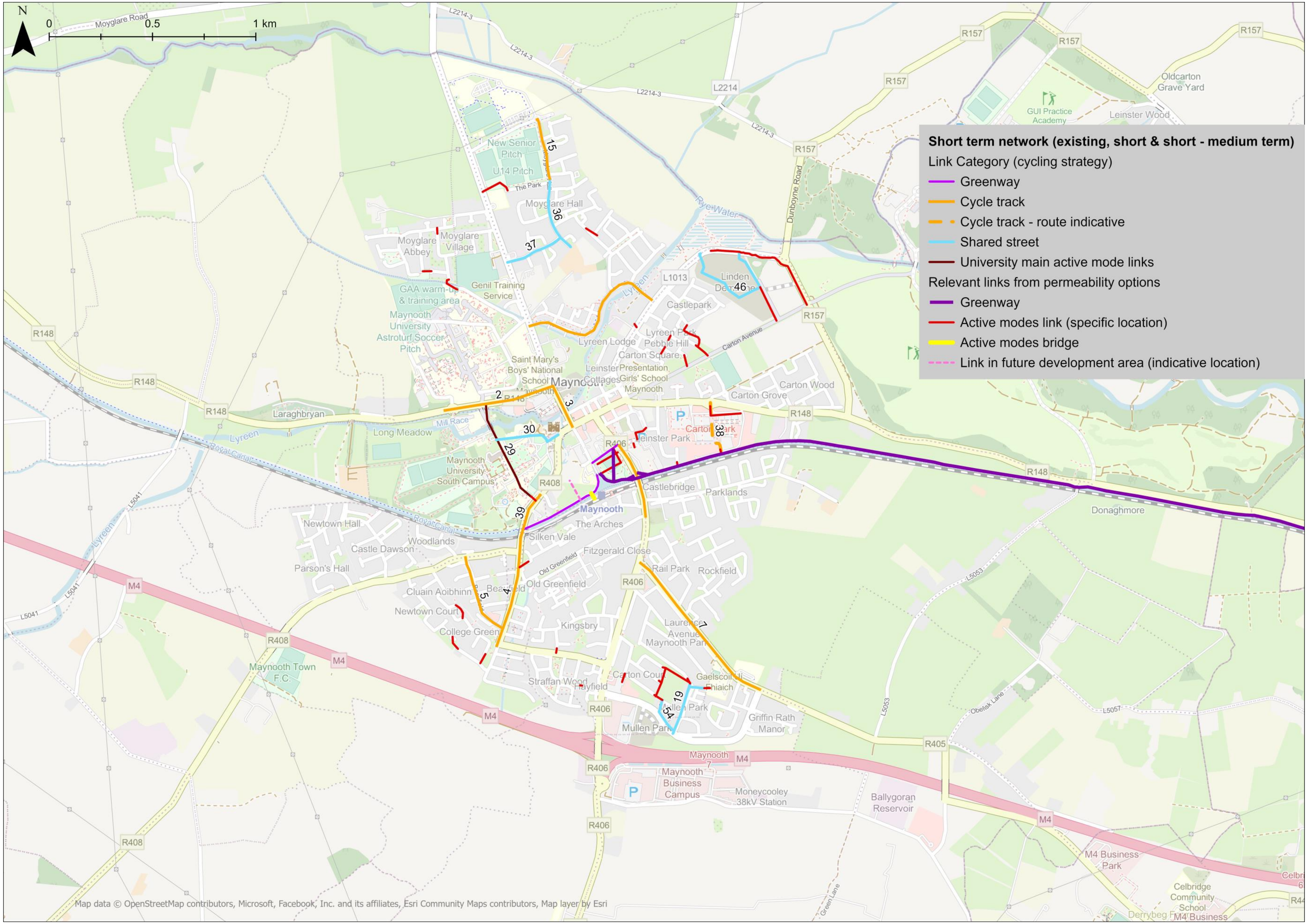

Permeability Measures
Medium term (short, medium & medium - long term)
New greenway/ greenway upgrade
New path on existing road
Active modes link (proposed or planned for specific location)
Path on road option or planned road
Amenity walk/linear park
Link delivered since baseline assessment
New active modes bridge
Link to/through future development area (indicative location)
Additional proposed link not in assessed DS network

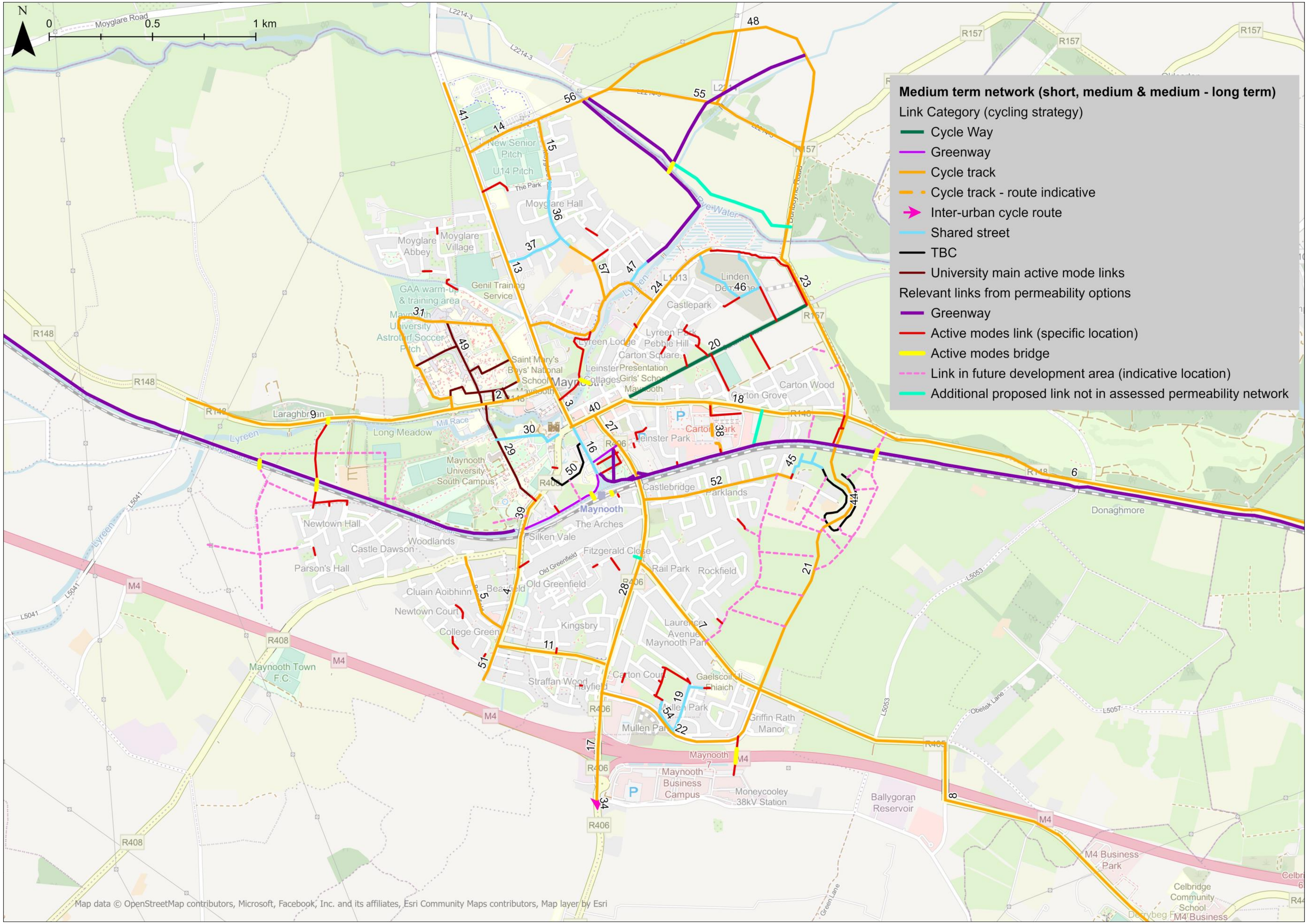

Permeability Measures
Long term (short, medium & long term)
New greenway/ greenway upgrade
New path on existing road
Active modes link (proposed or planned for specific location)
Path on road option or planned road
Amenity walk/linear park
Link delivered since baseline assessment
New active modes bridge
Link to/through future development area (indicative location)
Additional proposed link not in assessed DS network

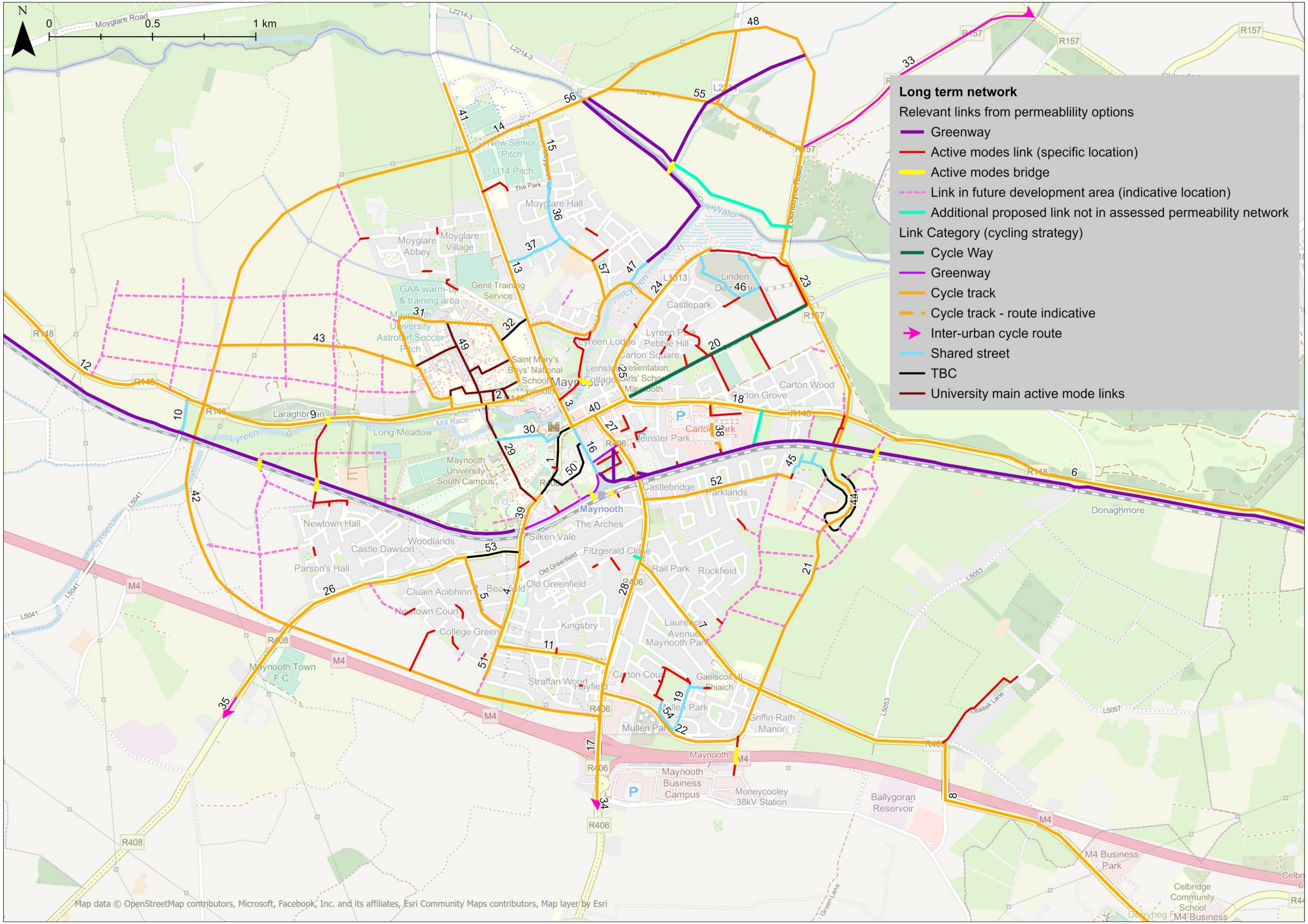
2. Permeability Strategy Map – Detailed Version


Permeability Measures
Long term (short, medium & long term)
New greenway/ greenway upgrade
New path on existing road
Active modes link (proposed or planned for specific location)
Path on road option or planned road
Amenity walk/linear park
Link delivered since baseline assessment
New active modes bridge
Link to/through future development area (indicative location)
Additional proposed link not in assessed DS network

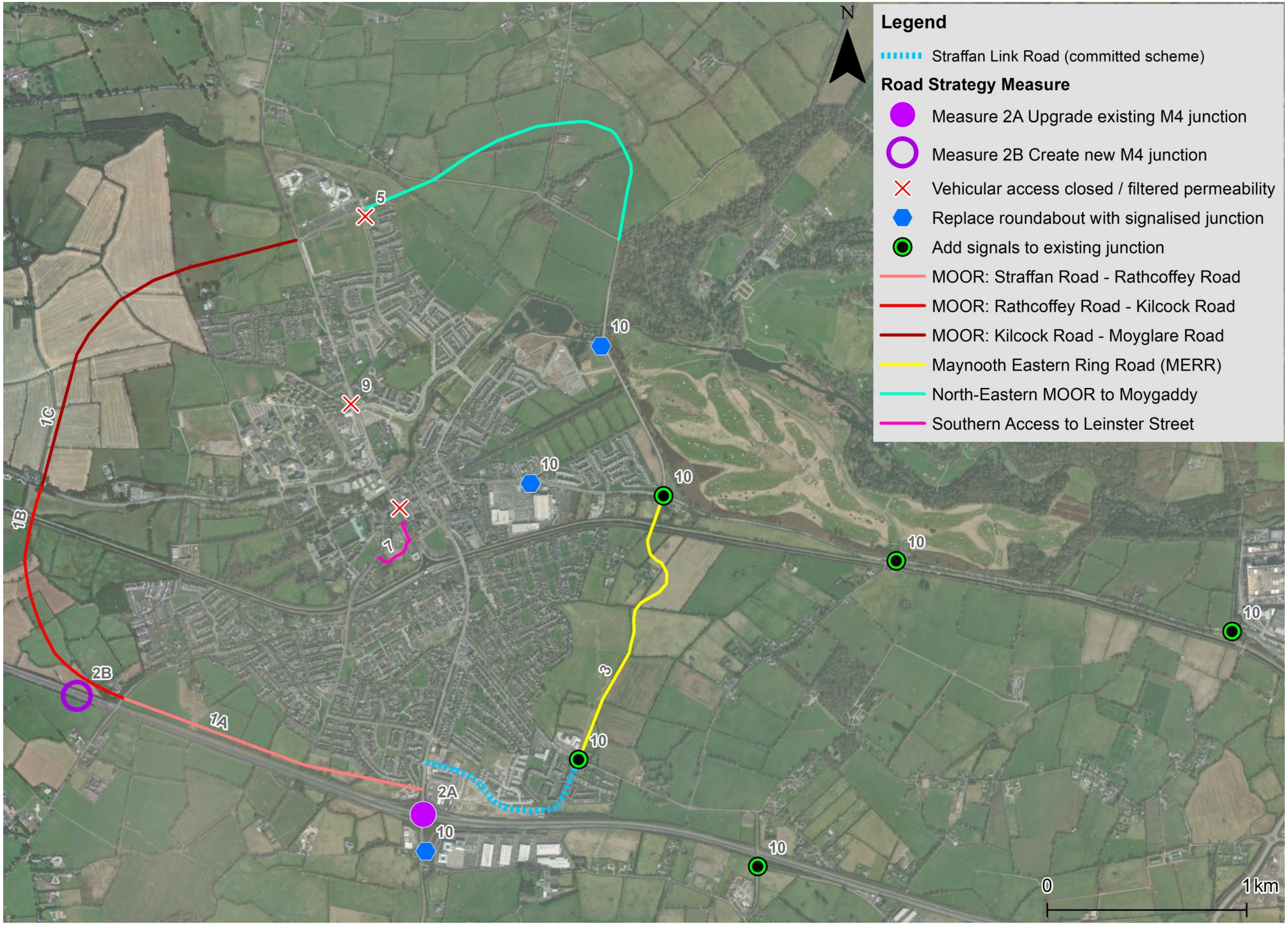
3. Cycling Strategy: Short Term, Medium Term, Long Term


N
0
0.5
1 km
Short term network (existing, short & short - medium term)
Link Category (cycling strategy)
Greenway
Cycle track
Cycle track - route indicative
Shared street
University main active mode links
Relevant links from permeability options
Greenway
Active modes link (specific location)
Active modes bridge
Link in future development area (indicative location)
Map data © OpenStreetMap contributors, Microsoft, Facebook, Inc. and its affiliates, Esri Community Maps contributors, Map layer by Esri


Medium term network (short, medium & medium - long term)
Link Category (cycling strategy)
Cycle Way
Greenway
Cycle track
Cycle track - route indicative
Inter-urban cycle route
Shared street
TBC
University main active mode links
Relevant links from permeability options
Greenway
Active modes link (specific location)
Active modes bridge
Link in future development area (indicative location)
Additional proposed link not in assessed permeability network
N
0
0.5
1 km
Maynooth
Map data © OpenStreetMap contributors, Microsoft, Facebook, Inc. and its affiliates, Esri Community Maps contributors, Map layer by Esri


Long term network
Relevant links from permeablility options
Greenway
Active modes link (specific location)
Active modes bridge
Link in future development area (indicative location)
Additional proposed link not in assessed permeability network
Link Category (cycling strategy)
Cycle Way
Greenway
Cycle track
Cycle track - route indicative
Inter-urban cycle route
Shared street
TBC
University main active mode links
N
0
0.5
1 km
Maynooth
Maynooth University South Campus
Map data © OpenStreetMap contributors, Microsoft, Facebook, Inc. and its affiliates, Esri Community Maps contributors, Map layer by Esri

4. Road Strategy

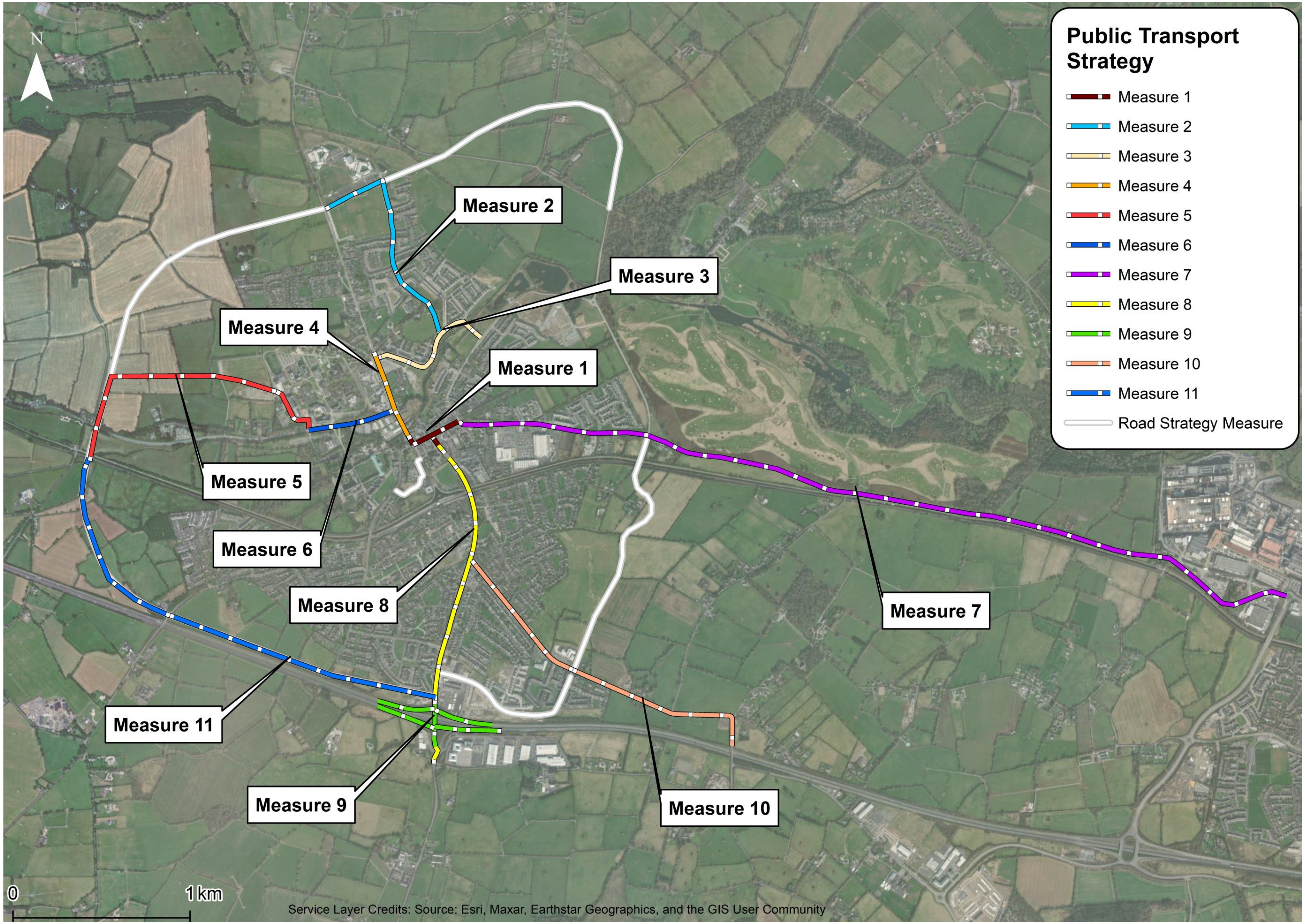


N
Legend
Straffan Link Road (committed scheme)
Road Strategy Measure
Measure 2A Upgrade existing M4 junction
Measure 2B Create new M4 junction
Vehicular access closed / filtered permeability
Replace roundabout with signalised junction
Add signals to existing junction
MOOR: Straffan Road - Rathcoffey Road
MOOR: Rathcoffey Road - Kilcock Road
MOOR: Kilcock Road - Moyglare Road
Maynooth Eastern Ring Road (MERR)
North-Eastern MOOR to Moygaddy
Southern Access to Leinster Street
5
9
10
1C
1B
1A
2A
2B
7
3
0
1 km

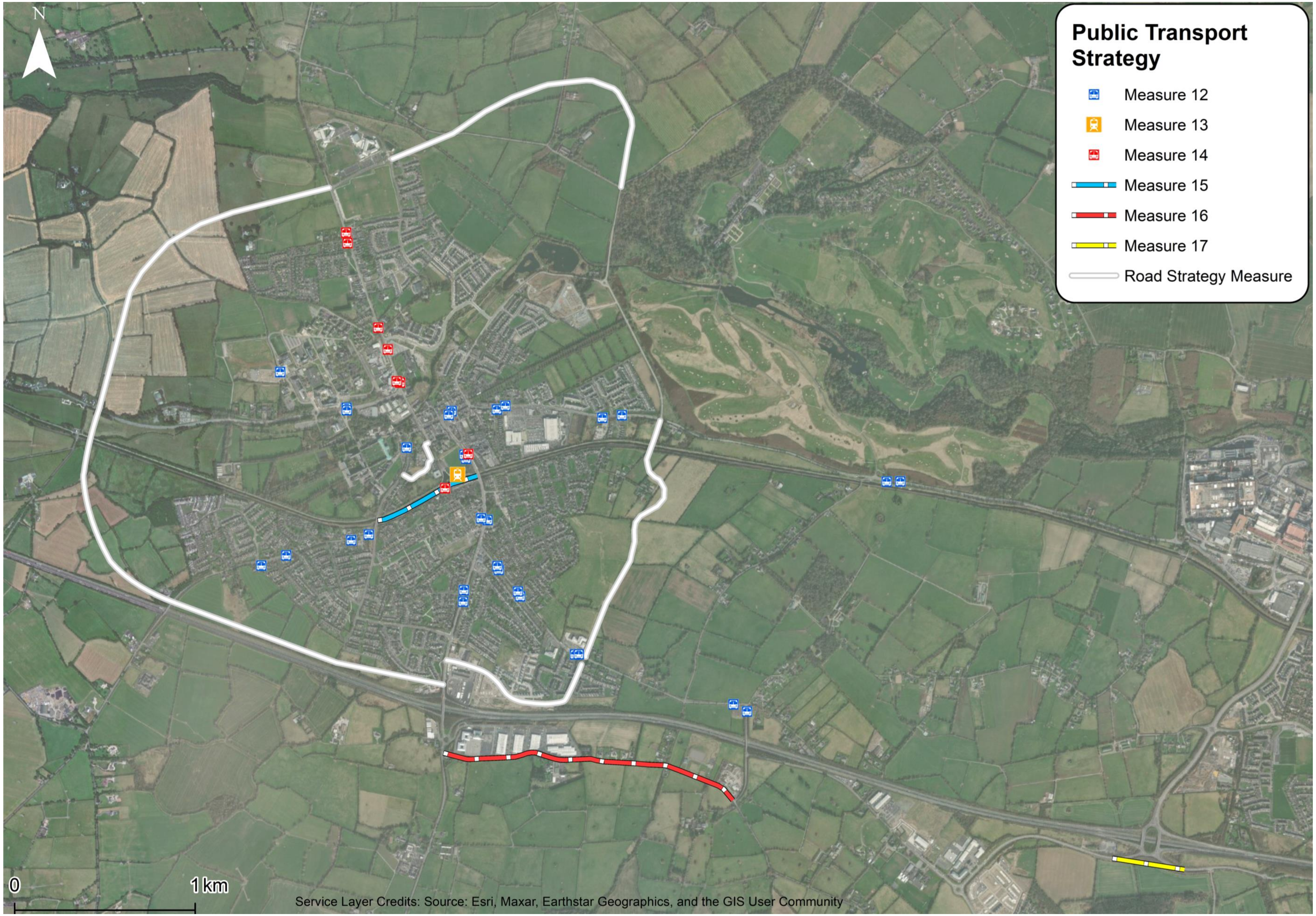
5. Parking Strategy


Legend
Parking Measures
Reduced car parking, increased parking charges & mobility hub at existing station
New park & ride facility & mobility hub at Maynooth West station
VMS parking sign
Relocate parking from Main Street
Parking measures at Maynooth University
Upgrade Leinster Street car park & new access
Improve & reorganise drop off facilities at MEC
Provide park & stride facility & public parking
12
8
4 & 5
1
9 & 10
14
6
7, 15
N
0
1 km

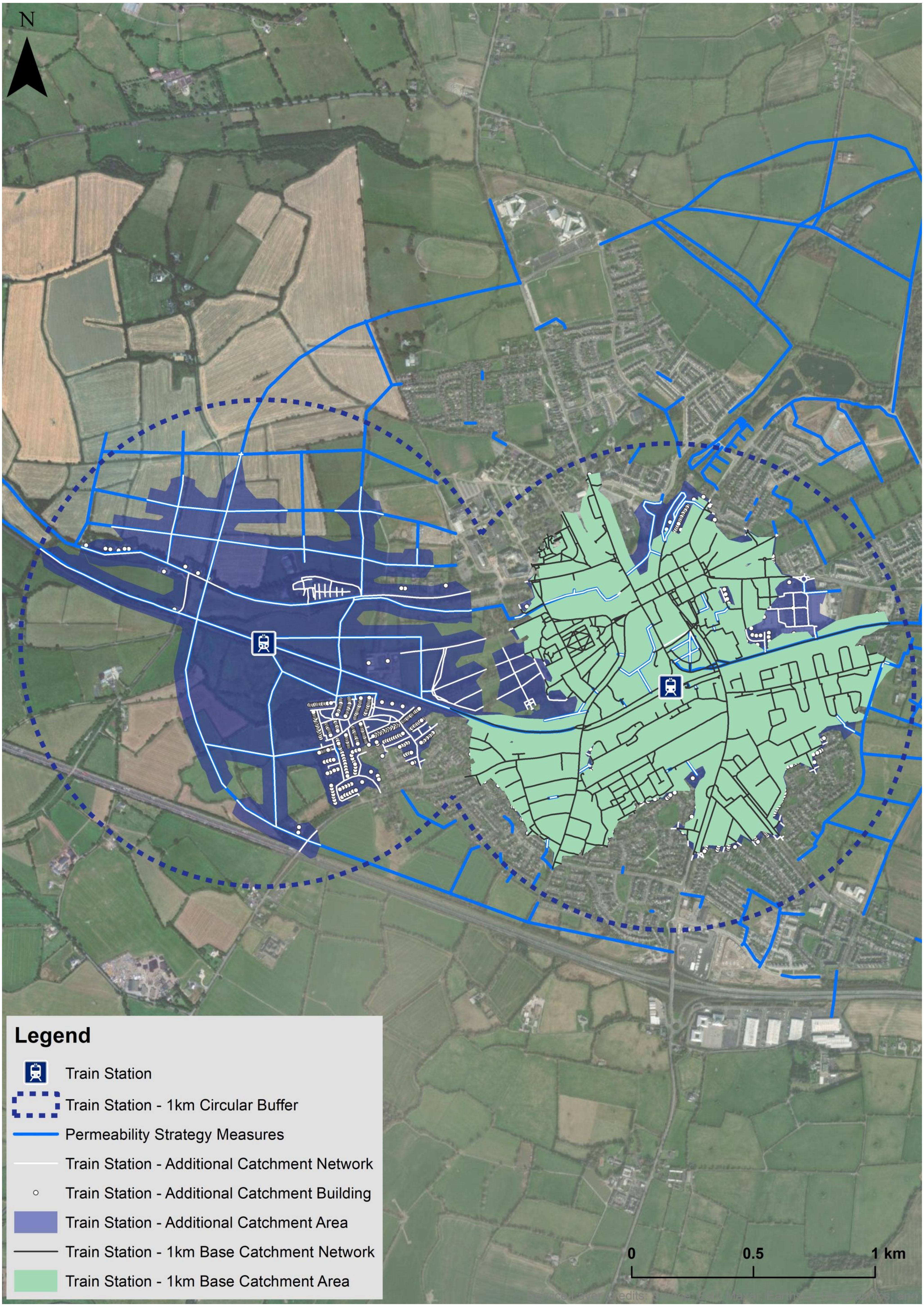
6. Public Transport Strategy

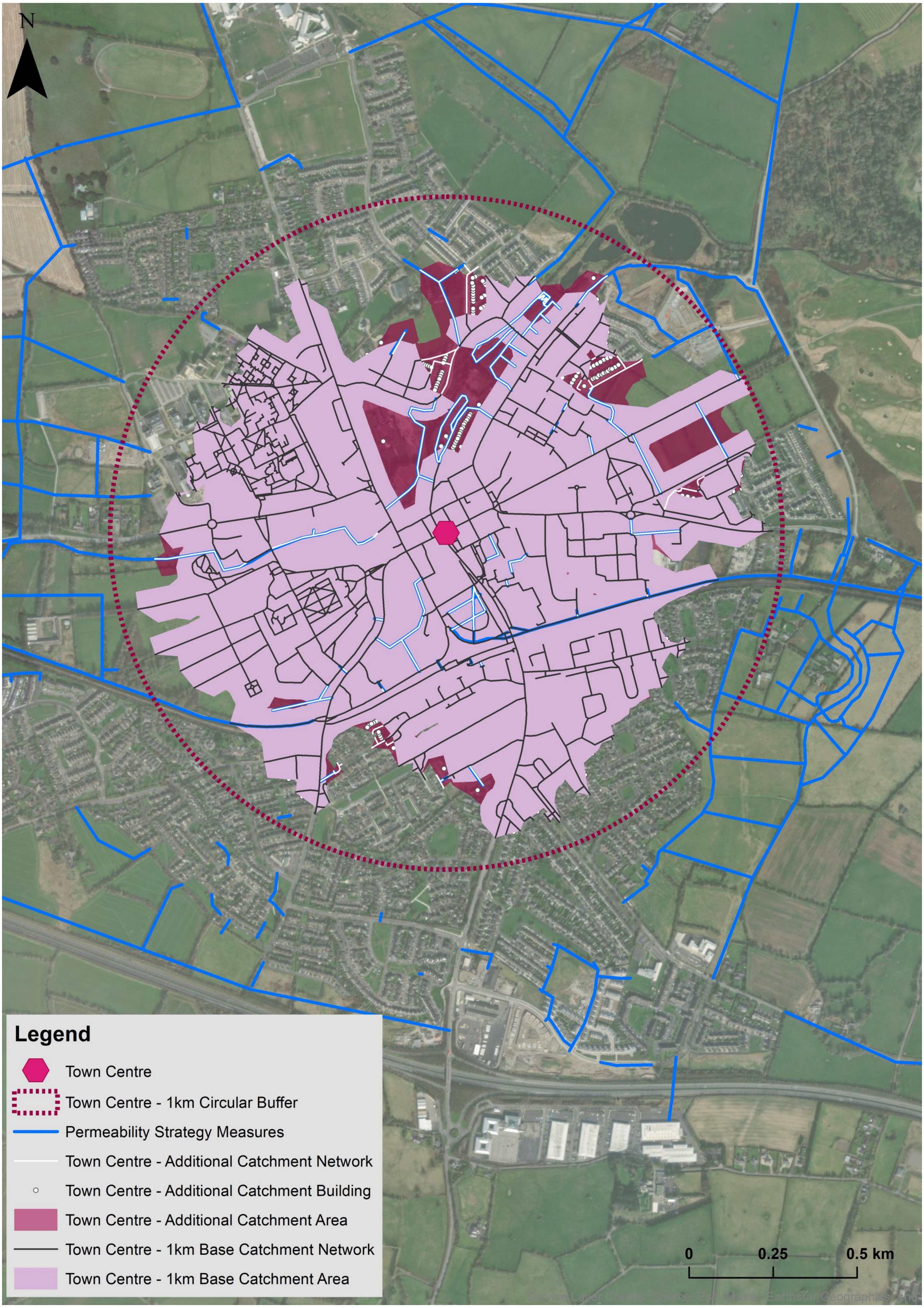


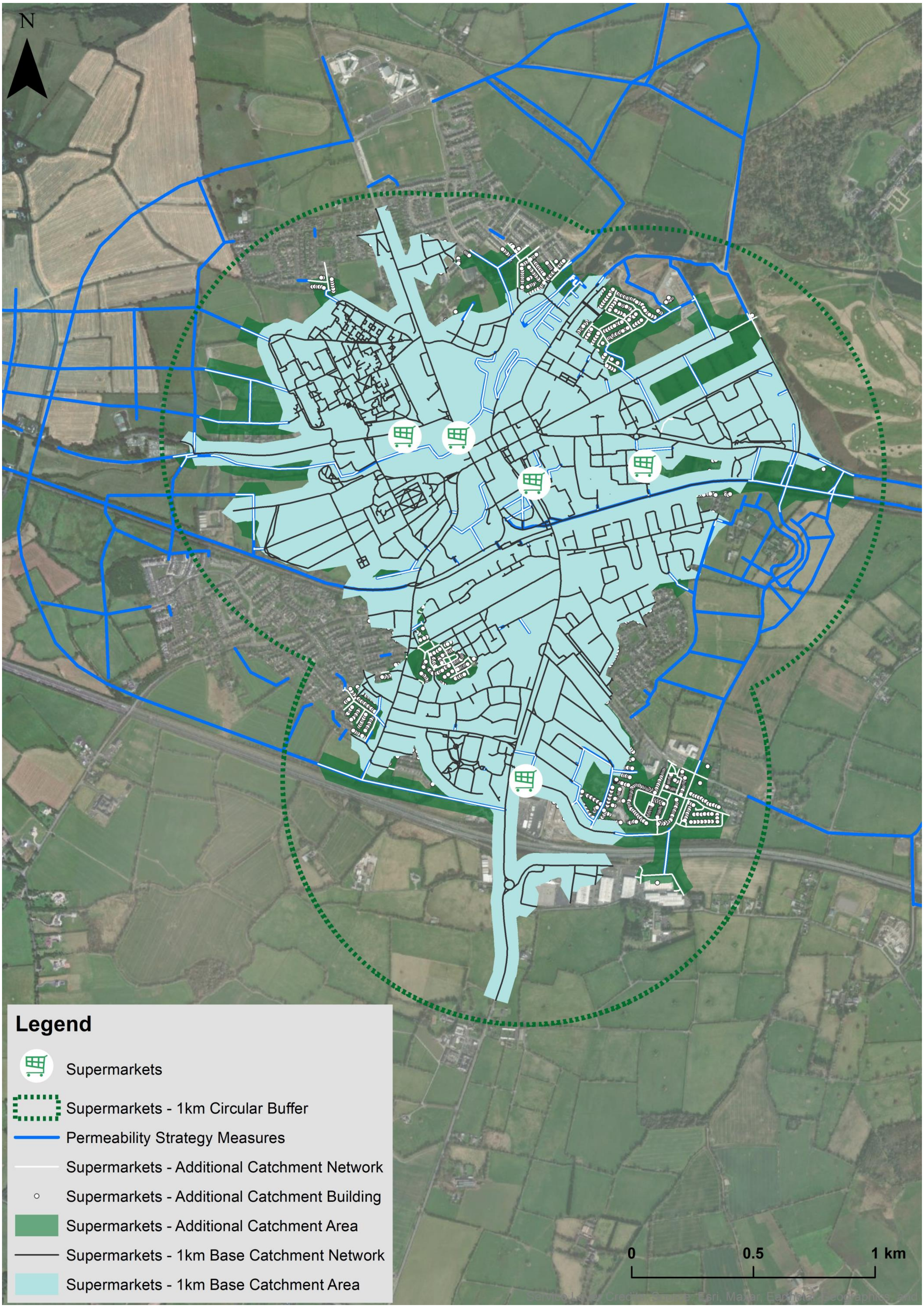
N
Public Transport Strategy
Measure 1
Measure 2
Measure 3
Measure 4
Measure 5
Measure 6
Measure 7
Measure 8
Measure 9
Measure 10
Measure 11
Road Strategy Measure
Measure 2
Measure 3
Measure 4
Measure 1
Measure 5
Measure 6
Measure 8
Measure 7
Measure 11
Measure 9
Measure 10
0
1 km
Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

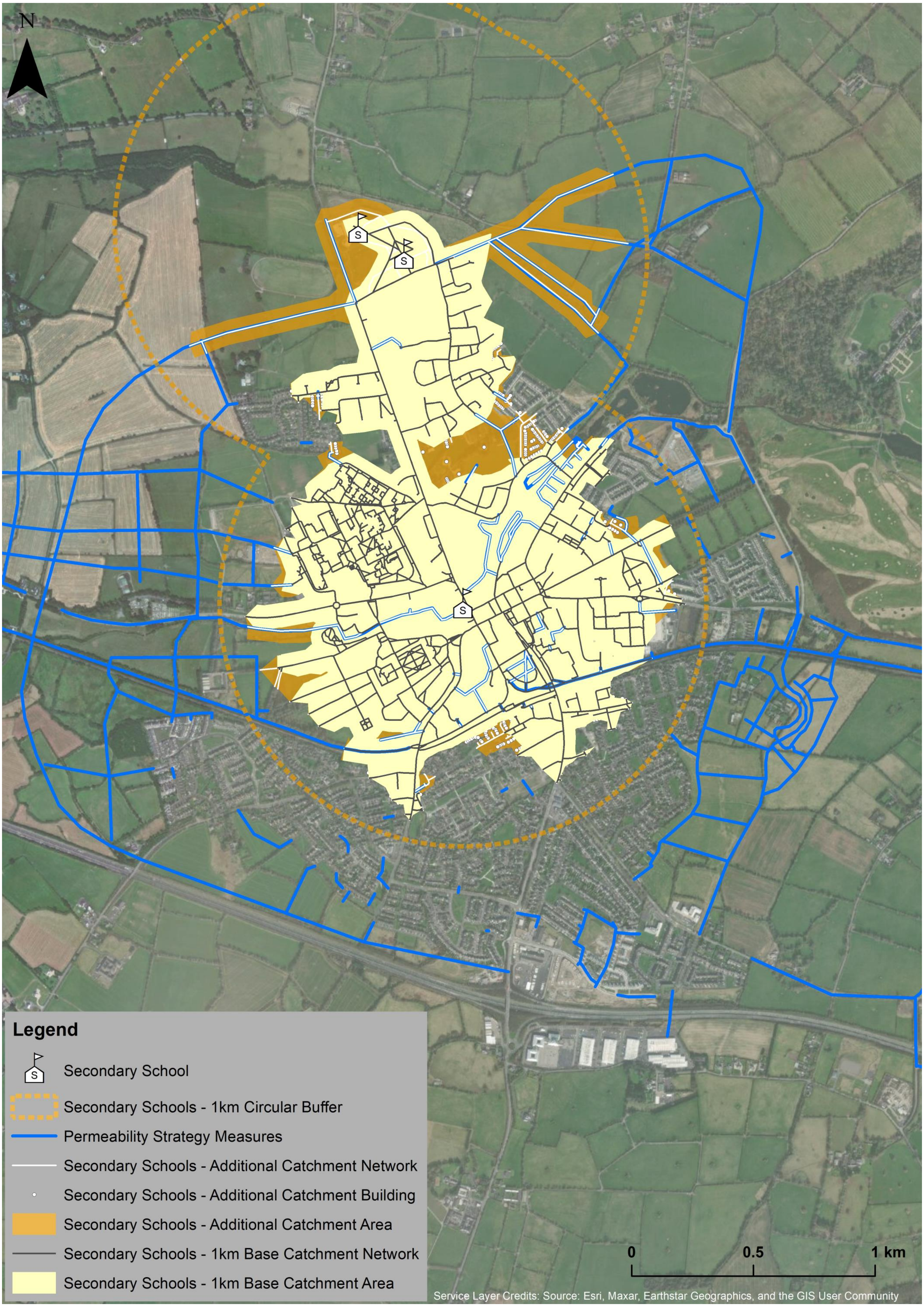

N
Public Transport Strategy
Measure 12
Measure 13
Measure 14
Measure 15
Measure 16
Measure 17
Road Strategy Measure
0
1 km
Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

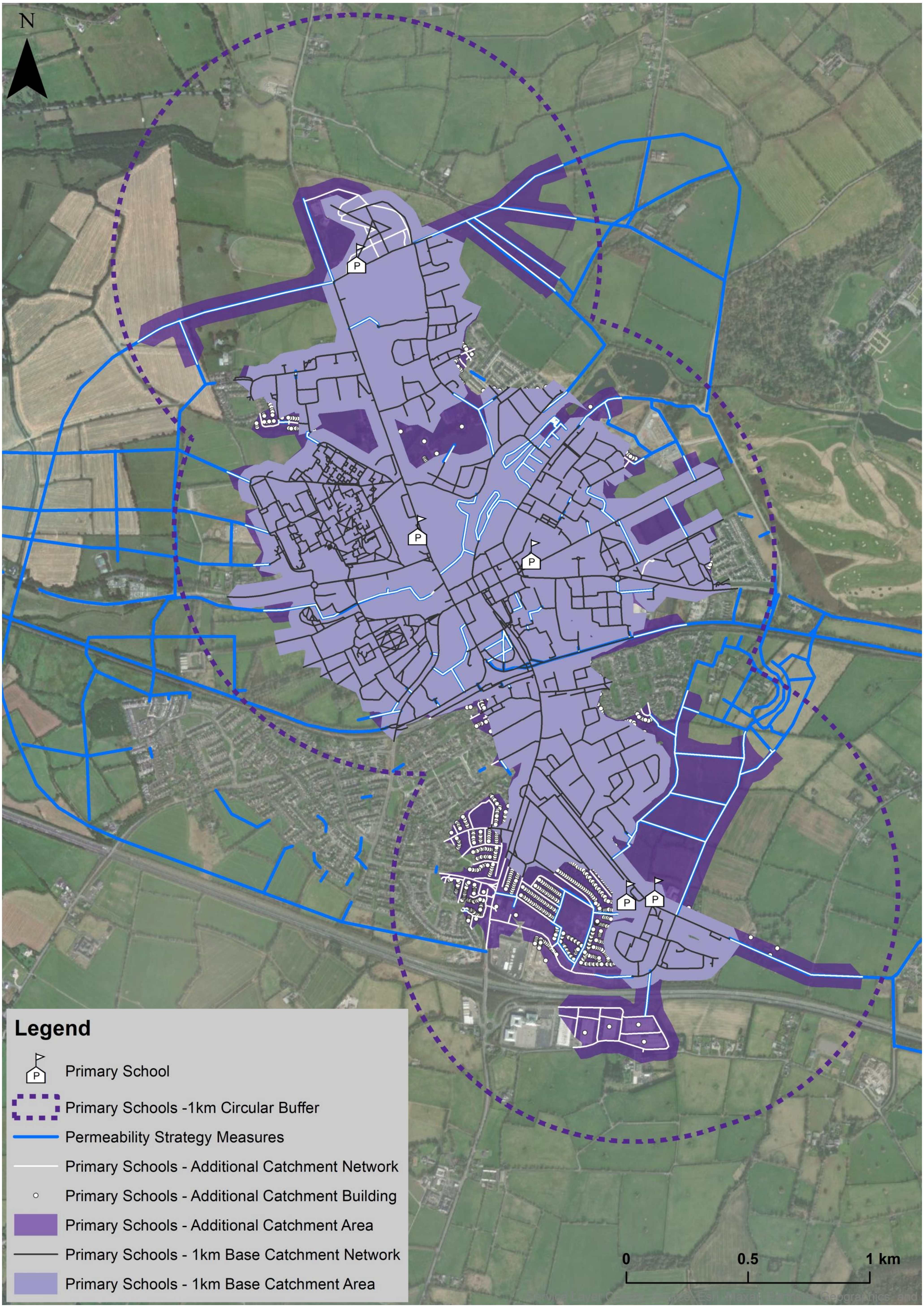
7. Permeability Strategy - Catchment Expansion Maps

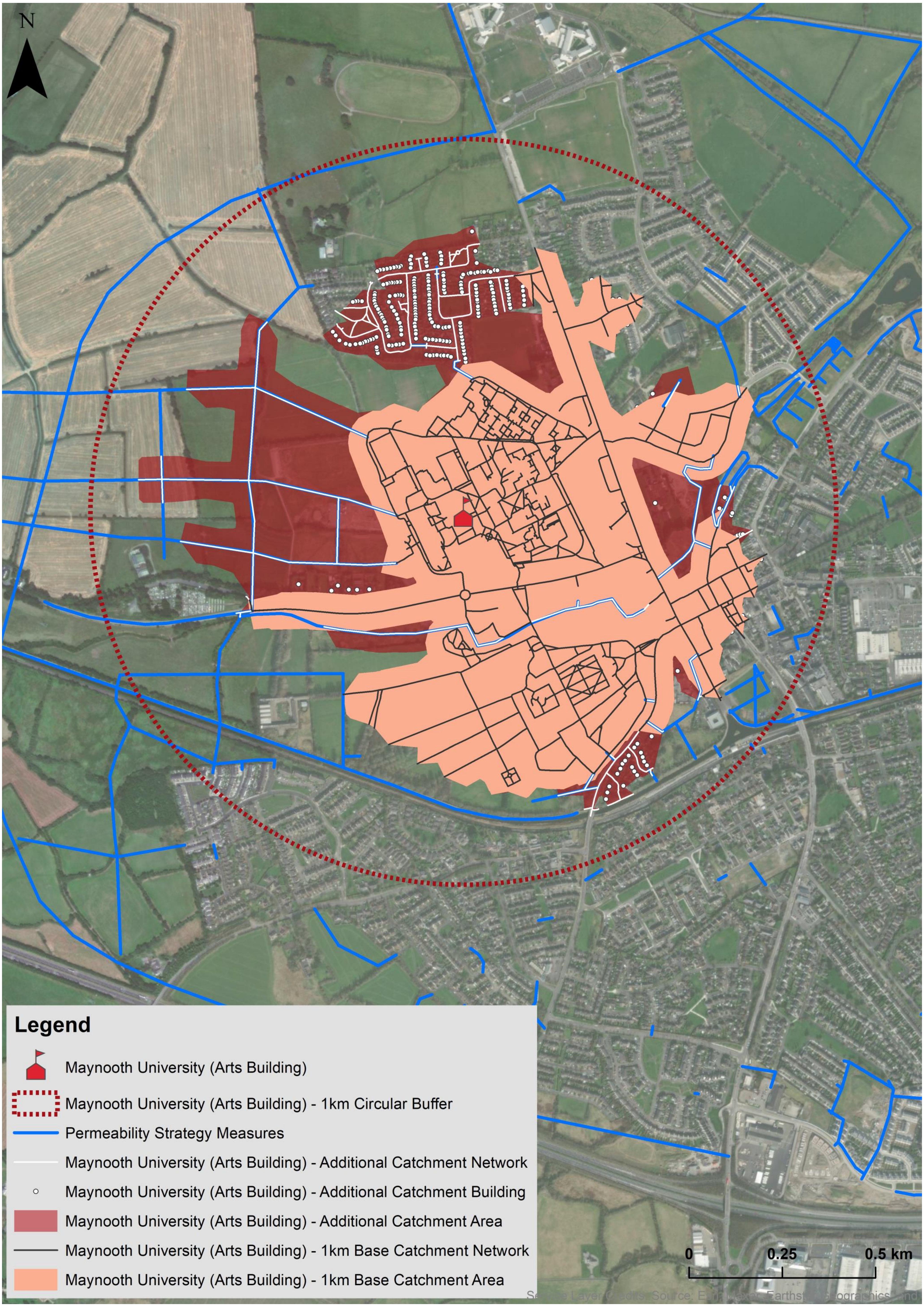

N
Legend
Train Station
Train Station - 1km Circular Buffer
Permeability Strategy Measures
Train Station - Additional Catchment Network
Train Station - Additional Catchment Building
Train Station - Additional Catchment Area
Train Station - 1km Base Catchment Network
Train Station - 1km Base Catchment Area
0
0.5
1 km

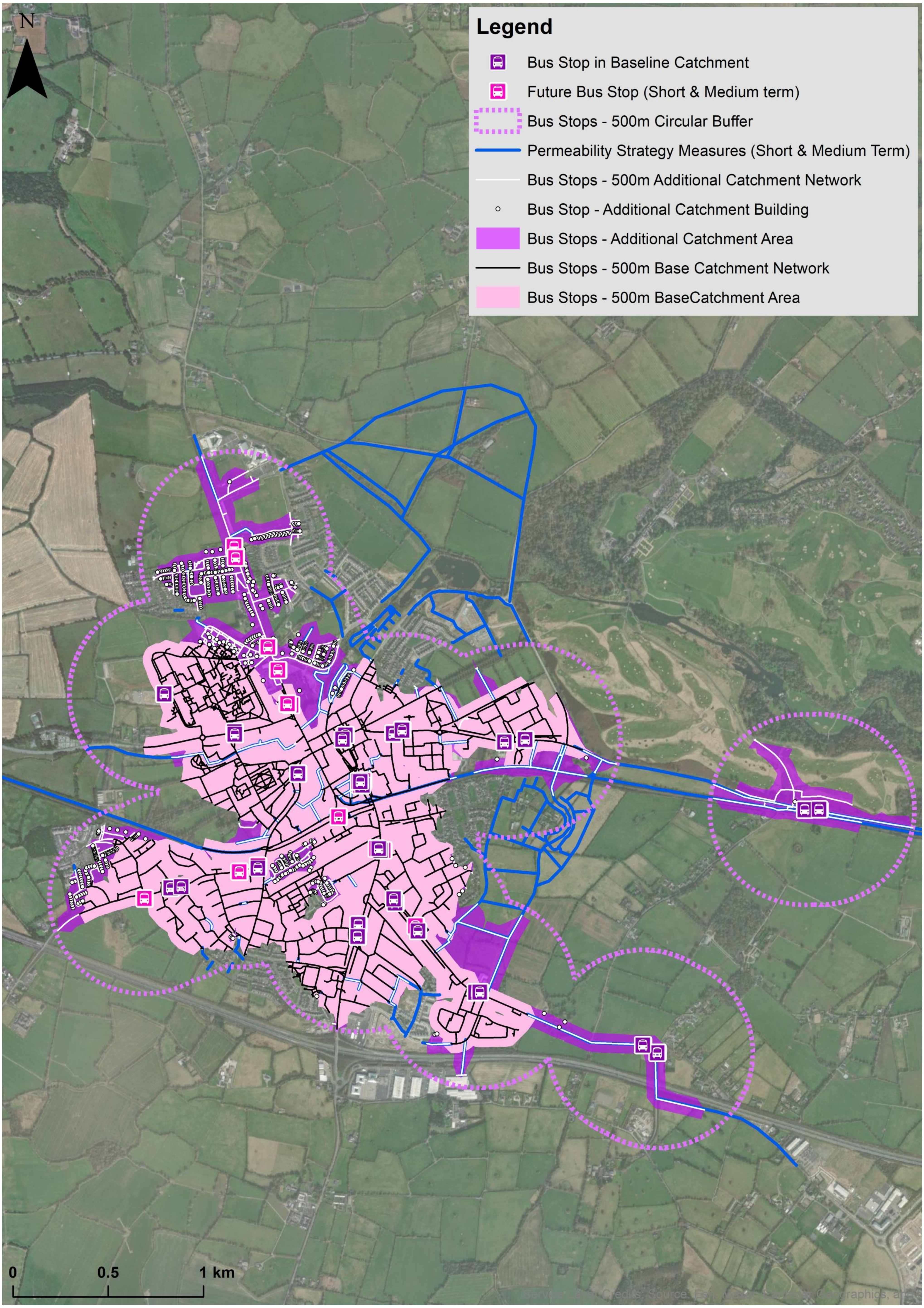

N
Legend
Town Centre
Town Centre - 1km Circular Buffer
Permeability Strategy Measures
Town Centre - Additional Catchment Network
Town Centre - Additional Catchment Building
Town Centre - Additional Catchment Area
Town Centre - 1km Base Catchment Network
Town Centre - 1km Base Catchment Area
0
0.25
0.5 km


N
Legend
Supermarkets
Supermarkets - 1km Circular Buffer
Permeability Strategy Measures
Supermarkets - Additional Catchment Network
Supermarkets - Additional Catchment Building
Supermarkets - Additional Catchment Area
Supermarkets - 1km Base Catchment Network
Supermarkets - 1km Base Catchment Area
0
0.5
1 km


N
Legend
Secondary School
Secondary Schools - 1km Circular Buffer
Permeability Strategy Measures
Secondary Schools - Additional Catchment Network
Secondary Schools - Additional Catchment Building
Secondary Schools - Additional Catchment Area
Secondary Schools - 1km Base Catchment Network
Secondary Schools - 1km Base Catchment Area
0
0.5
1 km
Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community


N
Legend
Primary School
Primary Schools -1km Circular Buffer
Permeability Strategy Measures
Primary Schools - Additional Catchment Network
Primary Schools - Additional Catchment Building
Primary Schools - Additional Catchment Area
Primary Schools - 1km Base Catchment Network
Primary Schools - 1km Base Catchment Area
0
0.5
1 km


N
Legend
Maynooth University (Arts Building)
Maynooth University (Arts Building) - 1km Circular Buffer
Permeability Strategy Measures
Maynooth University (Arts Building) - Additional Catchment Network
Maynooth University (Arts Building) - Additional Catchment Building
Maynooth University (Arts Building) - Additional Catchment Area
Maynooth University (Arts Building) - 1km Base Catchment Network
Maynooth University (Arts Building) - 1km Base Catchment Area
0
0.25
0.5 km


N
Legend
Bus Stop in Baseline Catchment
Future Bus Stop (Short & Medium term)
Bus Stops - 500m Circular Buffer
Permeability Strategy Measures (Short & Medium Term)
Bus Stops - 500m Additional Catchment Network
Bus Stop - Additional Catchment Building
Bus Stops - Additional Catchment Area
Bus Stops - 500m Base Catchment Network
Bus Stops - 500m BaseCatchment Area
0
0.5
1 km