FOR INFORMATION

Legend

- Study Area
- County Boundary
- Roads
- Railway
- Bus Eireann Routes

Notes

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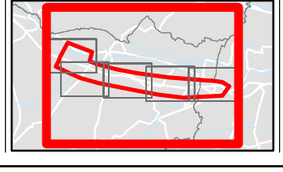

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MAYNOOTH TO LEIXLIP PROJECT

Scale	1:40,000 @A3
Role	Engineering
Date	29/01/2021

Issue	Date	By	Chkd	Appd
P01		AOR	SB	ZL

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Sheet 1 of 6

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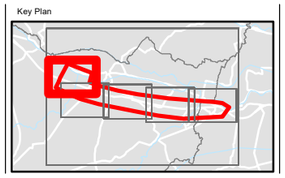

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P01		AOR	SB	ZL

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Sheet 2 of 6

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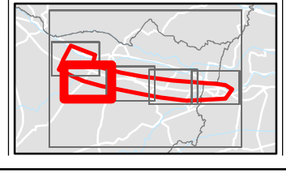

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Sheet 3 of 6

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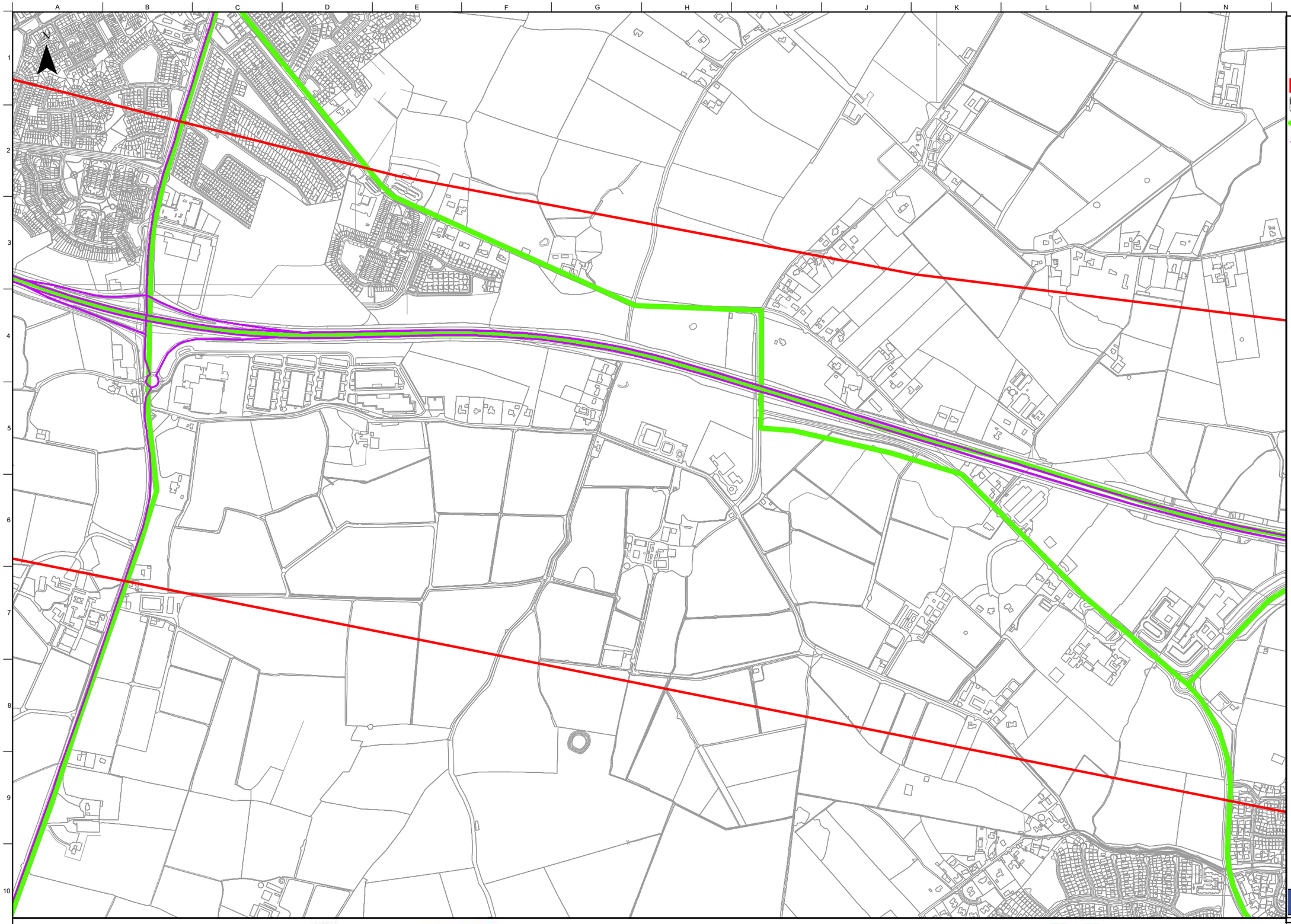

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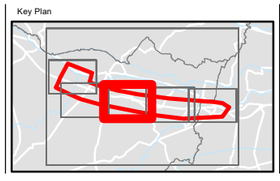

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Sheet 4 of 6

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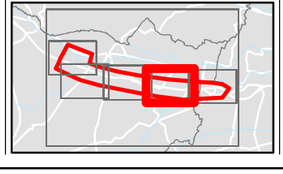

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Sheet 5 of 6

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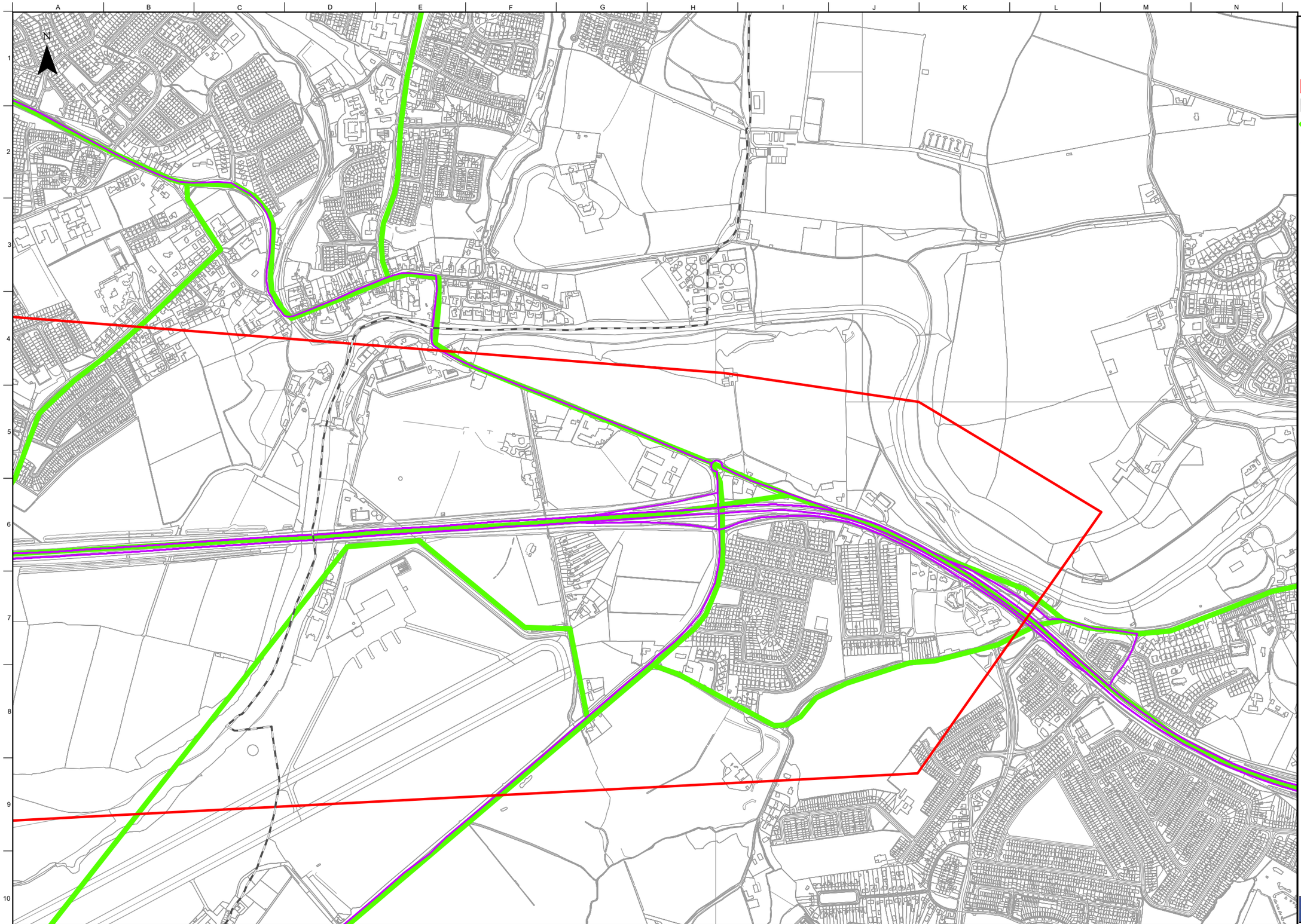

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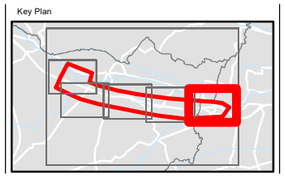

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Sheet 6 of 6

Suitability
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MAYNOOTH TO LEIXLIP PROJECT

Appendix 2.2

Phase 1 Feasibility Report

Kildare County Council

Maynooth to Leixlip Project

Feasibility Report

272691-ARUP-01-CF-RP-ZM-000004

Phase 1 | 21 December 2020

Job number 272691
PRS Reference: KE-18-16505

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1 Introduction

1.1 Overview

Arup has been appointed by Kildare County Council to provide multi-disciplinary technical consultancy services for the delivery of Phase 1 to 4 of the TII Project Management Guidelines for the Maynooth to Leixlip Project, on behalf of Kildare County Council and South Dublin County Council. This appointment includes concept and feasibility studies, options appraisal and selection, design and environmental evaluation and submission of a planning application.

1.2 Purpose of this Report

This Feasibility Report has been produced as an output of Phase 1 Concept and Feasibility. The purpose of this report is to gain a better understanding of the issues and challenges and to assist in planning the direction of further studies. The report has been prepared in advance of formal commencement of any planning or design. However, potential feasible solutions to meet the project objectives are suggested, with a more rigorous appraisal of the viability of these solutions to be undertaken during Phase 2 Option Selection.

1.3 Project Background

The M4 Maynooth to Leixlip is listed as a section of the transport network to be progressed through pre-appraisal and early planning and prioritised for delivery under the National Development Plan 2018–2027. The network forms part of the Trans-European Transport Network (TEN-T) comprehensive network.

The section of M4/N4 corridor under consideration includes the M4 mainline carriageway from Maynooth to Leixlip and the associated mainline junctions, Maynooth train line, the surrounding road network and any existing and proposed alternative transport modes or routes that provide suitable alternatives in favour of the M4/N4.

This section traverses two Local Authority Boundaries, Kildare County Council and South Dublin County Council. Kildare County Council has been appointed as the lead Local Authority and Sponsoring Agency of the project. Kildare National Roads Office (KNRO) has been appointed by Transport Infrastructure Ireland (TII), acting as the Approving Authority, to project manage the delivery of the project.

The existing M4/N4 corridor is predominantly in Kildare with 1.5km of the approximate 10km length in South Dublin County Council.

The study area is largely greenfield agricultural land punctuated by the urban centres of Maynooth, Celbridge and Leixlip.

The Rye Water Valley/Carton SAC (Special Area of Conservation) runs parallel to the line of the M4/N4 along the Rye River from Leixlip to Maynooth. The R157 and R406 allow for the transfer of strategic traffic from the M4/N4 to the M3 and M7 respectfully.

The study area as shown in Figure 1.1 represents the minimum anticipated study area for which options and alternatives will be developed. The wider transport study area, also shown in Figure 1.1, will be used for assessing transport alternatives. The corridor under consideration is shown in Figure 1.2.

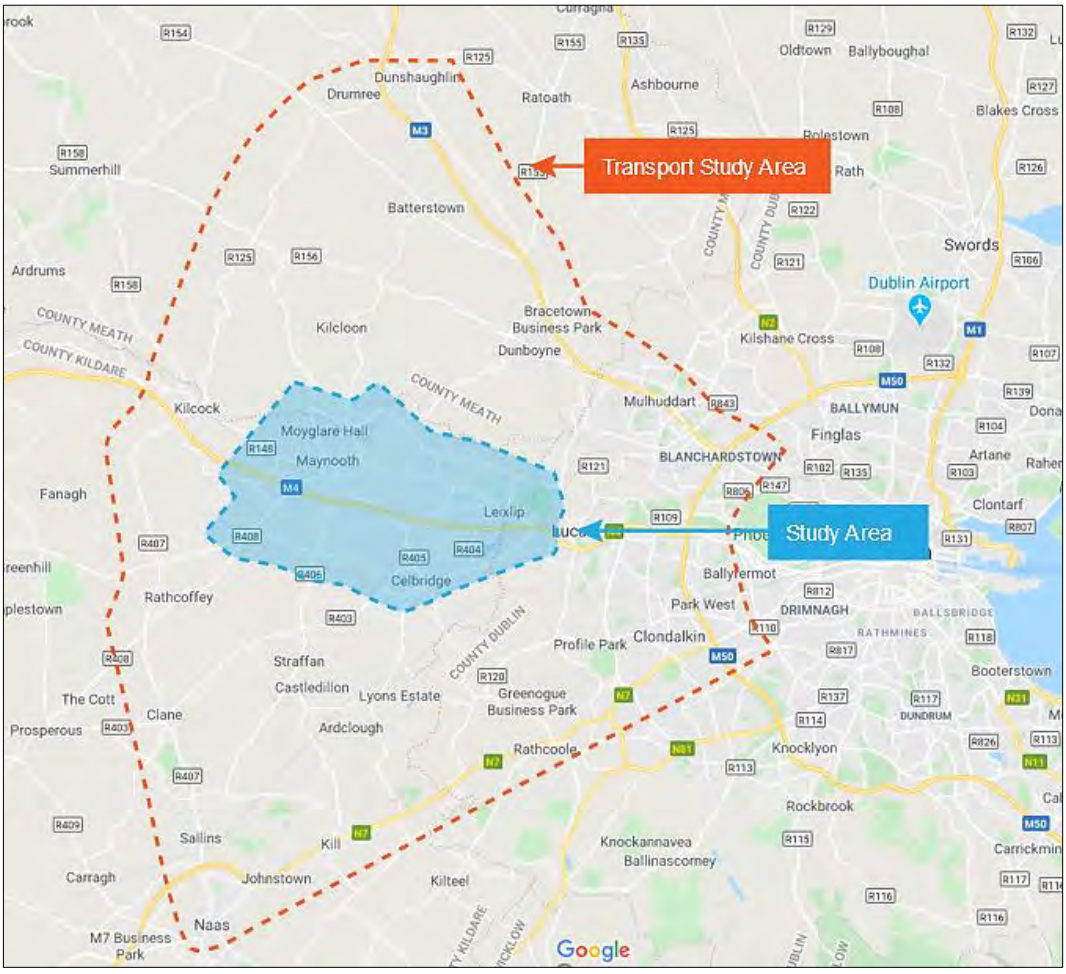


Figure 1.1: Study Area (© Google Map data ©2020 Tele Atlas)

Figure 1.2: Corridor under Consideration (© Google Map data ©2020 Tele Atlas)

1.4 Project Aim

The aim of the project is to assess the needs of the M4/N4 mainline corridor and junctions from Maynooth to Leixlip in terms of catering for future demand from a capacity, safety and operational perspective. Additionally, it aims to assess alternative transport modes or routes within the study area.

2 Policy Context

2.1 European Policy - Trans-European Transport Network (TEN-T)

The TEN-T networks are a set of road, rail, air and water transport networks in Europe. The M4 corridor forms part of the TEN-T comprehensive networks connecting Dublin to the West and Northwest of the country as shown in Figure 2.1.

Figure 2.1: TEN-T network connecting Dublin to the West and Northwest (© Google Map data ©2020 Tele Atlas)

Regulation (EU) Number 1315/2013 sets out the requirements for high quality roads that shall form part of the TEN-T road network, both Core (2030)[1] and Comprehensive (2050)[2], and states under Article 17(3), the following:

"High-quality roads shall be specially designed and built for motor traffic, and shall be motorways, express roads or conventional strategic roads".

[1] *The TEN-T Core network is targeted for completion by 2030*
[2] *The TEN-T Comprehensive network is targeted for completion by 2050*

Article 10 of the EU Directive No. 1315/2013 sets out the general priorities in the development of the comprehensive network and states:

"In the development of the comprehensive network, general priority shall be given to measures that are necessary for:

a) Ensuring optimal integration of the transport modes and interoperability within transport modes;

b) Bridging missing links and removing bottlenecks, particularly in cross-border sections;

c) Promoting the efficient and sustainable use of the infrastructure and, where necessary, increasing capacity"

Improvements to the TEN-T comprehensive network would enhance growth in the Project Ireland 2040 assigned urban growth regions of Galway, Athlone and Sligo thus enhancing the M4 capabilities to provide a reliable strategic route between the east and west of the country.

2.2 National Policy

2.2.1 Project Ireland 2040 (National Planning Framework)

The National Planning Framework (NPF) – Project Ireland 2040 was published by the Government on the 16 February 2018. It sets out a new strategic planning and development context for Ireland and all its regions up to 2040, setting a high-level framework for the co-ordination of a range of national, regional and local authority policies, activities, planning and investment, both public and private. Under Enhanced Regional Accessibility, the NPF states the following national strategic outcomes of the plan:

Inter Urban Roads – *"maintaining the strategic capacity and safety of the national road network including planning for future capacity enhancements" and "improving average journey times targeting an average inter-urban speed of 90kph"*

The National Planning Framework highlights the importance of maintaining and building strategic connections between the five cities and the two Regional Centres of Sligo and Athlone. National Policy Objectives 2b and 7 recognise the key regional roles of Athlone in the Midland and Sligo in the Northwest.

The NPF highlights the importance of maintaining and building strategic connections between the five cities and the two Regional Centres of Sligo and Athlone. National Policy Objectives 2b and 7 recognise the key regional roles of Athlone in the Midland and Sligo in the Northwest.

National Policy Objective 2 states:

"The regional roles of Athlone in the Midlands, Sligo and Letterkenny in the North-West and the Letterkenny-Derry and Drogheda-Dundalk-Newry cross-border networks will be identified and supported in the relevant Regional Spatial and Economic Strategy."

In addition, National Policy Objective 7 includes the following:

"Apply a tailored approach to urban development, that will be linked to the Rural and Urban Regeneration and Development Fund, with a particular focus on:

• Strengthening Ireland's overall urban structure, particularly in the Northern and Western and Midland Regions, to include the regional centres of Sligo and Letterkenny in the North-West, Athlone in the Midlands and cross-border networks focused on the Letterkenny-Derry North-West Gateway Initiative and Drogheda Dundalk-Newry on the Dublin-Belfast corridor

• Addressing the legacy of rapid unplanned growth, by facilitating amenities and services catch-up, jobs and/or improved sustainable transport links to the cities, together with a slower rate of population growth in recently expanded commuter settlements of all sizes"

Based on these objectives; improvements to the M4 corridor would build on links between the east, Midlands, West and Northwest of the country, as the M4 connecting Dublin to Galway, Athlone and Sligo.

2.2.2 National Development Plan (2018 – 2027)

The National Development Plan (NDP) 2018–2027 will drive Ireland's long term economic, environmental and social progress across all parts of the country over the next decade. The NDP is clearly aligned with the delivery of the outcomes and objectives of the NPF (outlined in Section 2.2.1). It sets out under corresponding Strategic Investment Priorities, the investment priorities over the next ten years that will underpin the successful implementation of each of the National Strategic Outcomes in the NPF.

In this regard, for National Strategic Outcome 2 (Enhanced Regional Accessibility) and National Policy Objective 7, the NDP outlines "*a number of the major road developments to be delivered under the National Development Plan*". Within this list, the NDP includes the *'M4 Maynooth to Leixlip'* as one of the sections of the National Road network which "*will be progressed through pre-appraisal and early planning during 2018 to prioritise projects which are proceeding to construction in the National Development Plan*".

2.2.3 Investment in our Transport Future – Strategic Investment Framework for Land Transport (SIFLT)

The Department of Transport, Tourism and Sport (DTTAS) published 'Investing in our Transport Future - Strategic Investment Framework for Land Transport (SIFLT)' in 2015. The document recognises that an effective transport network is central to the functioning of society and the economy.

This framework provides a number of principles and priorities as criteria against which land based transport programmes will be drawn up and assessed. Rather than setting out a list of projects to be prioritised, SIFLT forms a filter for transport investment projects prior to their appraisal for suitability for inclusion in national/regional programmes. These priorities include:

- Priority 1: Achieve Steady State Maintenance;
- Priority 2: Address Urban Congestion; and
- Priority 3: Maximise the Value of Existing Land Transport Networks.

Investment in the section of the M4 corridor under consideration is supported by a number of the priorities set out within SIFLT, in that: upgrade would likely address some urban congestion. Furthermore, the third priority of the SIFLT is particularly relevant in the context of proposals to upgrade the M4 corridor. The underlying principles of this priority are that any further investment should be targeted to maximise the contribution of the land transport networks by enhancing the efficiency of the existing network, particularly:

- Through increased use of Intelligent Transport Systems (ITS) applications;
- Through investments that improve connections to key seaports and airports or support other identified national and regional spatial planning priorities; and
- In the case of roads, investment should provide access to poorly served regions, access for large-scale employment proposals, complete missing links or address critical safety issues.

2.2.4 National Ports Policy 2013

The National Ports Policy was published by DTTAS in 2013. The report introduces clear categorisation of the ports sector based on significance and the port governance model to be adopted by Ireland.

Dublin Port is a Tier 1 port of National Significance. Tier 1 ports are categorised as ports that:

- are responsible for 15% to 20% of overall tonnage through Irish ports; and,
- have clear potential to lead the development of future port capacity in the medium and long term, when and as required.

In order to provide resilience to the Irish trading networks following potential outcomes of the Brexit process it is important the internal linkages to Tier 1 ports

are enhanced. The M4 is the primary link from Project Ireland 2040 assigned urban growth regions of Galway, Athlone and Sligo as well as the Northwest of the country to this Tier 1 port.

2.2.5 Smarter Travel – A Sustainable Transport Future (2009 – 2020)

Smarter Travel, A Sustainable Transport Future 2009-2020, presents a transport policy framework for Ireland covering the period up to 2020. The policy, launched by the Department of Transport in 2009, sets out a vision, goals and targets to be achieved, and outlines 49 actions that form the basis for achieving a more sustainable transport future. One of the key goals of the initiative is:

- *"Improve economic competitiveness through maximising the efficiency of the transport system and alleviating congestion and infrastructural bottlenecks".*

This key goal as defined within the policy document, in relation to maximising the efficiency of the transport system and alleviating congestion and infrastructure bottlenecks aligns with the ambitions of the Maynooth to Leixlip Project.

2.2.6 Road Safety Authority – Road Safety Strategy 2013 - 2020

The Road Safety Authority (RSA) Road Safety Strategy 2013 – 2020, sets outs targets to be achieved in terms of road safety in Ireland as well as policy to achieve these targets. The primary target of this strategy is:

"A reduction of road collision fatalities on Irish roads to 25 per million population or less by 2020 is required to close the gap between Ireland and the safest countries. This means reducing deaths from 162 in 2012 to 124 or fewer by 2020.

A provisional target for the reduction of serious injuries by 30% from 472 (2011) to 330 or fewer by 2020 or 61 per million population has also been set."

The plan sets out strategies for engineering and infrastructure in terms of the benefits that they can have in terms of reducing collisions. Any potential project should align and support this RSA strategy.

2.2.7 Infrastructure and Capital Investment 2016 - 2021

The national capital plan '*Building on Recovery: Infrastructure and Capital Investment 2016-2021'* published by the Department of Public Expenditure and Reform (DPER) in September 2015 sets out a framework for transport infrastructure investment over a seven-year period. It identifies the need for further development of the road, rail and public transport networks and sets out transport implementation priorities for the period of the plan. Under *Public Transport*, this document mentions major projects enabled to proceed, one of which is the design

and planning progress for expansion of DART services to Maynooth in the west and Hazelhatch in the southwest.

The potential provision of the upgraded and expansion of public transport, including DART services, proposed as part of this project will support this RSA strategy.

2.2.8 National Roads Needs Study – July 1998

The National Roads Needs Study was carried out by the NRA and published in July 1998. The report sets out specific needs for the National Road network to perform efficiently and to meet the future demands of the growing population.

Some strategic considerations of the report are of particular relevance to the Maynooth to Leixlip Project, such as:

"Ireland peripheral island location, without a land link to the rest of the European Union, requires efficient access to ports and airports in order to minimise the economic disadvantage of the absence of a land link"

Our reliance on the sea and air transport for access to European and International markets needs to be supported by the necessary infrastructure to continue our foreign trade of goods and services required for sustainable economic growth and employment creation. The need to move freight from the West of Ireland to connect with Dublin Port (Tier 1 port) via the M4 motorway, is relevant under this heading.

The National Roads Needs Study states that:

"A sustainable Road Transport Policy requires……a continued focus on the elimination of bottlenecks and inefficiencies in the infrastructural system, diversion of traffic away from communities where practicable, upgrading of existing alignments where this is an option rather than new routes…"

Intervention in the corridor would enhance the efficiency of this strategic corridor to Dublin Port and Dublin Airport.

The report set out objectives for National Primary Roads as follows:

"The Operational Programme for Transport (OPT 1994-1999) has an objective to achieve a level of service equivalent to 80kph inter – urban journey speed in the network".

With regard to the OPT, the National Road Need Study equates that an "*average inter-urban journey speed of 80kph is taken to be equivalent to the U.S. HCM Level of Service D".*

2.3 Regional Policy

2.3.1 Transportation Strategy for the Greater Dublin Area (2016-2035)

In April 2016 the National Transport Authority (NTA) adopted its '*Transport Strategy for the Greater Dublin Area 2016 – 2035*'. This provides a planning framework for the delivery of transport infrastructure and services across the Greater Dublin Area (GDA), based on the principles of effective, efficient and sustainable travel. The strategy outlines a suite of transportation objectives for the GDA including the provision of additional public transport (heavy rail, light rail, bus and bus rapid transit facilities), cycling and walking infrastructure and road network measures up to 2035.

The GDA Strategy considers the Study Area for this project as part of Corridor C which encompasses Maynooth – Leixlip – Lucan – to Dublin City Centre as shown in Figure 2.2.

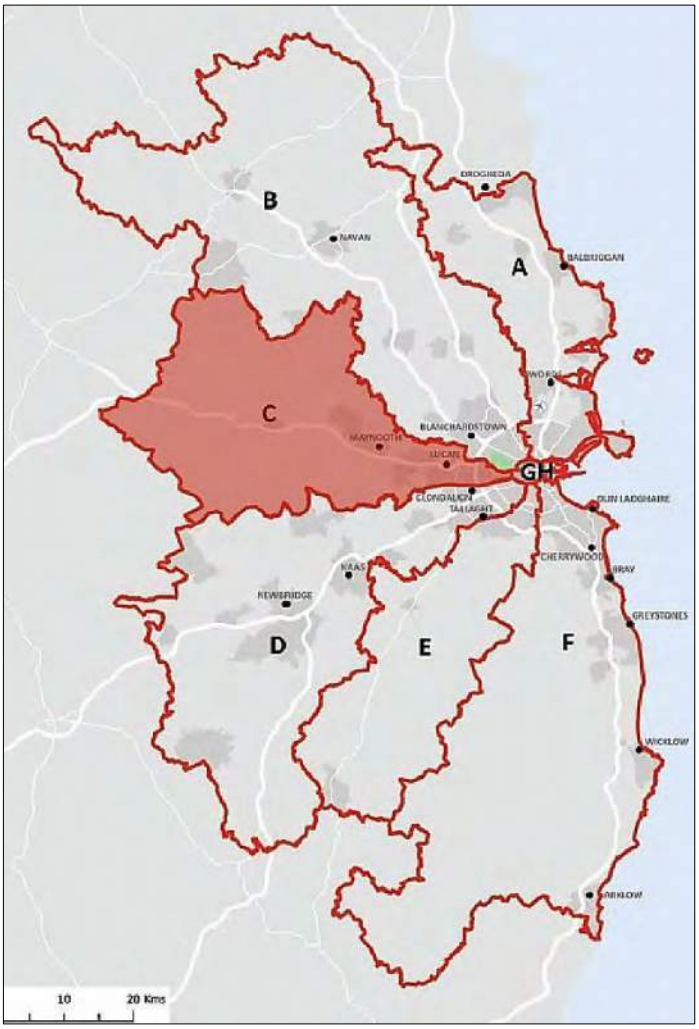


Figure 2.2: GDA Corridors with the Study Area within Corridor C (https://busconnects.ie/)

The M4/N4 is identified as one of six Core Regional Bus Networks with in the GDA as shown in Figure 2.3. The Core Regional Bus Networks are defined as representing "*the most important bus routes in the region and are generally characterised by a high frequency of bus services, high passenger volumes and with significant trip attractors located along the route. The identified core network comprises sixteen radial bus corridors, three orbital bus corridors and six regional bus corridors."*

The strategy outlines that "*In order to ensure an efficient, reliable and effective bus system, it is intended, as part of the Strategy, to develop the Core Bus Network to achieve, as far as practicable, continuous priority for bus movement on the portions of the Core Bus Network within the Metropolitan Area. This will mean enhanced bus lane provision on these corridors, removing current delays on the bus network in the relevant locations and enabling the bus to provide a faster alternative to car traffic along these routes, making bus transport a more attractive alternative for road users. It will also make the overall bus system more efficient, as faster bus journeys means that more people can be moved with the same level of vehicle and driver resources.*"

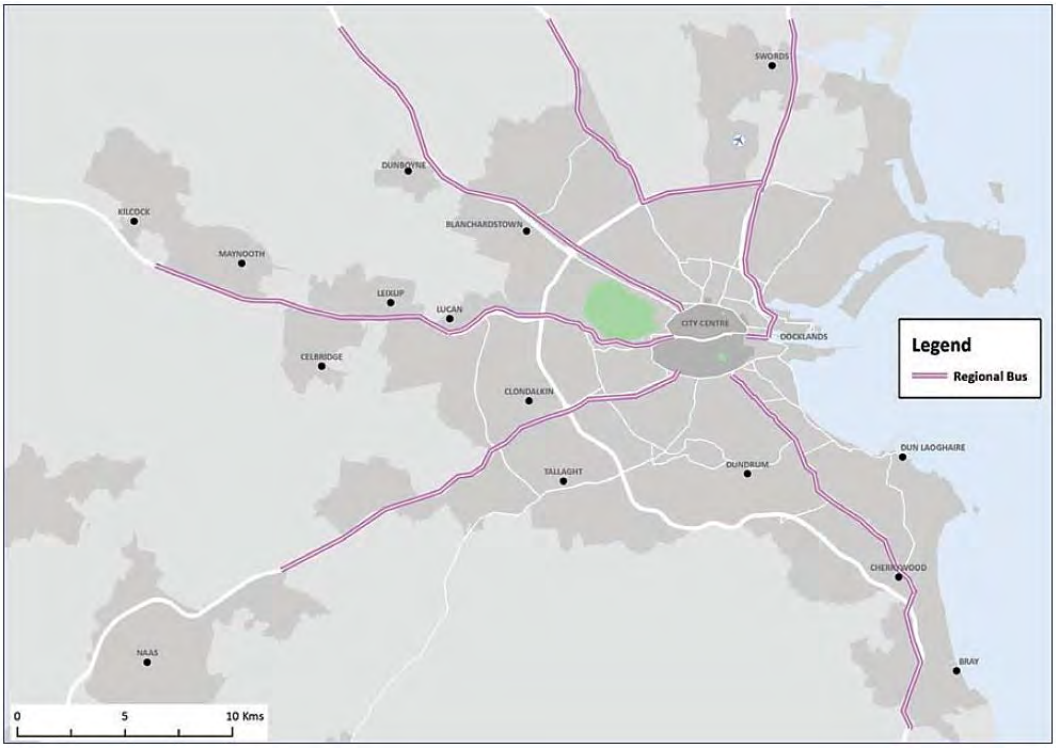


Figure 2.3: Core Bus Network - Regional Corridors (Transport Strategy for the Greater Dublin Area 2016-2035)

The strategy outlines that within this corridor, car mode share for all trip purposes is 72%, with public transport representing 8% of trips. The M4/N4 currently forms part of the Core Regional Bus Network for the GDA. While the proposed expansion of the DART network to Maynooth is acknowledged as a key public transport development for the corridor, the strategy also states that *"for large parts of the*

GDA it is simply not viable to provide public transport services at a frequency and capacity that caters adequately for the needs of the relevant area. In such locations car travel will continue to be the dominant mode of travel and investment in the road network will be an ongoing requirement".

The strategy also identifies the impact of congestion and the importance of orbital routes on bus services, as follows:

"Increasing levels of congestion are occurring on strategic and urban distributor roads within Corridor C, particularly on the orbital north-south routes, linking the N4 with the N7 and on adjoining local roads. This has a negative impact on the reliability of bus services during the peak periods."

In this regard the importance of and strategy for these regional and local roads is outlined in the GDA strategy as follows:

In relation to this network it is intended to:

- *Enhance orbital movement, outside of the M50 C-Ring, between the N3, the N4 and N7 national roads, by the widening of existing roads and the development of new road links;*
- *Develop orbital roads around town centres accompanied by and facilitating enhanced public transport, cycling and pedestrian facilities in the relevant centre;*
- *Develop appropriate road links to service development areas;"*

The GDA Strategy also aims to identify other alternative public transport options outside the Core Bus Network that could effectively meet the growth in travel demand along this corridor, proposing the following for this study area:

- Implement the DART Expansion Programme, which will provide DART services as far north as Drogheda; to Hazelhatch on the Kildare Line (including a tunnel connection from the Kildare Line to link with the Northern / South-Eastern Line); to Maynooth in the west and to the M3 Parkway;
- Construct additional train stations in developing areas with sufficient demand; Likely areas include Pelletstown on the Maynooth line.
- Core Radial Bus Corridor travelling from Lucan-Palmerstown-Kilmainham. Linking to the edge of the study area.

The NTA Strategy also sets out demand management measures for a number of road corridors within the Greater Dublin Area including the M4, as follows:

- *"Implement, when appropriate, demand management measures on the radial national routes approaching the M50 motorway (M1, M2/N2, N3/M3, N/M4, N/M7, M11) to ensure that these routes retain sufficient capacity to fulfill their strategic functions, including freight movement."*

2.3.2 Bus Connects

BusConnects is an extensive programme of priority investment for public transport which plans to fundamentally transform Dublin's bus system. The objective of BusConnects is to develop the radial and orbital bus corridors as identified in the NTA Transport Strategy for the Greater Dublin Area 2016 – 2035, so that each will have continuous bus priority.

BusConnects seeks the development of a more attractive and convenient bus service with greater scope for interconnection between routes, where connecting passengers do not necessarily have to travel to Dublin City Centre. The proposed bus network for the west region is shown in Figure 2.4.

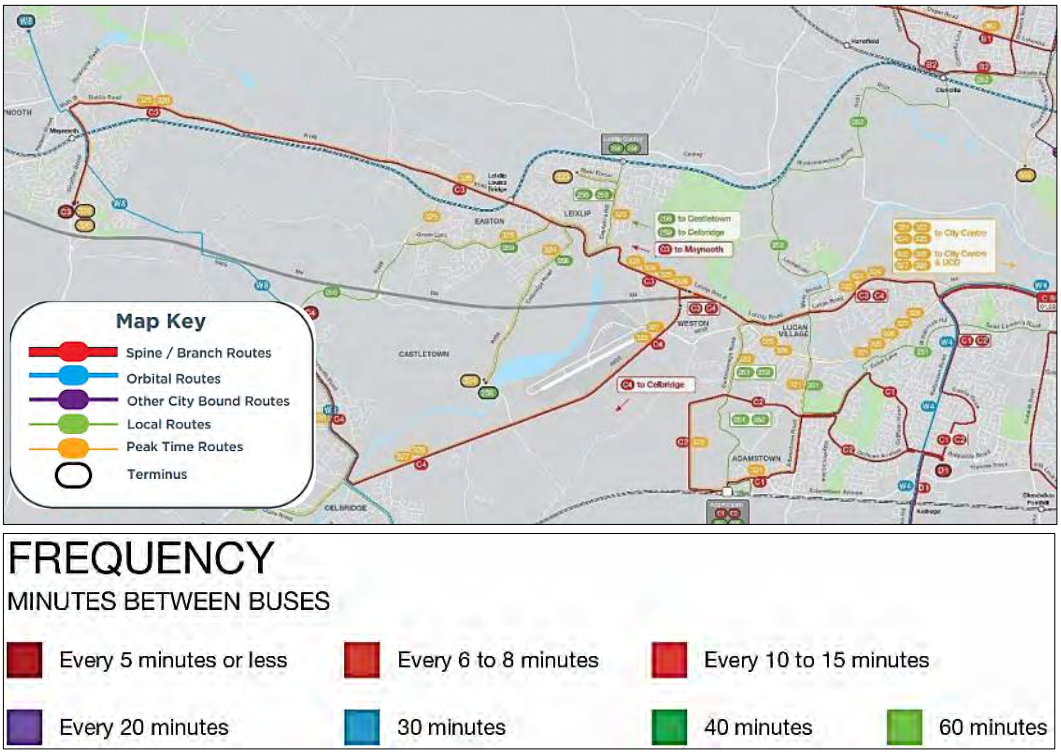


Figure 2.4: Proposed Bus Network for Overall West Region (https://busconnects.ie/)

The proposed bus network for Maynooth, Leixlip and Celbridge is shown in Figure 2.5.

BusConnects Proposal for Maynooth and Leixlip

The BusConnects proposal for weekday midday frequencies for Maynooth and Leixlip are as follows:

- Bus service every 20 to 25 minutes for Maynooth;
- Orbital bus service every 30 minutes for both Maynooth and Leixlip;
- Bus service every 10 to 15 minutes for Leixlip. This is comprised of 2 No. 20 to 25-minute services; and
- Commuter rail service every 30 minutes.

BusConnects Proposal for Celbridge

The BusConnects proposal for weekday midday frequencies for Celbridge is as follows:

- Bus service every 20 to 25 minutes;
- 2 No. orbital bus services every 30 minutes; and
- Rail service greater than 30-minute frequencies.

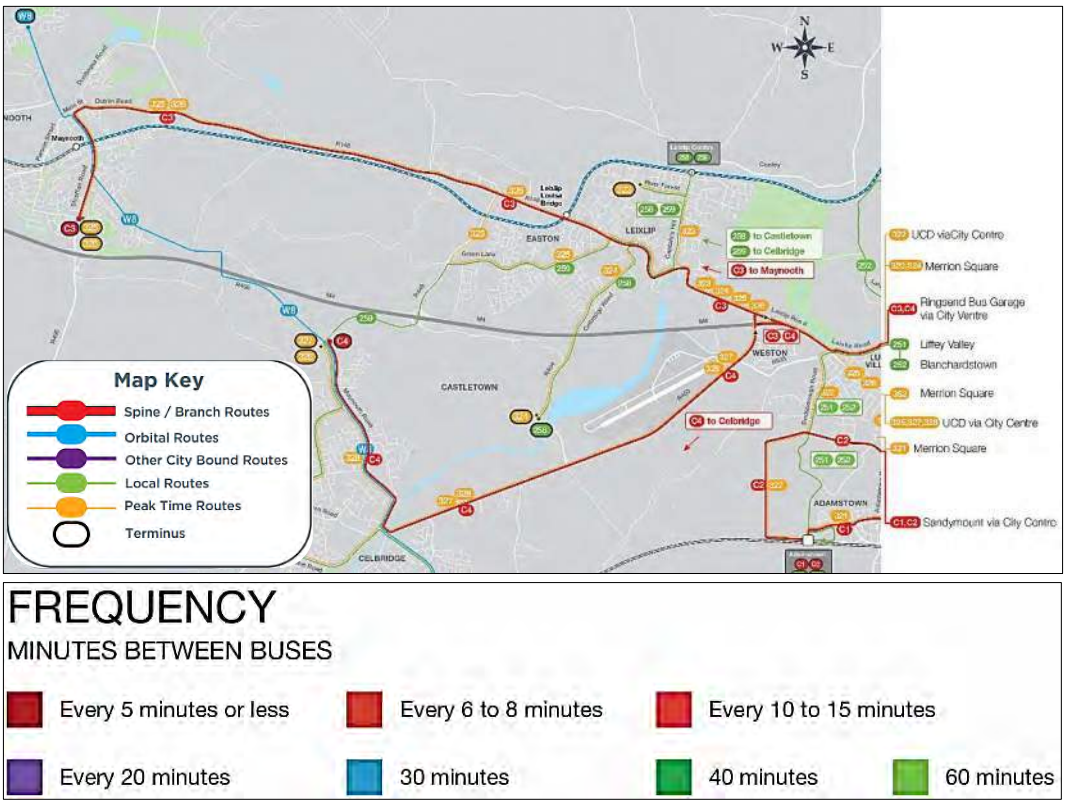


Figure 2.5: Proposed Bus Network for Maynooth, Leixlip and Celbridge (https://busconnects.ie/)

2.3.3 GDA Regional Planning Guidelines 2010-2022

The Regional Planning Guidelines (RPGs) for the Greater Dublin Area were prepared by the Regional Planning Guidelines Office in 2010. The significance of providing an efficient strategic connection for freight movement to Dublin Port (Tier 1 Port) is emphasised as follows:

"The GDA, through its ports and airport connections will continue to be the most important entry/exit point for the country as a whole, and as a Gateway between the European Union and the rest of the World. Access to and through the GDA will continue to be a matter of national importance."

The guidelines state:

"The efficient connection of port facilities to regional and national markets is a vital consideration in this regard, through high quality road connections to the national road network." and

"Road freight is by far the dominant mode of freight transport (accounting for 95% of all goods moved), however congestion has become a significant barrier to this type of activity, while associated CO2 emission levels have negative implications for the environment".

The focus on international freight transport is essential for the region, given that both Dublin Airport and Dublin Port are located within the GDA. Freight activity at a regional level is also key and measures which will improve efficiency, reduce travel times and reduce emissions are supported by these guidelines.

The primary purpose of the M4 as a National Road is to provide a strategic east/west transport link connecting both Dublin Airport and Dublin Port to the Midlands, West and Northwest regions.

In addition, the guidelines states that:

"Local congestion in the GDA represents the biggest road transport issue for the area".

The guidelines elude to the anticipated continued growth of towns such as Maynooth and Leixlip. This is emphasised with the extent of planned development and expansion in both towns and their environs.

2.3.4 NTA Greater Dublin Area Cycle Network Plan -2013

The NTA Greater Dublin Area Cycle Network Plan sets out the strategy for the development of an integrated cycle network. It identifies that within the Maynooth to Leixlip Project study area, there are a number of proposed primary, secondary, inter-urban and greenway cycle networks and thus form a key part of the strategic cycle network.

The objectives of the Maynooth to Leixlip Project should take cognisance of the current cycle network and the proposed cycle network outlined in this plan is shown in Figure 2.6.

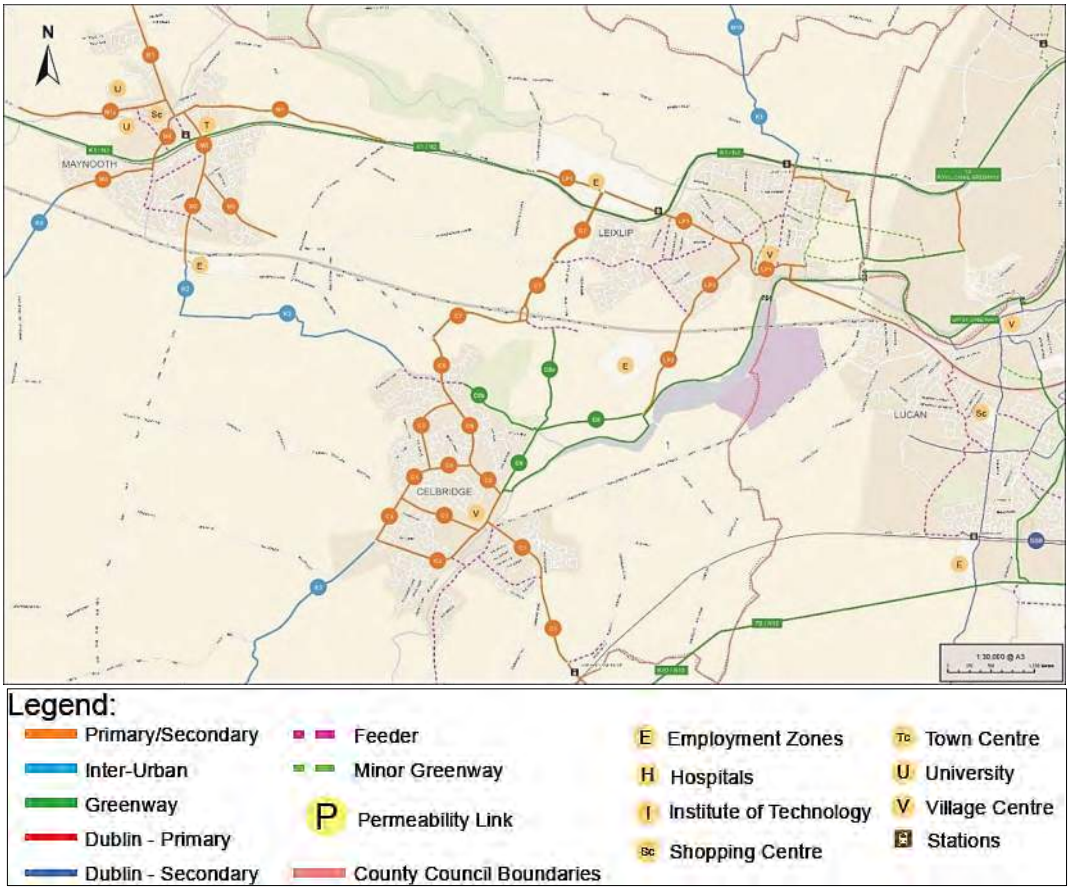


Figure 2.6: Maynooth, Leixlip and Celbridge Proposed Cycle Network (https://www.nationaltransport.ie/publications/strategic-planning/gda-cycle-network-plan/)

2.3.5 Leinster Orbital Route

The Leinster Orbital Feasibility Study was commissioned in 2007 to identify a new road link connecting the towns of Navan, Drogheda and Naas/Newbridge/Kilcullen whilst serving Navan/Kells/Trim and Kilcock/Maynooth/Leixlip/Celbridge. The general corridor identified in the Leinster Orbital route feasibility study is:

- M1 at Drogheda to M3 at Navan;
- M3 at Navan to R154 at Trim;
- R154 at Trim to M4 at Enfield or Kilcock;
- M4 at Kilcock or Enfield to M7/M9 at Naas / Newbridge.

In 2009 a Corridor Protection Study was carried out on the Leinster Orbital Route (LOR), to identify zones along the key radial routes from Dublin where junctions with the proposed LOR might possibly be constructed in future in order to protect these areas from development.

Three possible junction locations have been identified on the M4 are shown in Figure 2.7 and are as follows:

- Kilcock, located west of Kilcock town adjacent to the M4 Kilcock Junction;
- Between Kilcock and Enfield, located at a rural greenfield site 7.5km west of the existing M4 Kilcock Junction and 3.5km east of the Enfield Junction; and
- Enfield, located on the western side of Enfield adjacent to the existing M4 Enfield Junction.

Figure 2.7: Leinster Orbital Route Possible Junction Locations on the M4

2.4 Local Policy

2.4.1 Kildare County Development Plan (2017 – 2023)

Kildare County Development Plan outlines the importance the motorway network as follows:

"The motorway network primarily serves long and middle distance traffic originating in or passing through the county including the transportation of freight. These routes have an important role to play in the economic development of the county and the state."

The following policies and objectives taken from the Development Plan outline support for ensuring the capacity and strategic functionality of the motorway network is maintained and improved, together with identification of studies and projects pertinent to the Maynooth to Leixlip Project:

- 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;
- Examine the feasibility of delivering an overpass of the M4 to link the Wonderful Barn at Leixlip to Castletown Demesne in Celbridge in consultation with TII; and

- Examine options in consultation with South Dublin County Council, Fingal County Council, Meath County Council, TII and other statutory agencies for the delivery of an orbital link road from the M4 to the M3 in Meath.

2.4.2 South Dublin County Development Plan (2016 – 2022)

The South Dublin County Development Plan contains policies and objectives, that are directly and indirectly related to the Maynooth to Leixlip Project, such as;

- Provision of grade separated junction on the R148 to enhance the efficiency of the junction, particularly for buses on the N4/Lucan Road QBC and ensure safe crossing facilities are provided for all users.

2.4.3 Maynooth Local Area Plan

The Maynooth Local Area Plan 2013 – 2019 contains a number of road objectives with one directly related to the Maynooth to Leixlip Project:

- Investigation of the capacity of the existing M4 interchange to ascertain whether the interchange needs to be upgraded or if additional interchanges linked to the existing one is required.

2.4.4 Leixlip Local Area Plan (2020-2023)

The Leixlip Local Area Plan contains a number of road objectives which support all, or aspects of the Maynooth to Leixlip Project including:

- The provision of capacity enhancements to the strategic road network in particular the management of traffic to optimise and protect capacity at the M4-R449 Leixlip/Celbridge.
- The provision of additional capacity on the M4 between Maynooth and Leixlip/Lucan as identified in Section 8.4, 'Transport Investment Priorities', of the Regional Spatial and Economic Strategy is also supported.
- Capacity enhancements of the M4 Maynooth to Leixlip as provided for in the NTA Transport Strategy for the Greater Dublin Area 2016-2035 and the Regional Spatial and Economic Strategy.
- The feasibility of a new link road from the Celbridge Road (R404) to the south of the N4 connecting to the N4 Leixlip/Celbridge Interchange in consultation with TII, NTA and other stakeholders.

2.4.5 Celbridge Local Area Plan (2017-2023)

The Celbridge Local Area Plan contains a number of road objectives, although these plans are primarily related to local roads within the town of Celbridge. These road objectives include improved safety measures, reduced capacity and new minor road infrastructure. Although not directly related to the Maynooth to Leixlip Project, proposed options within the Maynooth to Leixlip Project should look to enable alignment with the Celbridge Local Area Plan road objectives.

3 Existing Conditions on the National Route

3.1 Existing Road Network

The existing M4/N4 is a national primary road from the M50 in Dublin to Sligo over a length of approximately 200km. It is a dual carriageway standard from the M50 to Junction 5 Leixlip incorporating direct accesses, busways, footpaths, cycleways and bus stops over a length of approximately 7km. The section from the M50 to Lucan was constructed in the mid-1980's with the Lucan Bypass constructed in the late 1980's, severing the old village to the north from the newer areas to the south. In 2009, the section the M50 to Lucan was upgraded to 3 lanes in each direction and closed off the majority of local accesses. It is motorway standard from Junction 5 Leixlip in Dublin to Coralstown in County Westmeath over a length of approximately 53km. It is a single carriageway from Coralstown in County Westmeath to Sligo over a length of approximately 140km. The section of the M4 between the Junction 5 and Junction 7 is a strategic two-lane motorway that has been in operation since 1994.

The surrounding regional and local road network provide access to the M4 and various towns and villages throughout the study area. The R148 runs from Dublin to Kinnegad in County Westmeath. The road is 45km long. It is generally of a very high standard for a regional road, with wide lanes, hard shoulders, and turning bays. It is still heavily used by traffic avoiding the tolled M4 between Kilcock and Kinnegad. The R148 was previously categorised as a National Primary route until the opening of the M4 motorway. It follows the same corridor and serve the same east west commuters as the M4. The R148 regional road extends from Leixlip, crossing the River Liffey and the Royal Canal. From the canal, it passes the Intel campus and continues to Maynooth. It then extends outside of the study area in a westerly direction via Kilcock and Enfield and finally terminates in Kinnegad in County Meath / Westmeath.

The R403 connects the M4 at Junction 5 and continues through Celbridge town in a southwest direction outside of the study area.

The R449 links into the M4 at Junction 6. From here it continues north and ties into the R148 at the Intel Ireland campus to the west of Leixlip town. The R449 ties into the R405 southwest of Junction 6. The R405 extends from Celbridge to Maynooth and crosses the M4 via an overbridge. The R406 (Straffan Road) links into the M4 at Junction 7. From here it continues north before tying into the R148 in Maynooth town centre. The R406 extend south and tie into the R403 and Barberstown Road at a four-armed roundabout. Barberstown Road extends south before tying into L2007 which then connects to Straffan Road tying into the N7 at Junction 7. This provide a link from the M4 to the M7.

The existing road network is shown in Figure 3.1.

Figure 3.1: Existing Road Network (© Google Map data ©2020 Tele Atlas)

3.2 Existing Natural Constraints

The study area is largely greenfield agricultural land combined with the built-up areas of Maynooth and Leixlip to the north and Celbridge to the south. The Dublin-Sligo train line and Royal Canal Way are both significant features within the study area to the north of the M4.

There are a number of areas of notable environmental significance within the study area include the following:

- Rye Water Valley/Carton SAC;
- Rye Water Valley/Carton pNHA;
- Ballynafagh Bog SAC;
- Ballynafagh Lake SAC;
- Royal Canal pNHA;
- Grand Canal pHNA; and
- River Liffey.

The natural constraints and areas of environmental importance identified within the study area are shown in Figure 3.2.

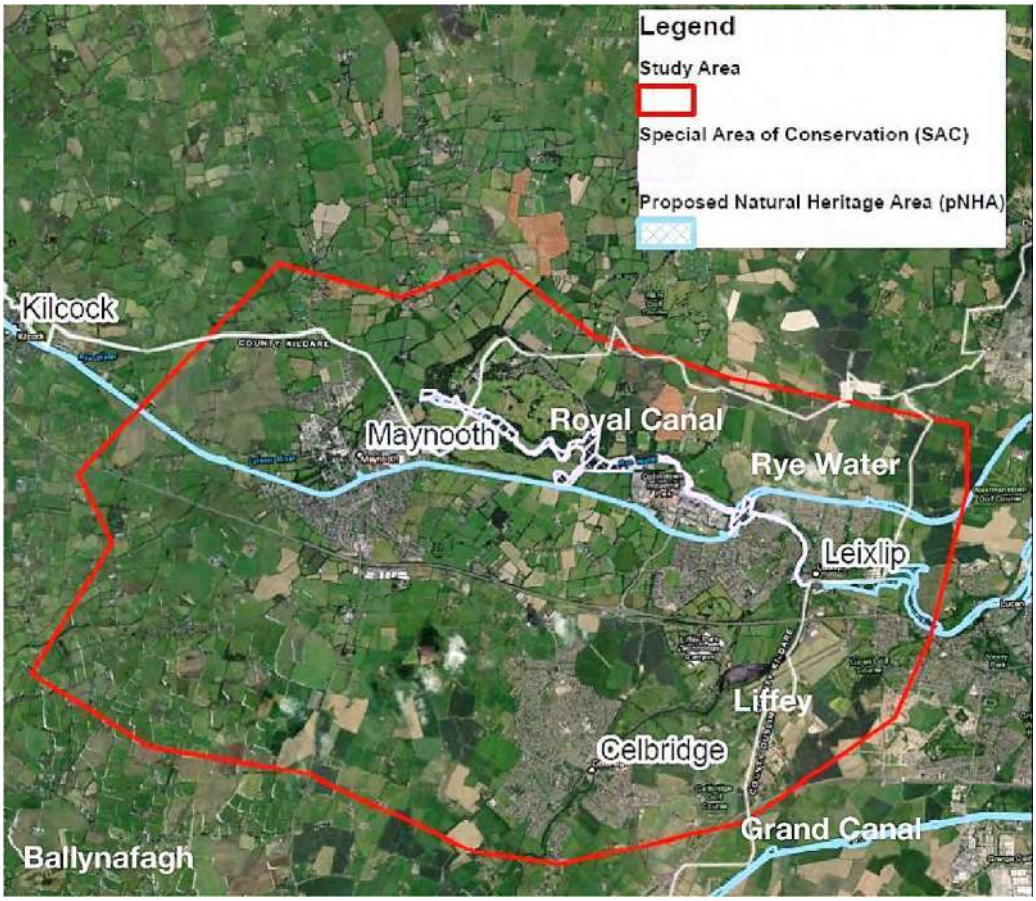


Figure 3.2: Existing Natural Constraints (© Google Imagery ©2020 DigitalGlobe)

3.3 Existing Built Environment

There are a number of built up areas within in the study area mainly the towns of Maynooth, Leixlip and Celbridge. There are a number of different built environments through the study area including business parks, a university, an airport etc. A number of built up areas of notable significance are listed below.

- Leixlip;
- Maynooth;
- Celbridge;
- Dublin to Sligo Train Line;
- The Royal Canal Greenway;
- Weston Airport;
- Overhead powerlines between Junction 4 and Junction 5;
- Overhead powerlines and pylons between Junction 5 and R405 overpass;
- Intel Ireland Leixlip Campus;
- Liffey Business Campus;
- M4 Business Park;
- M4 Interchange Business Park;
- Maynooth Business Campus;
- Maynooth University;
- Tara Park;
- Bartons Transport;
- Brian Noone Limited;
- Leixlip Reservoir and Water Treatment Plant;
- Watermains serving Leixlip Water Treatment Plant; and
- Ballygoran Reservoir.

3.4 Existing Human Environment

The Maynooth to Leixlip study area is located mainly within County Kildare. The overall population in County Kildare in 2016 was 222,504. This was a 5.8% increase on the 2011 figure. According to the 2016 figures, Kildare now accounts for 4.7% of the state total of 4.76 million and 32% of the eastern regional total of 688,857. The regional assemblies are shown in Figure 3.3.

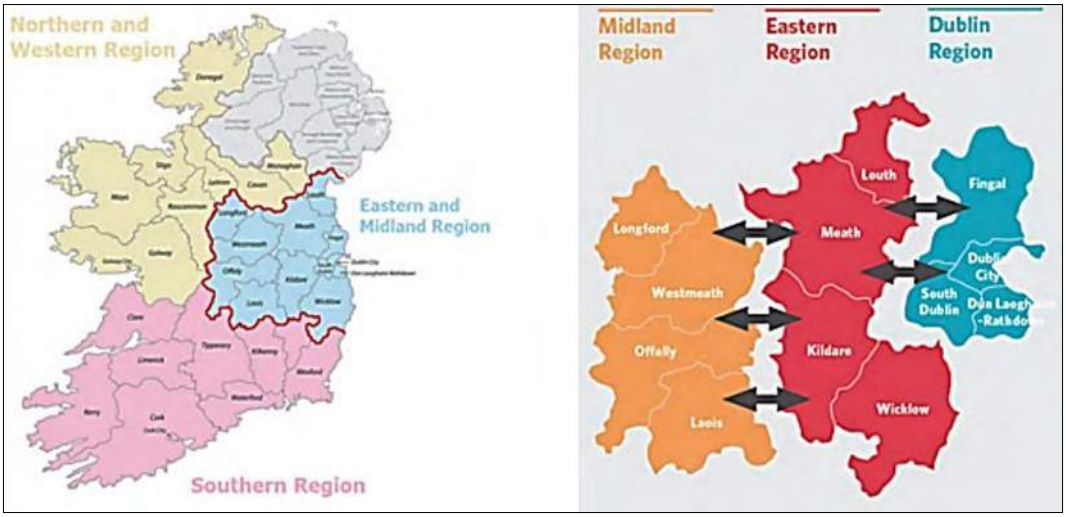


Figure 3.3: Regional Assemblies and the Eastern and Midland Region (Eastern and Midland Regional Assembly, Eastern Strategic Planning Area (SPA), Socio-Economic Evidence Baseline Report, November 2017)

Within the study area there are three main towns; Maynooth, Leixlip and Celbridge. The population and employment are shown in Table 3.1 below.

Town	Population (2016)	Resident Workers	Total Jobs	Jobs / Resident Workers Ratio
Maynooth	14,585	6,295	5,201	0.83
Leixlip	15,504	7,166	5,825	0.81
Celbridge	20,288	9,374	2,339	0.25

Table 3.1: Maynooth, Leixlip and Celbridge Population and Employment

From the 2016 census, the labour force rate in Kildare (resident workers) is 64%, with 89% of the labour force 'At Work' in Kildare. The towns of Maynooth, Leixlip and Celbridge have a combined population of 50,377 and a working population of 22,835. The towns of Maynooth and Leixlip have significantly more employment than Celbridge. This is reflective of employment centres, including international, in these areas. However, Celbridge has a jobs / resident workers ratio of 0.25 and thus has a high commuting population.

The Regional Planning Guidelines for the Greater Dublin Area 2010-2022 identifies the Metropolitan Area as a singular planning policy zone.

The Metropolitan Area includes the north east Kildare towns of Maynooth, Leixlip, Celbridge and Kilcock. The objective for future development in this planning policy zone is to ensure consolidation of urban centres, development of brownfield sites and achieve greater use of sustainable transport modes.

3.5 Existing Transportation Issues

3.5.1 M4 Corridor

The transportation issues within the M4 corridor have been examined as part of the Scope and Pre-Appraisal of the project and are documented within the Project Brief. Annual Average Daily Traffic (AADT) volumes were collected from the TII permanent traffic counters as shown in Table 3.2 below. The TII traffic counter locations are shown in Figure 3.4.

Road Type	TII Counter Location	AADT (2019)
Dual Carriageway - 3 Lane + Bus Lane	N4 Junction 3 Newcastle – Junction 4 Lucan	85,939
Motorway - 2 Lane	M4 Junction 6 Celbridge – Junction 7 Maynooth	59,435
Motorway - 2 Lane	M4 Junction 7 Maynooth – Junction 8 Kilcock	46,585
Motorway - 2 Lane	M4 Junction 8 Kilcock – Junction 9 Enfield (east)	29,402
Motorway - 2 Lane	M4 Junction 9 Enfield (west)	14,971

Table 3.2: M4 AADT Data Summary

Figure 3.4: TII Traffic Counter Locations (© Google Map data ©2020 Tele Atlas)

A summary of the key operational issues affecting the route are outlined below and discussed in more detail throughout this report.

- High dependency on cars (>60%) for those living in Maynooth but working outside of Maynooth (Maynooth Traffic Management Plan, 2017).
- The predicted modal shift has not happened within the study area from private car to public transport, which is a contributing factor to the traffic and congestions problems along the M4 (refer Section 3.5.2).
- Between Junction 6 Celbridge and Junction 7 Maynooth, the AADT increased by 16% between 2013 and 2019. The minimum target for Level of Service (LoS) D on the M4 motorway is exceeded by 15% (refer to Section 6).
- Between Junction 7 Maynooth and Junction 8 Kilcock, the AADT increased by 22% between 2013 and 2019. The minimum target for LoS D is currently being

achieved however trends suggest that this may change in the near future. Should AADT trend continue to grow in line with actual AADT growth from 2013 to 2019, the minimum target for LoS D would be exceeded by 2025 (refer to Section 6).

3.5.2 Existing Public Transport Provision

Figure 3.5 outlines keys existing public transport hubs and proposed hubs based on strategy documents. The spaces shown in Figure 3.5 represent approximate on-site car parking facilitates provided by each public transport hub.

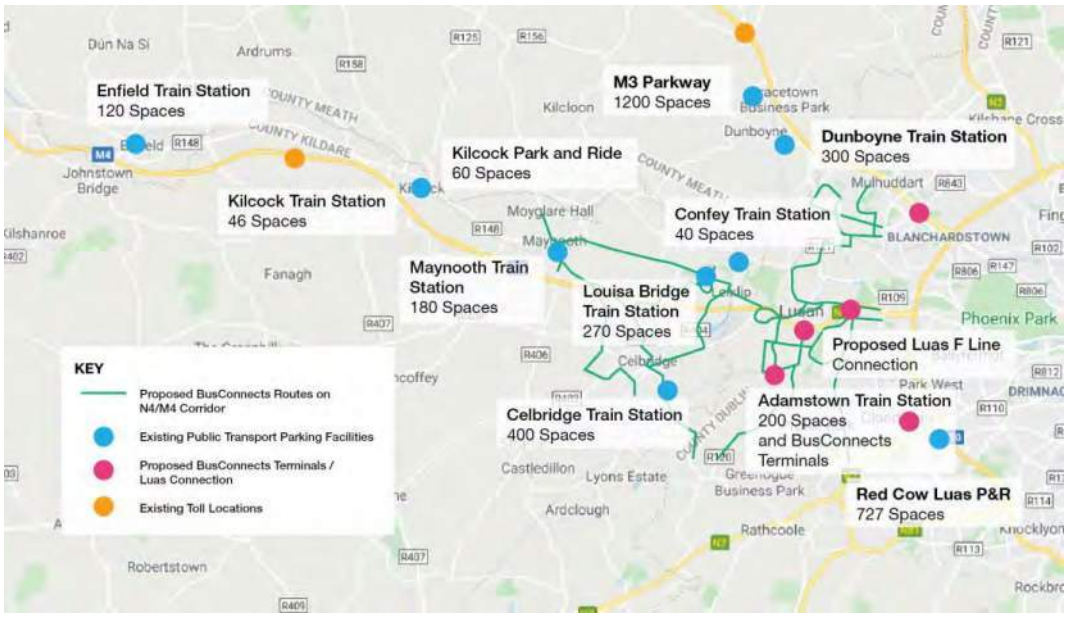


Figure 3.5: Key Public Transport Hubs (© Google Map data ©2020 Tele Atlas)

Rail Network

The study area interacts with two rail lines:

- Western rail line extending from Dublin Connolly (City Centre) to Sligo and passes through Leixlip and Maynooth.
- Southern rail line extending from Dublin Heuston to Cork and passes to the south of Celbridge, where it is serviced by the Hazelhatch / Celbridge station.

The frequency of the existing rail services through the study area is as follows:

- Maynooth is serviced by two routes:
  - Dublin-Maynooth/Longford route with services typically running every 20 to 30 minutes to Maynooth during the weekdays and typically every 30 minutes to one hour during the weekends.
  - Dublin Connolly - Sligo with 11 services daily during weekdays and a reduced number of services during weekends.
- Leixlip is serviced by two stations - Leixlip Confey and Leixlip Louisa Bridge. These stations are serviced by the Dublin-Maynooth / Longford route. This

route typical runs every 30 minutes during the weekdays to Leixlip and every 30 minutes to one hour during weekends.

- Celbridge is serviced by three routes:
  - Dublin Heuston – Galway with one service during weekdays.
  - Dublin Heuston – Waterford with two services during the weekdays, one service on Saturdays. There are no services on Sundays.
  - Grand Canal Dock and Dublin Heuston – Portlaoise – Cork with up to 45 services during the weekdays, 19 services on Saturdays and 5 services on Sundays.

Bus Network

The population centres within the study area are reliant on the bus network to a considerable degree with a variety of routes served by Dublin Bus, Bus Eireann, Go Ahead and private operators, as shown in Figure 3.6.

Figure 3.6 Bus Routes within the Study Area (© Google Map data ©2020 Tele Atlas)

- **Dublin Bus Route 66:** Operates from Merrion Square to Maynooth Straffan road via Parkgate Street, Chapelizod, Lucan Village and Leixlip Village with frequency up to every 30 minutes.
- **Dublin Bus Route 66a:** Operates from Merrion Square to Leixlip Captains Hill via O Connell Bridge, Parkgate Street, Chapelizod, Liffey Valley Shopping Centre and Lucan Village with frequency up to every hour.
- **Dublin Bus Route 66b:** Operates from Merrion Square to Castletown (Hewlett Packard) via O Connell Bridge, Parkgate Street, Chapelizod, Liffey Valley Shopping Centre, Lucan Village and Leixlip Village with frequency up to every hour.

- **Dublin Bus Route 66e:** Operates from Merrion Square to Maynooth via Parkgate Street, Chapelizod, Liffey, Lucan Village and Leixlip Village five services during the weekdays only.
- **Dublin Bus Route 66x:** Operates from UCD Belfield to Maynooth Straffan Road with three services during weekdays only. Operates from UCD Belfield to Captains Hill or Castletown Rd one service each during the weekdays only. Operates from Westmoreland Street to Straffan Road two services during weekdays only.
- **Dublin Bus Route 67:** Operates from Merrion Square to Maynooth Straffan road via O'Connell Bridge, Parkgate Street, Chapelizod, Liffey Valley Shopping Centre, Lucan Village and Celbridge with frequency up to every 30 minutes. Last service of the day departs from Westmoreland Street.
- **Dublin Bus Route 67x:** Operates from UCD Belfield to Maynooth (via Aghards Road) through Celbridge Salesian College with four services during the weekdays only. Operates from UCD Belfield to Maynooth (via Celbridge Main Street) through Celbridge Salesian College, with two services during the weekdays only. Operates from Westmoreland Street to Maynooth (via Celbridge Main Street) through Celbridge Salesian College with two services during the weekdays only. Operates from Merrion Square to Maynooth (via Celbridge Main Street) through Celbridge Salesian College with one service during the weekdays only. Operates from Merrion Square to Maynooth (via Aghards Road) through Celbridge Salesian College with one service during the weekdays only.
- **Dublin Bus 66n:** Operates from Westmoreland Street to Leixlip Louisa Bridge via Glen Easton. Night bus with 5 services on Friday and Saturday night only.
- **Dublin Bus 66n:** Operates from Westmoreland Street to Celbridge/Maynooth. Night bus with 4 services on Friday and Saturday night only.
- **Bus Eireann 20:** Operates from Dublin Airport to Galway, with five services through Maynooth daily.
- **Bus Eireann 22:** Operates from Dublin Airport/Dublin Busarus to Ballina with seven services through Maynooth daily.
- **Bus Eireann 23:** Operates from Dublin Airport/Dublin Busarus to Sligo with two to three services through Maynooth daily.
- **Bus Eireann 115:** Operates from Dublin Connolly to Mullingar via Maynooth with service frequencies of 30 minutes.
- **Bus Eireann 115C:** Operates from Kilcock to Mullingar with one service through Maynooth daily.
- **Go Ahead 120:** Operates from Dublin Connolly to Edenderry via Celbridge with service frequencies of 30 minutes.

- **JJ Kavanagh & Sons 139:** Operates from Blanchardstown IT to Naas via Leixlip and Maynooth.
- **Kearns:** 847 Operates from Portumna to Dublin Cathal Brugha Street with two service through Maynooth during the weekdays and 2-4 services on the weekend. Kearns NUM02 Operates during college term only from Birr to Maynooth.
- **Airport Hoper 767:** Operates from Maynooth to Dublin Airport via Leixlip with service frequencies of 30 minutes.
- **Maynooth TAL02:** Operates from Maynooth to IT Tallaght via Leixlip and Celbridge.

3.5.3 Modal Shift

Although there is an extensive public transport network (both bus and rail) within the study area, a modal shift from private car to public transport has not materialised. There is a high dependency on private cars as a preferred mode of travel within the study area and given the range of public transport options available to road users, the services are underutilised. This may be based upon the following:

- Accessibility to rail based public transport is an issue due to inadequate cyclist infrastructure and a general lack of availability of park and ride facilities.
- Availability of park and ride facilities for bus services.
- Bus services utilising the M4 must negotiate the same traffic volumes as private cars and are subject to the same unreliability in journey time – this in turn disincentivises take up of public transport alternatives to the private car.
- Perception that public transport may be convoluted, difficult to use and is not reliable.

These factors will be further investigated during Phase 2 to determine how to increase the use of public transport facilities.

4 Existing Road Alignment

4.1 Overview

The corridor under consideration includes the M4 mainline carriageway from Maynooth to Leixlip and the associated mainline junctions. The required cross section for a standard Motorway / Type 1 Dual Carriageway as per TII detail CC-SCD-00007 is shown in Figure 4.1.

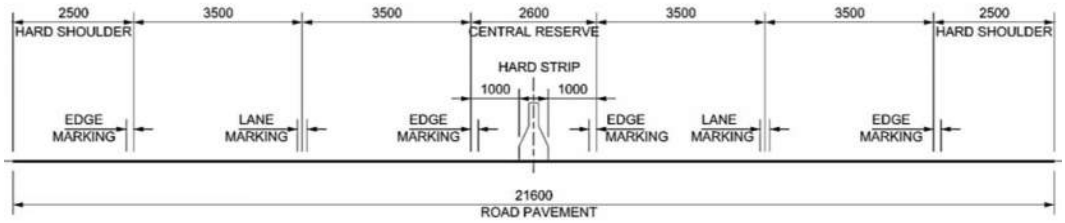


Figure 4.1: Standard Motorway/Type 1 Dual Carriageway Cross Section (TII Publications)

4.2 Mainline

The mainline is of motorway standard, which was designed and constructed as per relevant standards appropriate in 1994. There are no substandard direct accesses along this route within the study area. There are three junctions within the study area, moving from east to west; Junction 5 Leixlip, Junction 6 Celbridge and Junction 7 Maynooth.

4.3 Junction 5 Leixlip

Junction 5 Leixlip is located towards the east of the study area. A schematic is shown in Figure 4.2 and an aerial view shown in Figure 4.3. It serves Leixlip to the north via the R148 and Celbridge to the south via the R403. It is a grade separated junction with a dumbbell roundabout to the north and signalised junction to the south.

The eastbound diverge and westbound merge are both standard 1 lane slip roads. The eastbound merge is unorthodox and is a 2-way road from the roundabout for a length of 100m to accommodate 2 No. private dwelling houses. From here to the M4/N4 eastbound mainline, it incorporates 1 No. traffic lane, 1 number bus lane and a footway. The westbound diverge incorporates a footway, on-road cycleway and 2 No. traffic lanes. The overbridge incorporates 1 No. northbound lane, 1 No. southbound lane, 1 No. right-turn lane and 2 No. footways.

Continued planned growth around the Leixlip and Adamstown area may put additional pressure on Junction 5 particularly during peak traffic times. The junction is also located close to busy urban environments and provides direct access from the M4 to Leixlip, Celbridge and Weston Airport.

The provision of a new Celbridge Link Road as Phase 7 of the Adamstown Strategic Development Zone (SDZ) may put additional pressure on the operation and capacity of Junction 5 as it will provide a link between the SDZ and the M4 and also facilitate access to Adamstown Train Station, Park and Ride facility and BusConnects Terminus. The link road also makes provision for pedestrian and cyclist facilities which may increase vulnerable road users in the vicinity of Junction 5. This will be further examined during Phase 2 along with the impact of future growth on the operation and capacity of the junction.

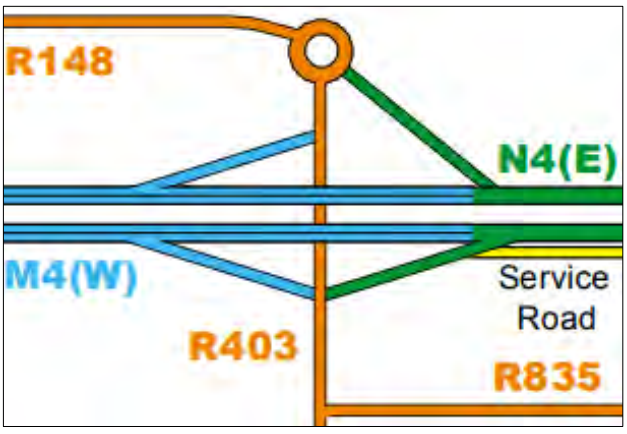


Figure 4.2: Junction 5 Leixlip – Schematic (www.tii.ie/tii-library/Network_Management/Junction%20Layout%20Maps/M4-Junctions.pdf)

Figure 4.3: Junction 5 Leixlip – Aerial (© Google Imagery ©2020 DigitalGlobe)

4.4 Junction 6 Celbridge

Junction 6 Celbridge is located centrally within the study area. A schematic is shown in Figure 4.4 and an aerial view shown in Figure 4.5. It serves Intel Ireland, located west of Leixlip town and north of Junction 6 via the R449 and Celbridge and the Liffey Business Campus to the south via the R449 and an access road respectively. It is a grade separated 2 lane rotary junction with a roundabout to the north.

The rotary overbridge incorporates 2 No. traffic lanes throughout. The R449 Leixlip Road to the north of the junction incorporates 2 No. traffic lanes, footway and cycleway in each direction along the entire length to the R148. There is a free-flow slip-road from the R449 to the M4 eastbound.

The R449 Celbridge Road to the south of the junction incorporates 1 No. traffic lane, footway and cycleway in each direction along the entire length to the R405. The Liffey Business Campus access road to the south of the junction incorporates 1 No. traffic lane, footway and cycleway in each direction along the entire length to the campus site.

The westbound merge is a standard 1 lane slip road. The eastbound merge incorporates 2 No. traffic lanes at the start and immediately prior the nose of the slip road, the left-hand slip lanes merges into one lane. From here the slip road is a typical standard 1 lane slip road. The westbound diverge incorporates 2 No. traffic lanes with a left-hand slip road to the Liffey Business Campus. The eastbound diverge incorporates 2 No. traffic lanes.

Continued growth in the Leixlip and Celbridge areas, in particular industry such as expansion of the Intel Campus and the potential of the Liffey Business Campus, may put additional pressure on Junction 6 particularly during peak traffic times. The junction also makes provision for vulnerable road users with footpaths, cycle facilities and uncontrolled crossing points to allow vulnerable road users traverse the junction. This will be further examined during Phase 2 along with the impact of future growth on the operation and capacity of the junction.

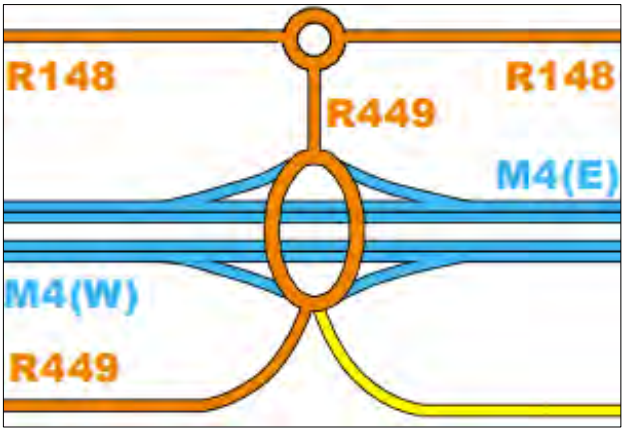


Figure 4.4: Junction 6 Celbridge – Schematic (www.tii.ie/tii-library/Network_Management/Junction%20Layout%20Maps/M4-Junctions.pdf)

Figure 4.5: Junction 6 Celbridge – Aerial (© Google Imagery ©2020 DigitalGlobe)

4.5 Junction 7 Maynooth

Junction 7 Maynooth is a grade separated junction located towards the west of the study area. A schematic is shown in Figure 4.8 and an aerial view shown in Figure 4.9. It serves Maynooth to the north via the R406 and Straffan to the south, also via the R406.

The westbound diverge is a standard 1 lane slip road connecting to the Straffan Road Roundabout. The westbound merge, eastbound merge and eastbound diverge are all a standard 1 lane slip road. The overbridge incorporates 1 No. northbound lane, 1 No. southbound lane, 1 No. right-turn lane and 2 No. footways.

The Straffan Road Roundabout also incorporates access to Maynooth Business Campus to the east and a number of local businesses to the west.

This junction has geometric and safety issues particularly from a vulnerable road users' perspective. Site observation indicate high volumes of vulnerable road users accessing Maynooth Business Park to the south of the junction from Maynooth town. These users need to navigate through the junction where they will interface with traffic using the slip roads and the Straffan Road Roundabout.

Observed driver behaviour onsite also noted, as a result of congestion at peak times, drivers using the eastbound diverge planning to turning right towards Straffan had reduced opportunities for cross the junction and some turned left at the top of the slip road and undertook a U-turn at Barton Transport to proceed towards Straffan.

Figure 4.6: Barton Transport Entrance (Arup Site Visit 5th of February 2020)

Figure 4.7: Vulnerable Road Users at Junction 7 (©2020 Google)

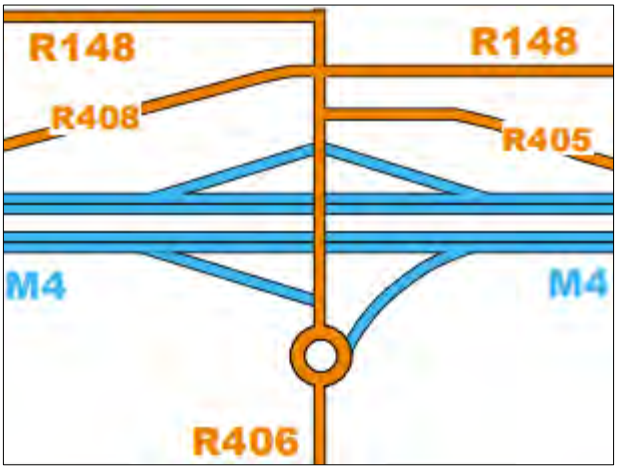


Figure 4.8: Junction 7 Maynooth – Schematic (www.tii.ie/tii-library/Network_Management/Junction%20Layout%20Maps/M4-Junctions.pdf)

Figure 4.9: Junction 7 Maynooth – Aerial (© Google Imagery ©2020 DigitalGlobe)

5 Journey Time Assessments

Journey time data for M4/N4 corridor was collected using the Google Maps data. Journey time durations were taken on Wednesday 12th February 2020 for the am peak (07:30), pm peak (17:30) and off-peak times for a number of different routes within the study area. These are shown in Figure 5.1 and Figure 5.2.

Average journey times from different locations to the M50 vary from approximately 16 minutes (Junction 5) to 25 minutes (Junction 7) during the am peak which equates to an average speed of 21km/h and 32km/h respectively. Average journey times from the M50 to different locations vary from approximately 13 minutes (Junction 5) to 18 minutes (Junction 7) during the am peak which equates to an average speed of 27km/h and 45km/h respectively.

Average journey times from different locations to the M50 vary from approximately 5 minutes (Junction 5) to 10 minutes (Junction 7) during the pm peak which equates to an average speed of 63km/h and 77km/h respectively. Average journey times from the M50 to different locations vary from approximately 12 minutes (Junction 5) to 21 minutes (Junction 7) during the pm peak which equates to an average speed of 28km/h and 39km/h respectively.

These figures indicate that during the am peak, there may be no significant difference in the inbound and outbound journey times to Junction 6, with some differences apparent between Junction 6 and 7. However, during the pm peak, the outbound journey times are significantly longer than the inbound journey times. Outbound pm peak journey times to Junction 5, Junction 6, Junction 7 and to Celbridge town are approximately double those of the inbound pm peak journey times.

From an analysis of the anticipated travel patterns, it could be assumed that the inbound am and outbound pm represents the peak demand flow directions in either period, as they include the movements of commuters travelling to and from Dublin. Therefore, the outbound am and inbound pm peaks would represent a lower demand flow to their opposing flow direction in each period. This can be seen by the improved journey time in the inbound pm peak, which closely match off peak times. However, this is not reflected for the outbound am peak. This may be due to the lane drop experienced on the outbound am peak from 3 lanes to 2 lanes at Junction 5, which is a lane gain for the inbound pm peak. Further journey time assessments will be undertaken as part of the detailed studies during Phase 2.

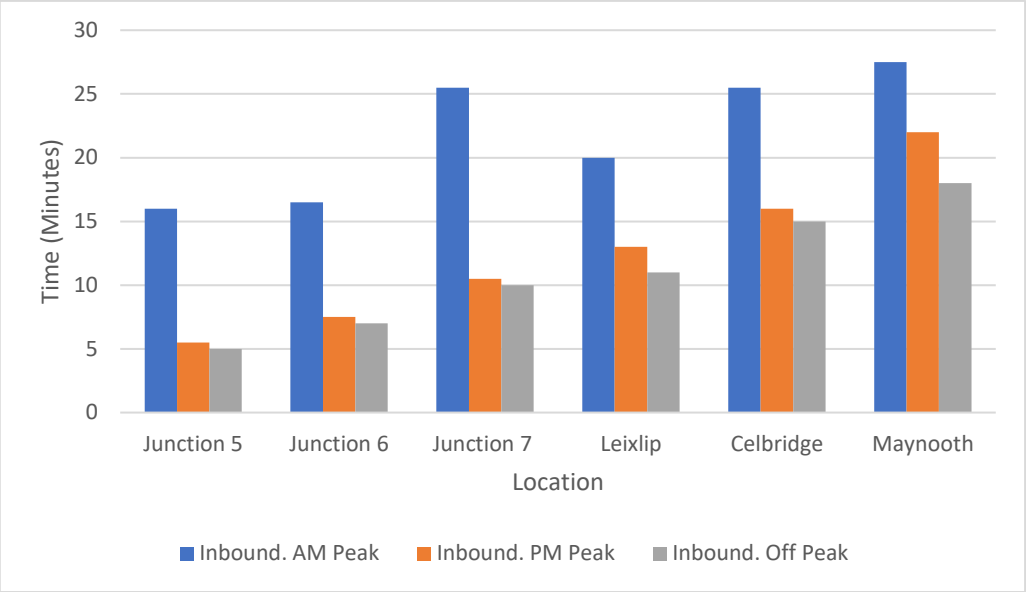


Figure 5.1: Inbound Travel Times from various locations to M50

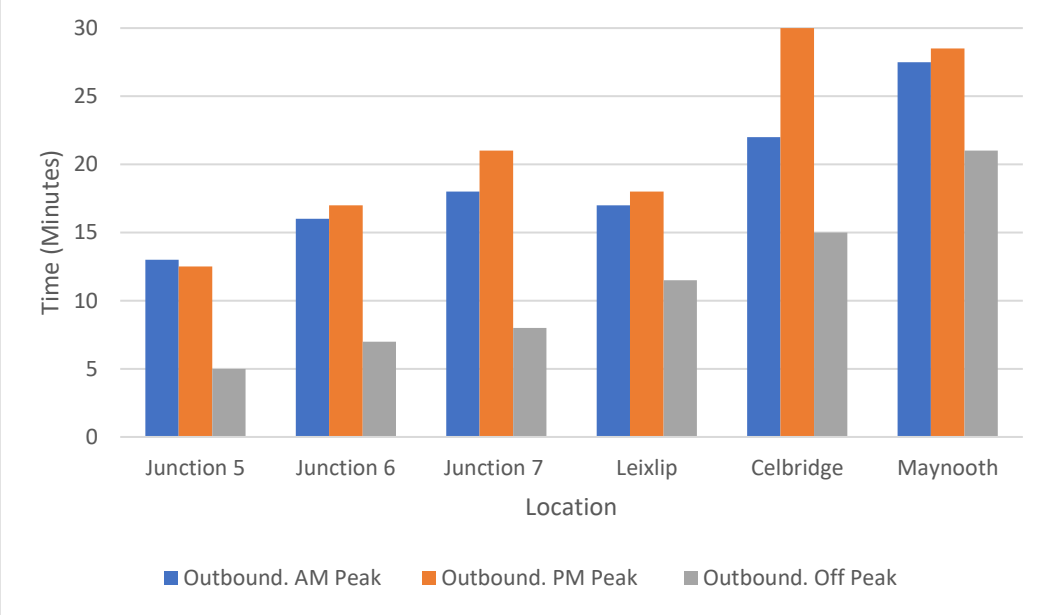


Figure 5.2: Outbound Travel Times from M50 to various locations

The am peak and pm peak journey times comparison with off-peak journey times is shown in Figure 5.3. There is an increase of 230% in the journey time from Junction 5 to the M50 inbound during the am peak when compared to the free-flow conditions at off-peak times, which provides an indication of the congestion issues on the M4 between the study area and the M50. Furthermore, there is an increase of 155% in the journey time from Junction 7 to the M50 inbound during the am peak when compared to the free-flow condition at off-peak times.

Outbound, there is an increase of 143% in the journey time from the M50 to Junction 6 outbound during the pm peak when compared to the free-flow conditions

at off-peak times, which provides an indication of the congestion issues on the M4/N4 both within the study area and between the study area and the M50.

There is an increase of 163% in the journey time from the M50 to Junction 7 outbound during the pm peak when compared to the free-flow conditions at off-peak times, which provides an indication of the congestion issues on the M4/N4 both within the study area and between the study area and the M50.

There are also increases in the journey times from the M50 regarding the towns of Celbridge (100%), Leixlip (57%) and Maynooth (36%) when comparing the pm peak to the free-flow conditions. The journey time to the M50 regarding the towns of Celbridge (70%), Leixlip (82%) and Maynooth (53%) increase when comparing the am peak to the free-flow conditions.

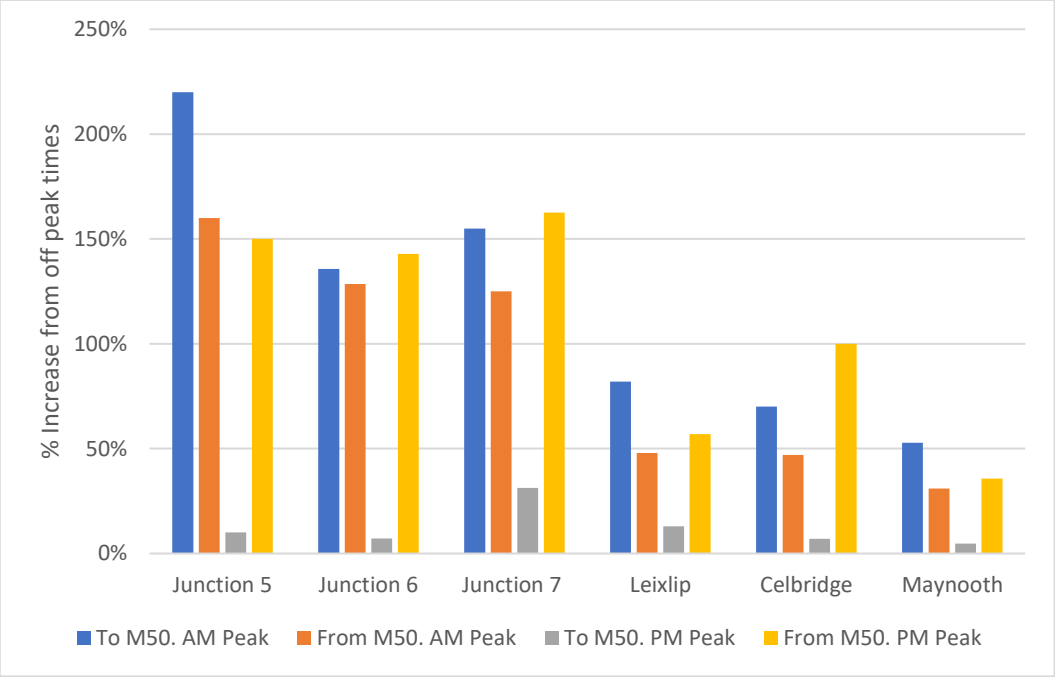


Figure 5.3: % Time Increase at Peak Times versus Off Peak

5.1 Potential Impact

The potential impact of this high congestion is that it may be causing a 'shockwave' queue back onto local, regional and distributor roads accessing and exiting the M4 at a number of locations including Junction 5, Junction 6 and Junction 7.

The above journey times represent averages. The degree of saturation on the route means that such journey times can be highly volatile and unpredictable, particularly in the am and pm peaks. Refer to Section 6.1 for analysis on traffic volumes.

Comparatively minor incidents along this corridor can compound congestion significantly with consequent increases in journey times. The most common type of collision on the M4 corridor between Junction 5 and Junction 7 were rear end shunt type collisions, which accounted for 32% of all collisions between 1996 and 2013 (refer to Section 7). These are typically indicative of congestion and driver distraction.

Further journey time assessments will be undertaken as part of the detailed studies during Phase 2.

6 Traffic Volumes

6.1 Traffic Counts

6.1.1 Overview

Transport Infrastructure Ireland's (TII) Traffic Count Data website presents information on traffic volume and composition obtained via a network of traffic counters embedded in the road surface. Using this database, Annual Average Daily Traffic (AADT) volumes for the existing M4 within the study area for the year 2019 have been obtained from TII Traffic Monitoring Units (TMU) located on the route and are presented in Table 6.1 below. The TMU locations are shown in Figure 6.1.

Traffic Counter Location	AADT (2019)	HGV (%)	HGV (AADT)
M4 Junction 3 Newcastle – Junction 4 Lucan	85,939	4.5	3,867
M4 Junction 6 Celbridge – Junction 7 Maynooth	59,435	5.6	3,328
M4 Junction 7 Maynooth – Junction 8 Kilcock	46,585	9.6	4,472
M4 Junction 8 Kilcock – Junction 9 Enfield (east)	29,402	10.3	3,028
M4 Junction 9 Enfield (west)	14,671	10.6	1,555

Table 6.1: Existing M4 AADT

Figure 6.1: Traffic Counter Locations (© Google Map data ©2020 Tele Atlas)

Table 6.1 shows that traffic volumes on the M4/N4 between Junction 9 Enfield and Junction 3 Newcastle increases significantly as the population centres of Enfield, Kilcock, Maynooth, Celbridge, Leixlip, Lucan and the surrounding hinterlands utilise the M4/N4 route as their main route to access the M50 and Dublin.

There is a circa 6-fold increase (85,939/14,671) in traffic volumes from Junction 9 Enfield to Junction 3 Newcastle. There is a circa two-fold increase (29,402/14,671) in traffic volume at Junction 9. This is due to the traffic accessing the M4 from the

town of Enfield and its surrounds. This pattern of increase is replicated at all junctions from Junction 9 through the study area and onto Junction 3. Increases, based on traffic counter data, include 128% (59,435/46,585) between Junction 6 and 7 and 158% (46,585/29,402) between Junction 7 to 8. Trends in HGV volumes indicate a spike in AADT between Junction 7 and 8, which drops off either side of both junctions. This trend may be influenced by a number of factors including the toll, orbiting routes and local businesses. This and the influence the toll has on travel patterns on the M4 mainline will be examined further in Phase 2.

Based on the TII traffic counters located between Junction 6 Celbridge and Junction 7 Maynooth, the M4 is carrying approximately 20% of the daily traffic on the route during the am peak period (06:00 – 09:00) and 24% of the daily traffic on the route during the pm peak period (16:00 – 18:00). This constitutes approximately 44% of the total daily traffic. These figures are comparable with two other major commuter routes into Dublin, the N11 and N7.

6.1.2 Level of Service

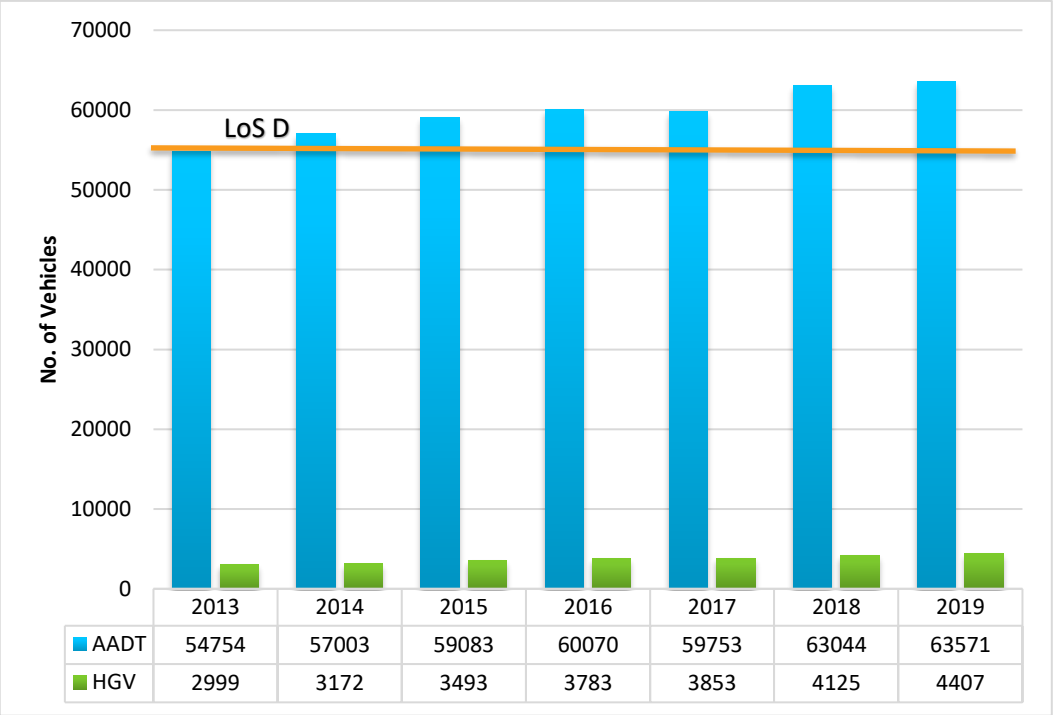
The US Highway Capacity Manual (HCM) specifies a Level of Service (LoS) for a road as a quality measure describing operational conditions within a traffic stream. This is generally in terms of service measures such as speed and travel time, freedom to manoeuvre, traffic interruptions, and comfort and convenience. Six LoS are defined for various types of routes from A to F, with LoS A representing the best operating conditions and LoS F the worst. The target minimum LoS for national roads in Ireland is LoS D.

TII standards (DN-GEO-03031) defines the capacity for a wide motorway for LoS D as 55,000 AADT. Traffic figures taken from the TII permanent traffic counters on the M4 indicate that the section of the corridor under consideration does not meet LoS D in terms of capacity. Between Junction 7 Maynooth and Junction 8 Kilcock, the minimum target for LoS D is currently being achieved however trends suggest that this may change in the near future.

6.1.3 M4 Junction 6 Celbridge to Junction 7 Maynooth

Based on data from 2013 to 2019 and using averaged daily figures for weekdays (Monday – Friday) only during the month of October, it is evident that traffic volumes on the M4 at this location have increased significantly.

The AADT and HGV figures for 2013 through to 2019 are shown in Figure 6.2. The AADT increased from 54,754 in 2013 to 63,571 in 2019, an increase of over 16%. The HGV levels increased from 2,999 in 2013 to 4,407 in 2019, an increase of 47%. This indicates the increasing importance of the M4 as a strategic TEN-T route for the transportation of goods to and from Dublin Port and Dublin Airport.



	2013	2014	2015	2016	2017	2018	2019
AADT	54754	57003	59083	60070	59753	63044	63571
HGV	2999	3172	3493	3783	3853	4125	4407

Figure 6.2: M4 AADT and HGV between Junction 6 and Junction 7 (2013 - 2019)

A comparison of the 2013 and 2019 traffic flow profile (2-way volumes) is shown in Figure 6.3. This data illustrates the magnitude and concentration of flows around the am and pm peaks. While the increase in overall traffic volume is clearly apparent, it is evident that the maximum traffic volumes experienced during the am and pm peaks have not risen significantly. Instead, the duration of the am and pm peak has broadened, with morning and evening congestion lasting longer than before, particularly the am peak. The am peak in 2013 was from 7am to 7:30am whereas the am peak in 2019 commences earlier from 06:00 and continues through to 09:00. The pm peak in 2013 was at 17:00 whereas the peak in 2019 is at 16:30. This reflects commuters starting their workday earlier, which may be related to commuters seeking to avoid congestion and unreliability of journey time. There is a general increase in AADT outside of the peak times.

The geometric road layout between Junction 5 and Junction 8 is of a high standard with increasing traffic volumes being the primary reason why the LoS has dropped below the minimum target.

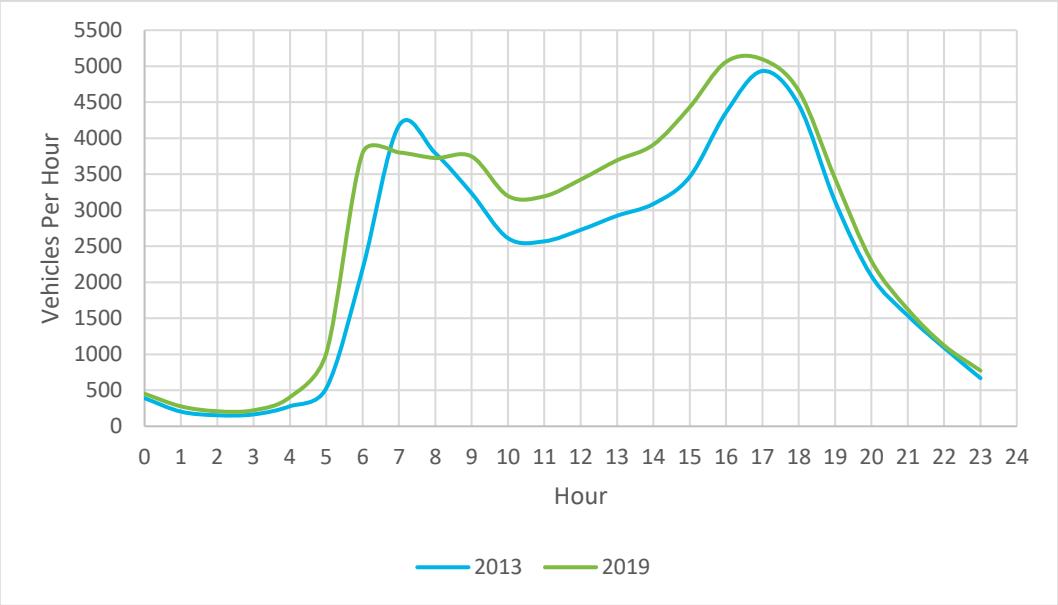


Figure 6.3: M4 Daily Traffic Flow Profile (2 Way Volumes) – 2013 / 2019

The 2019 traffic flow profiles for the eastbound and westbound directions are shown in Figure 6.4. This shows a very distinct eastbound am peak at 06:00 with commuters travelling to Dublin for work and other purposes. The data also shows a westbound pm peak between 16:00 and 17:00. This also demonstrates that westbound and eastbound traffic levels are now in excess of 15,000 and 14,800 vehicles during the morning (06:00 - 09:00) and evening (16:00 - 18:00) peaks respectively.

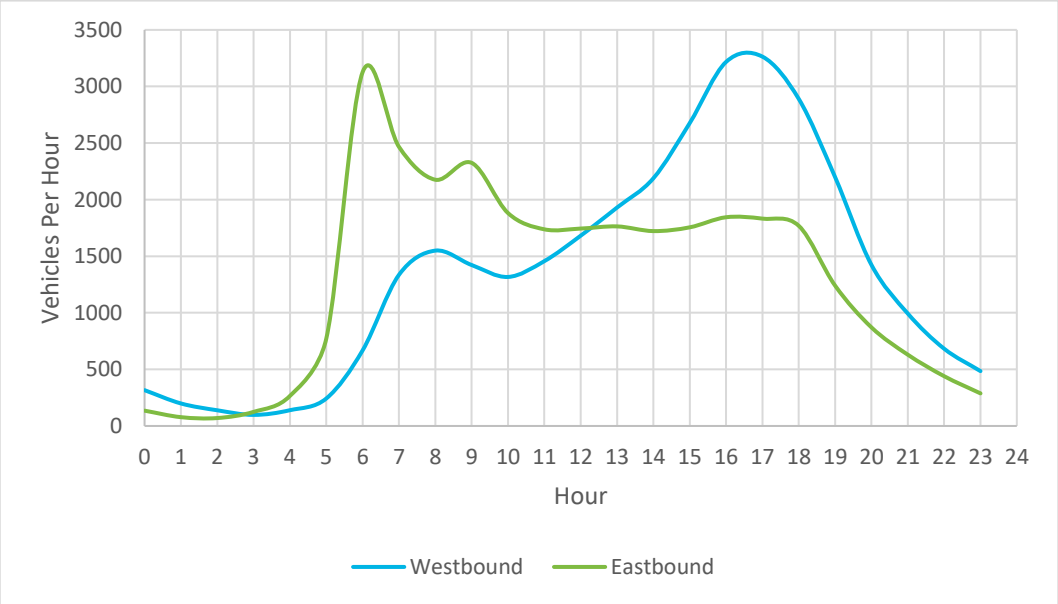


Figure 6.4: M4 Daily Traffic Flow Profile (Each Direction) – 2019

6.1.4 M4 Junction 7 Maynooth to Junction 8 Kilcock

Based on data from 2013 to 2019 and using averaged daily figures for weekdays (Monday – Friday) only during the month of October, it is evident that traffic volumes on the M4 at this location have increased significantly.

The AADT and HGV figures for 2013 through to 2019 are shown in Figure 6.5. The AADT increased from 40,468 in 2013 to 49,269 in 2019, an increase of 22%. The HGV levels increased from 3,424 in 2013 to 5,930 in 2019, a significant increase of 73%. This indicates the increasing importance of the M4 as a strategic TEN-T route for the transportation of goods to and from Dublin Port and Dublin Airport.

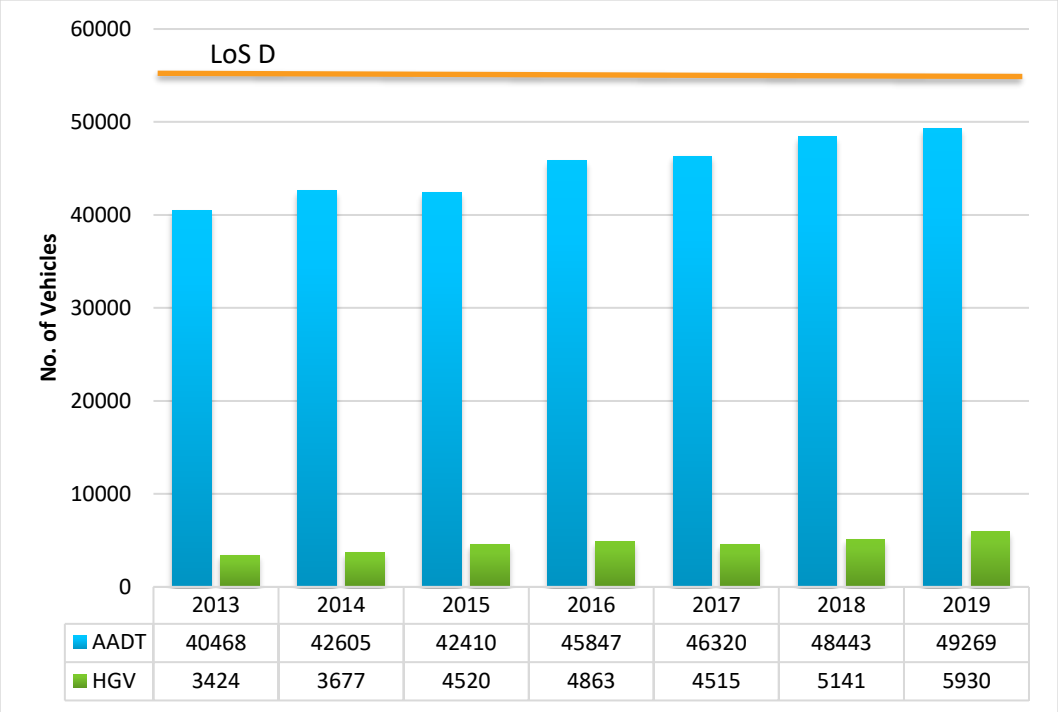


Figure 6.5: M4 AADT and HGV between Junction 7 and Junction 8 (2013 - 2019)

A comparison of the 2013 and 2019 traffic flow profile (2-way volumes) is shown in Figure 6.6. This data illustrates the magnitude and concentration of flows around the am and pm peaks. While the increase in overall traffic volume is clearly apparent, it is evident that the maximum traffic volumes experienced during the am peak has not risen significantly. Instead, the duration of the am and pm peak has broadened, with morning and evening congestion lasting longer than before, particularly the am peak.

The am peak in 2013 was from 7am to 7:30am whereas the am peak in 2019 commences earlier from 06:00 and continues through to 09:00. The pm peak in 2013 was at 17:00 whereas the peak in 2019 is at 16:45. This reflects commuters starting and finishing their workday earlier. There is a general increase in AADT outside of the peak times.

The geometric road layout between Junction 5 and Junction 8 is of a high standard with increasing traffic volumes being the primary reason why the LoS has dropped below the minimum target.

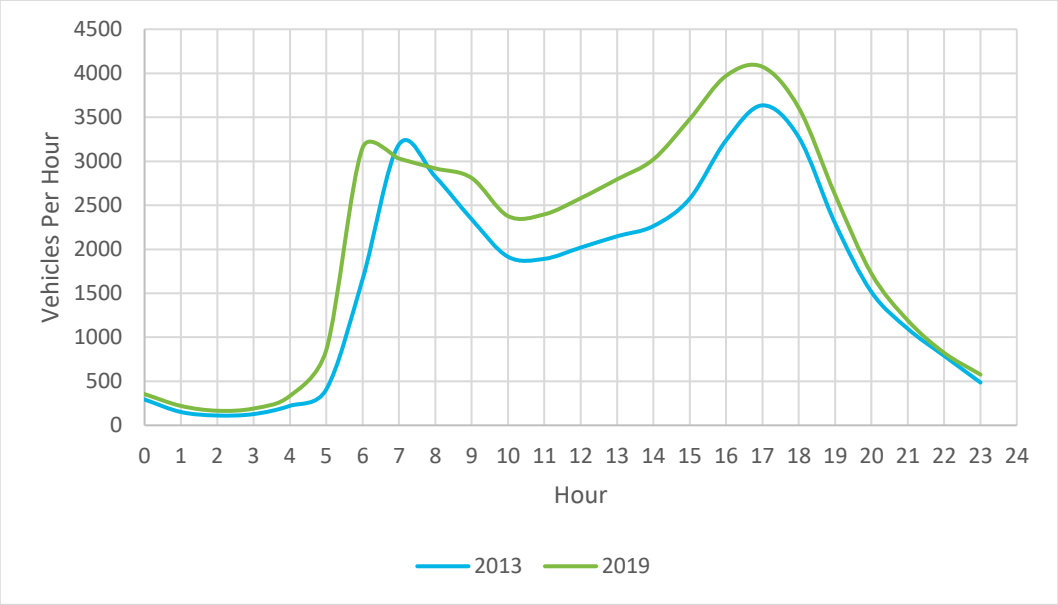


Figure 6.6: M4 Daily Traffic Flow Profile (2 Way Volumes) – 2013 / 2019

The 2019 traffic flow profiles for the eastbound and westbound directions are shown in Figure 6.7. This shows a very distinct eastbound am peak at 06:00 with commuters travelling to Dublin for work and other purposes. The data also shows a westbound pm peak between 16:00 and 17:30. This also demonstrates that westbound and eastbound traffic levels are now in excess of 11,900 and 11,600 vehicles during the morning (06:00 - 09:00) and evening (16:00 - 18:00) peaks respectively.

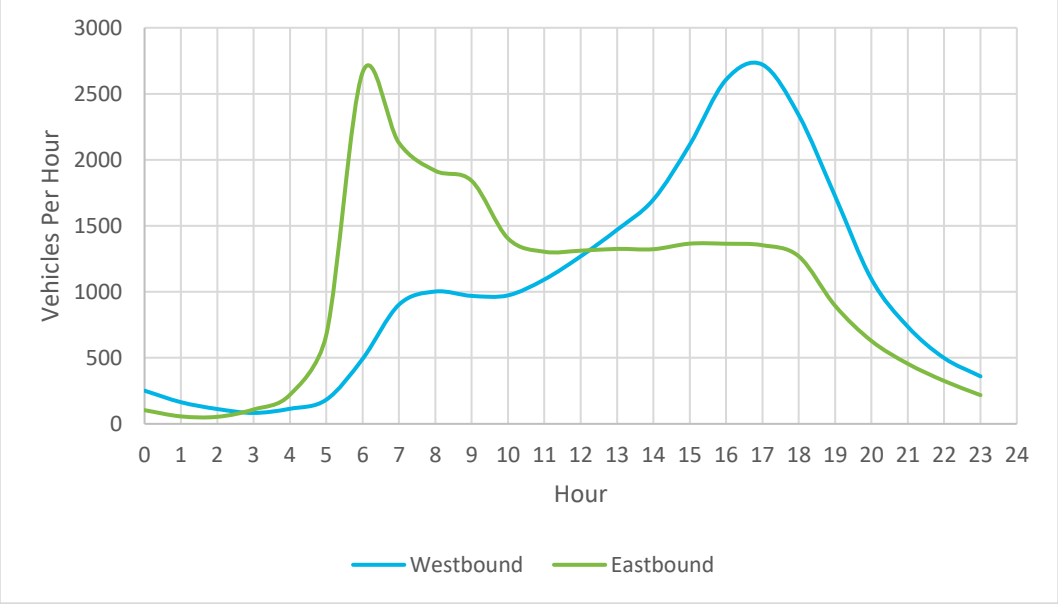


Figure 6.7: M4 Daily Traffic Flow Profile (Each Direction) – 2019

6.2 Origin and Destination Data

6.2.1 Overview

2016 census data has been utilised to determine the commuting origins and destinations for towns associated with the Maynooth to Leixlip Project. Maynooth, Leixlip and Celbridge, being the three primary towns in the study area are discussed separately. Other towns including Clane, Straffan, Enfield, Kilcock, Mullingar, Longford, Athlone and Kinnegad are discussed as a group.

6.2.2 Study Area Towns

Maynooth

Origin - The highest number of commuters travelling from Maynooth either remain in Kildare or travel to Dublin. The next most frequented county is Meath which borders Kildare to the north. Other destinations from Maynooth include Wicklow and Westmeath with a lesser quantity of commuters travelling to counties such as Offaly, Galway, Louth and Carlow.

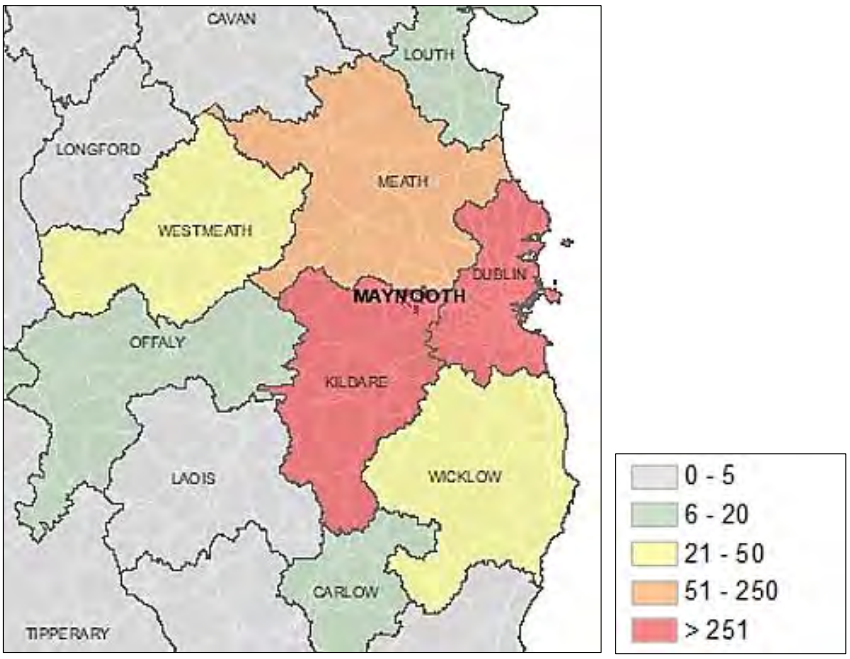


Figure 6.8: Maynooth as an Origin (2016 Census)

Destination - The counties with the highest quantity of commuters to Maynooth include all counties bordering Kildare other than Wicklow, Carlow and Laois. There are 15 counties that have more than 50 commuters travelling to Maynooth. Further south in Clare, Cork, Waterford and Kerry there are between 20 and 50 commuters travelling to Maynooth. The below map indicated that Maynooth is utilised as a major destination for many commuters across the entire country.

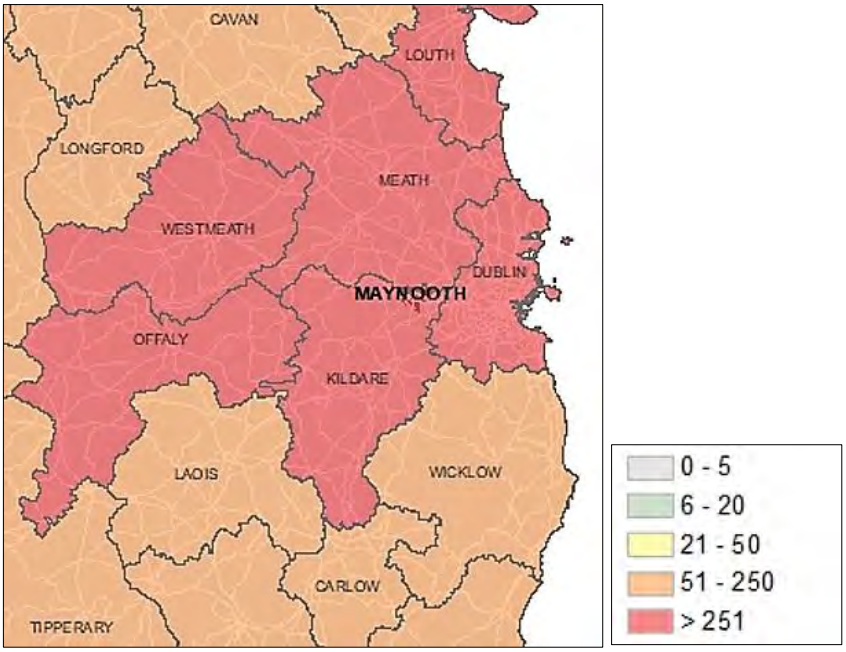


Figure 6.9: Maynooth as a Destination (2016 Census)

Leixlip

Origin - Over 250 commuters travel from Leixlip to Dublin and Kildare county. Meath is the next most frequented county for commuters travelling from Leixlip followed by Wicklow. A sporadic selection of counties are identified including Longford, Westmeath and Offlay next with between 6 and 20 commuters each.

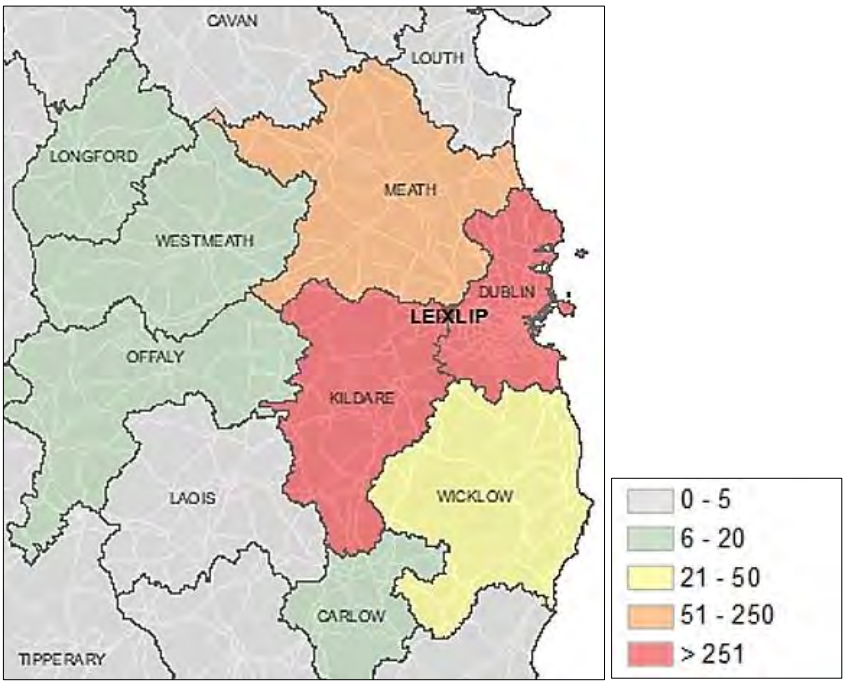


Figure 6.10: Leixlip as an Origin (2016 Census)

Destination – In excess of 250 commuters travel to Leixlip from Dublin, Kildare county and Meath. Between 50 and 250 commuters travel to Leixlip from all other counties bordering Kildare including Westmeath, Offlay, Laois, Carlow and

Wicklow. Over 50 commuters also travel to Leixlip from Louth. Between 20 and 50 commuters travel to Leixlip from counties further west including Roscommon and Galway. All 26 counties have commuters with Leixlip as a destination.

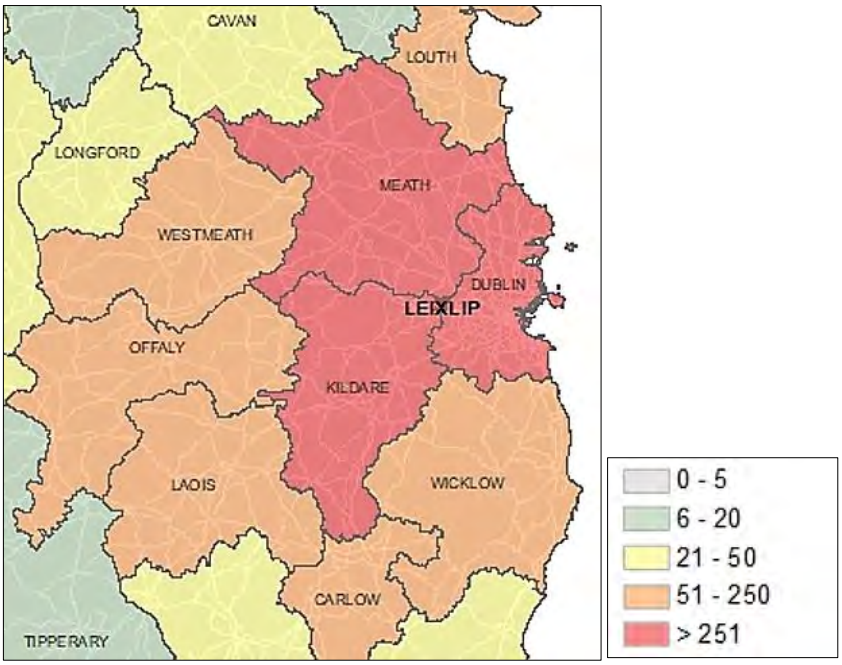


Figure 6.11: Leixlip as a Destination (2016 Census)

Celbridge

Origin - Dublin and Kildare county are the most popular destination for commuters from Celbridge. Meath is next, followed by Offlay, Westmeath, Wicklow and Carlow.

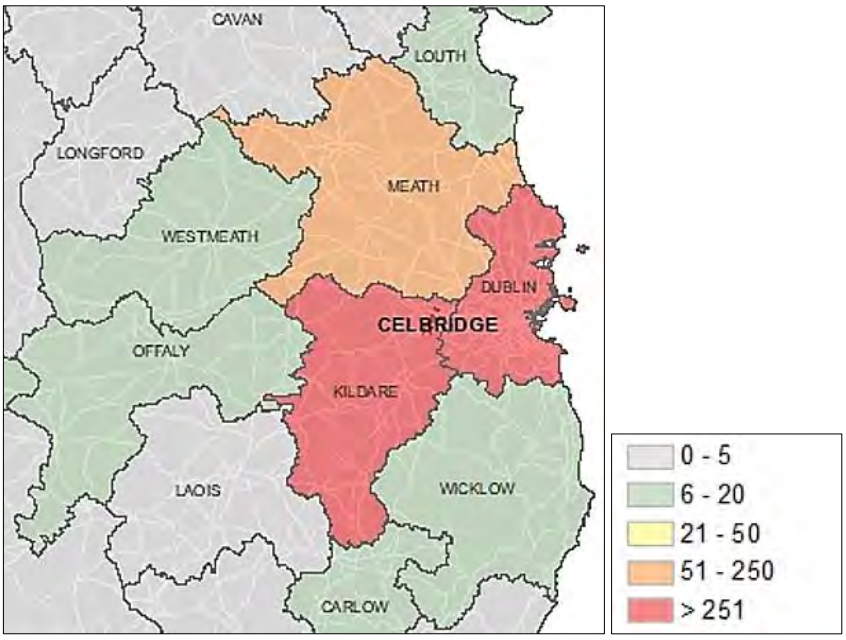


Figure 6.12: Celbridge as an Origin (2016 Census)

Destination - The most popular origin counties for commuters travelling to Celbridge are Dublin, Kildare county and Meath. Following this, Westmeath and

Offlay both have between 50 and 250 commuters to Celbridge while Wicklow, Laois and Louth have between 20 and 50 commuters. Roscommon, Longford, Cavan and Tipperary are also a further selection of counties with between 6 and 20 commuters travelling to Celbridge.

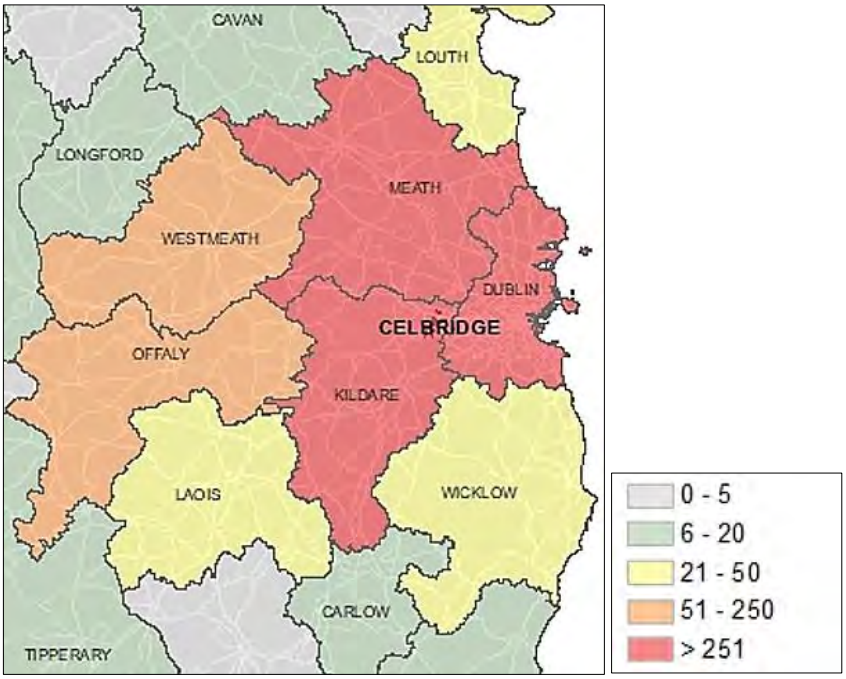


Figure 6.13: Celbridge as a Destination (2016 Census)

As an origin, general trends indicate that the residents of Maynooth, Celbridge and Leixlip commute locally within Kildare county or to adjoining counties for work, including north south, some of which within the GDA.

However, as a destination, general trends indicate that these locations are key trip attractors for adjoining counties and counties all over Ireland.

Other Towns

All other local towns noted is Section 6.2.1(Clane, Straffan, Enfield, Kilcock and Kinnegad) display similar trends to those of the three towns within the study area. All additional towns (Mullingar, Longford and Athlone) have Dublin within the top bracket of in excess of 250 commuters other than Longford. This indicates that in these towns those who commute by private car would typically utilise the M4 motorway. None of these additional towns are a destination for more than 250 commuters travelling from Dublin. Only Maynooth, Leixlip and Celbridge display this trend.

6.3 Future Forecasts

During Phase 2 of this project, a multi-modal model will be developed for the purpose of assessing the relative transport merits of various transport options, and for subsequent appraisal of the benefits of the preferred set of recommendations. This multi-modal traffic model is capable of accurately testing alternatives which may comprise of a combination of public transport options with road-based options.

The NTA, in consultation with Kildare County Council and South Dublin County Council, will define the future forecasts at the outset of the options appraisal based on planning data and these will be fixed for use throughout the project.

7 Safety Review

7.1 Study Area Assessment

The distribution of traffic collisions within the study area covering the period 1996 to 2013 is shown in Figures 7.1 to 7.3 below. The resulting number of casualties for the study area and the M4 corridor is listed in Table 7.1. This data has been obtained from the Road Safety Authority's collision statistics database and classifies accidents by severity, i.e. fatal, serious or minor.

7.2 Collision Data Summary

A summary of the collision data is shown in Table 7.1.

Year	Fatal	Seriously Injured	Minor Injury	Injury
1996	0	11	46	3
1997	3	16	66	2
1998	0	17	44	1
1999	1	11	43	1
2000	1	12	87	1
2001	1	12	40	5
2002	1	10	64	4
2003	3	7	58	1
2004	0	3	36	0
2005	1	3	50	0
2006	1	2	40	0
2007	1	2	19	0
2008	3	2	50	0
2009	2	0	29	3
2010	0	9	56	2
2011	2	10	43	1
2012	0	2	40	0
2013	1	3	55	0
Total	**21**	**132**	**866**	**24**

Table 7.1: Collision Data Summary

7.2.1 Fatal Collisions

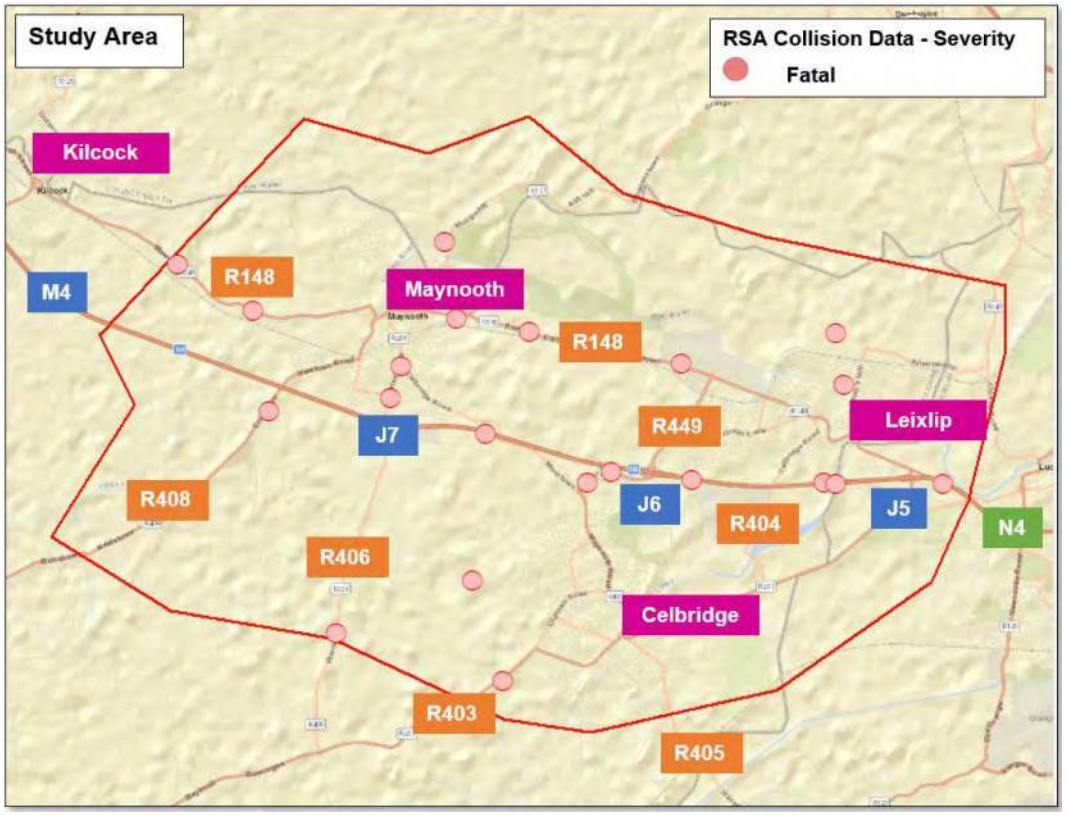


Figure 7.1: Distribution of Fatal collisions across Study Area (1996 – 2013)

Of the 21 fatalities within the study area, five of these occurred on the R148. It is heavily trafficked by vehicles avoiding the tolled M4 between Kilcock and Kinnegad. The road was previously categorised as a National Primary route until the opening of the M4 motorway and therefore carried a speed limit of 100km/h. The speed limit has now been reduced to 80km/h. Some drivers may see the R148 as a 'rat run' - adjacent to the mainline. The R148 traverses' residential areas which are not suitable for high traffic volumes or high speeds, possibly leading to an increased likelihood of collisions between vulnerable road users and vehicular traffic. A fatal collision occurred at Junction 5 Leixlip which involved a pedestrian. It occurred in 1997 at an off-peak time (22:00), the weather was dry at the time.

Further fatalities are sporadic throughout the study area on regional and local roads with an additional five collisions on the M4 corridor and three related specifically to the M4 junction diverges / merges, although no cluster pockets of fatal collisions were identified to warrant additional study. Of these five collisions, four were off peak and one was in the am peak.

7.2.2 Serious Collision

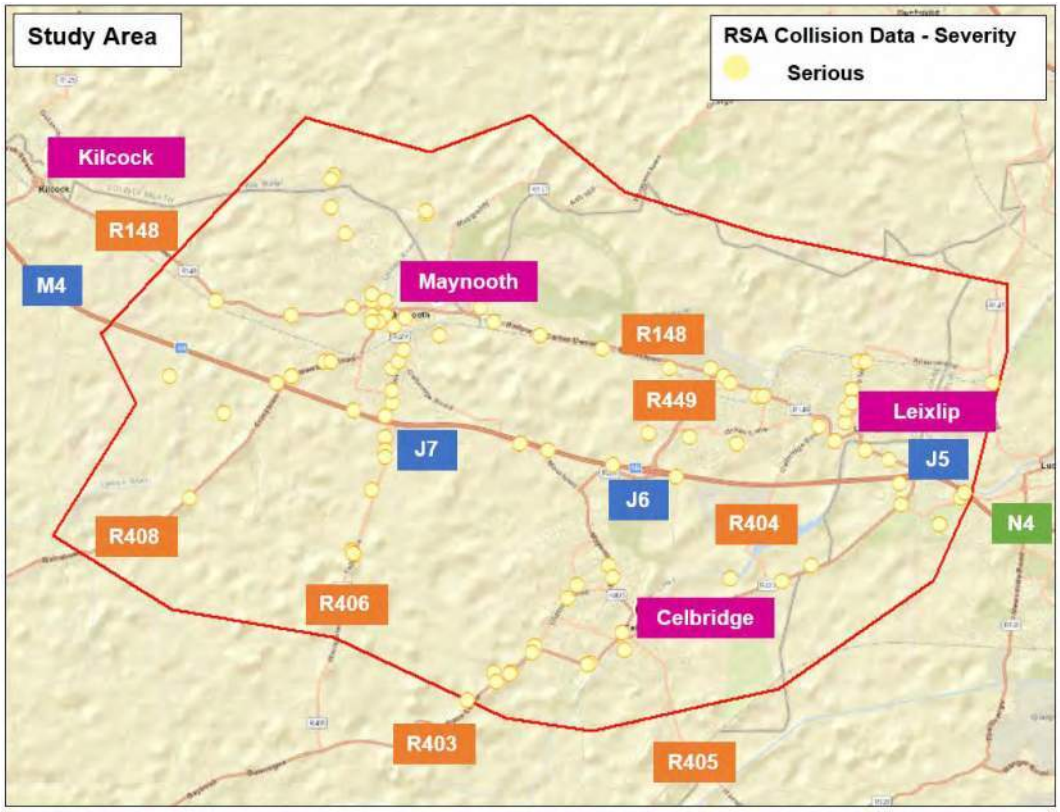


Figure 7.2: Distribution of Serious collisions across Study Area (1996 – 2013)

Within the study area, cluster pockets of serious collisions are noted on the R148, R149, R403 and R406 with a significant percentage involving direct interaction with pedestrians. A reduced number of collisions were observed on the M4 corridor when compared to the regional and local roads.

The M4 corridor displayed six serious collisions between 1996 and 2013 from Junction 5 and surrounding area to Junction 7 on the mainline. Of these six collisions, five were off peak and one was in the pm peak.

7.2.3 Minor Collisions

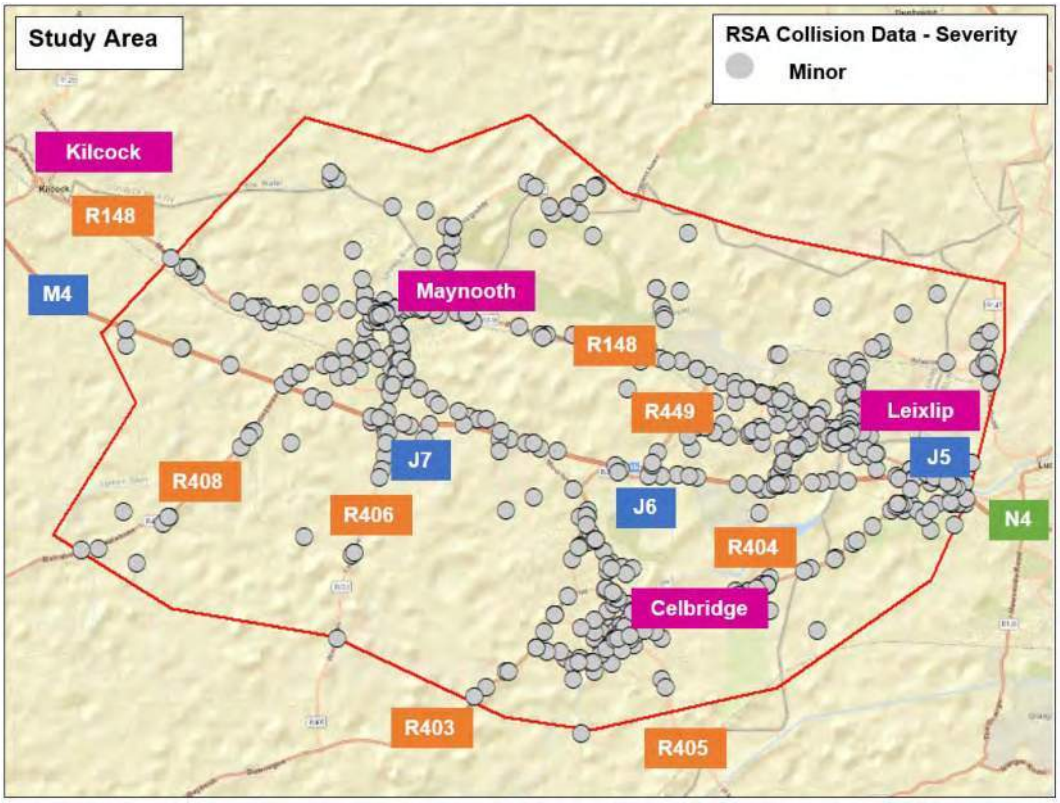


Figure 7.3: Distribution of Minor collisions across Study Area (1996 – 2013)

Within the study area, minor collisions follow a similar trend to serious collisions. There has been a significant percentage of collisions on the regional and local roads when compared to the M4 corridor itself. There appears to be an increase in minor collisions at Junction 5 Leixlip and the diverge / merge at Junction 6 Celbridge. This increase could be potentially related to the removal of the hard shoulder along with the introduction of buses and a speed limit reduction, which will be examined further in Phase 2. Upon site inspection it was noted that from a road safety engineering perspective there appears to be apparent issues on Junction 7 Maynooth in relation to capacity, movements and safety that will be examined in further detail in Phase 2.

On the M4 corridor, three minor collision clusters were identified between 1996 and 2013 from Junction 5 to Junction 7 on the M4 mainline corridor. One cluster was identified at the R404 overbridge on the M4 mainline where, within a 100m radius, seven minor collisions were evident. All collisions identified travelling eastbound occurred in the am peak time. All collisions identified travelling westbound occurred after 19:00 and were all off peak. An additional cluster was identified under the R406 overbridge on the M4 mainline. Two of the three incidents occurred on the same day within one hour of each other. The final cluster identified within this boundary was located to the east of Junction 5 on the M4 mainline. Ten minor collisions were highlighted within close proximity to each other. All identified clusters shall be examined in further detail in Phase 2.

7.2.4 Collision Type Analysis on M4 Corridor

On the M4 mainline, between Junction 5 and Junction 7, 32% (15 no.) of collisions that occurred were classed as rear end shunt type collisions, 30% (14 no.) were classed as other, 21% (10 no.) were single vehicle collisions, 11% (5 no.) were pedestrian involvement collisions and 6% (3 no.) were head on type collisions. Of the 5 pedestrian involved collisions, two of these occurred between Junction 5 and 6, two between Junction 4 and 5 and one between Junction 7 and 8. Of the three head on collisions, one occurred between Junction 4 and Junction 5, one occurred between Junction 6 and Junction 7 and one occurred between Junction 7 and Junction 8. These collisions occurred between 1996 and 2013 and are a combination of fatal, serious and minor collisions. Rear end shunt type collisions are indicative of higher density traffic (peak hour) and driver distraction. This coincides with the AADT values of the M4 as it is currently operating at LOS D or above between Junction 5 and Junction 7 which is defined as "approaching unstable flow for LOS D and “unstable flow” for LOS E (Highway Capacity Manual 2010).

7.3 M4 Average Collision Rates

TII have produced collision maps of the national road network indicating which sections of the network experience collision rates above or below the national average for a particular road type. The collision map covering the period 2014 – 2016 for the existing M4 corridor is shown in Figure 7.4 and indicates a number of sections along the route where rates exceed the national average. The highest collision rates on the route occur on the M4 motorway west of Junction 7 Maynooth and Junction 6 Leixlip. At Junction 7 Maynooth, to the west, three minor collisions occurred in the ‘twice above average rate’ section of corridor during 2014 and 2016. Two of these collisions were rear end shunt type collisions while one was a single vehicle collision. All three collisions occurred in the am peak time. At Junction 6 Leixlip eight collisions have occurred within this length of ‘twice above the national rate’ between 2014 and 2016. All eight collisions were minor collisions. Seven of the eight collisions were recorded as rear end shunt type collisions. Four of the eight collisions occurred in the am peak time with only one occurring in pm peak time. This could potentially indicate that during am peak time congestion is evident due to the high level of rear end shunt type collisions within this area. Elsewhere along the route, collision rates fluctuate above and below the national average. This information does not correlate with the collision data due to different ranges of time (1996 2013 -v- 2014 – 2016) although provides an informative means of analysing collision frequency on the mainline route.

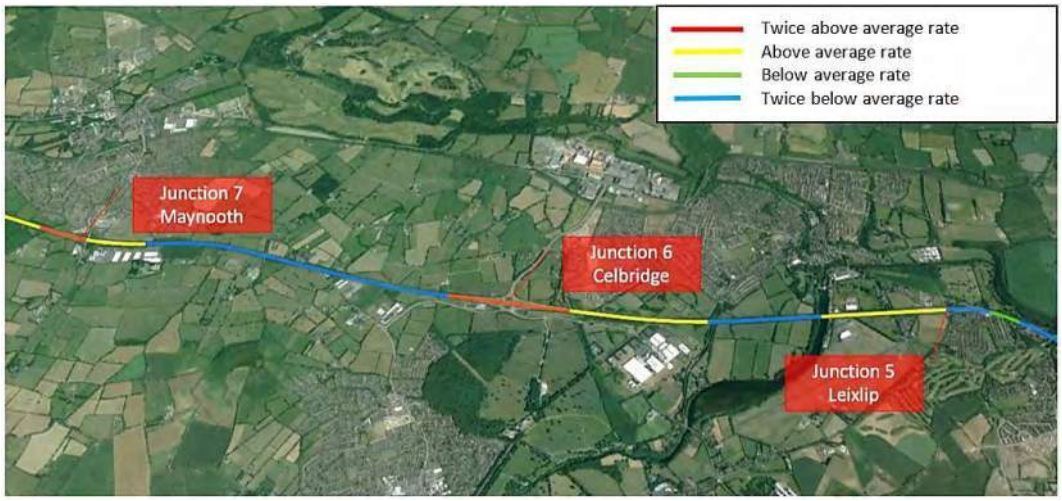


Figure 7.4: M4 Average Collision Rates (© Google Imagery ©2020 DigitalGlobe)

Reductions in the type and severity of collisions may potentially contribute to the overall benefit obtained from a project. Collision cost per casualty depending on the collision severity, extracted from the TII Project Appraisal Guidelines Unit 6.11 – National Parameters Value Sheet is shown in Table 7.2.

Collision Type	Value Per Casualty (€)
Fatal	2,310,500
Serious Injury	331,400
Damage Injury	31,100
Damage Only	2,500

Table 7.2: Collision Costs (TII Project Appraisal Guidelines Unit 6.11 – National Parameters Value Sheet)

As the project is currently at concept and feasibility phase, it is not possible to quantify the costs of any future accident savings, as the precise form of the transportation solution has not yet been identified. However, detailed projections of the safety benefits and resultant casualty savings will be analysed and compared for each potential solution during Phase 2.

7.4 Typical Collisions Profile

Figure 7.5 presents the collision type witnessed within the study area including the overall average for each type of collision at each location. As expected, pedestrian involvement is lower at the three main junctions of the mainline in comparison to the wider study area. A high quantity of rear end shunt type collisions are evident at Junction 5 while Junction 6 displays a higher than average level of single vehicle collisions. These will be investigated further in Phase 2.

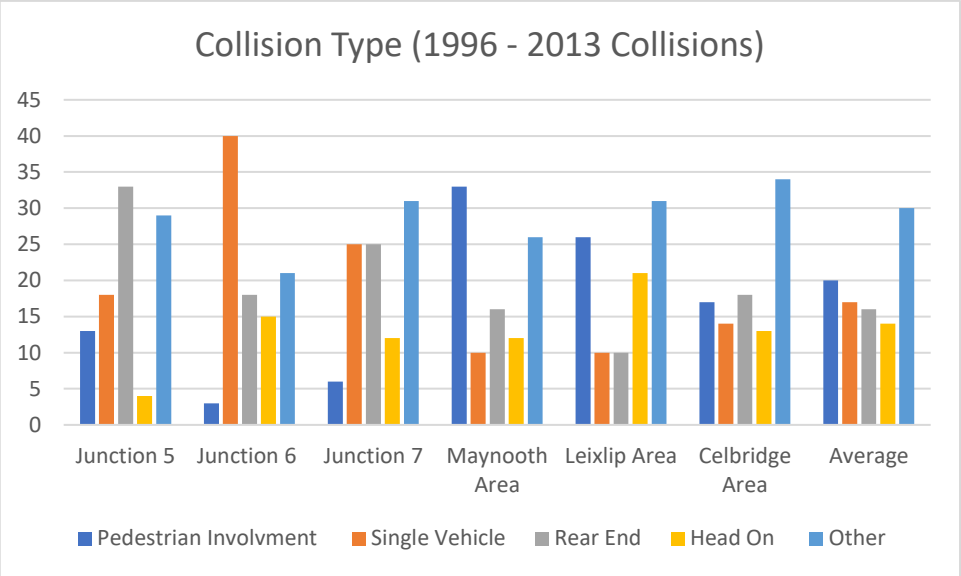


Figure 7.5: Collision Type (1996 – 2013 Collisions)

The distribution of collisions and incidents on the M4 corridor closely matches the typical profile of the traffic along the route. This is evidence that a high proportion of incidents may be attributed to the impacts of congestion. Capacity enhancement is not the sole means of reducing congestion difficulties – volumes may also be eased through demand management measures or by achieving a modal shift to public transport and a reduction in car-based commuting. Any solutions which ease congestion on the route may improve safety for all road users and should be considered.

8 Possible Transport Solutions

8.1 Overview

The Maynooth to Leixlip Project is proposed to resolve the existing transportation issues identified in the previous chapters. The options identified within the feasibility study will be taken forward for more detailed appraisal during Phase 2.

8.2 Possible Solutions

Numerous solutions to the transportation issues may be considered along the study area. The public transport solutions recommended in the Transport Strategy for the Greater Dublin Area 2016 – 2035, combined with road-based options form the basis of the feasibility study for the Maynooth to Leixlip Project. These combinations may have the potential to relieve some or most of the problems outlined above and deliver on the project objectives.

- **Do Nothing Option:** This option assumes that there will be no other investment in the transport network (other than regular maintenance) during the appraisal period.
- **Do Minimum Option:** This option involves maintaining the existing infrastructure and constructing committed projects.

8.2.1 Options - Road Based Solutions

- **Option 1**: Offline road alignment to the north;
- **Option 2**: Offline road alignment to the south;
- **Option 3**: Online Upgrade Solution;
  - Additional lanes;
  - Junctions upgrade of:
    - Junctions 5 Leixlip;
    - Junction 6 Celbridge;
    - Junction 7 Maynooth.
  - Additional lanes combined with junction upgrades (including new or additional junctions); and
  - Hard shoulder running.
- **Option 4a:** New parallel road network adjacent to M4;
- **Option 4b:** New ancillary lanes on the M4 mainline;
- **Option 5:** Upgrade of Regional Road Network;
  - Upgrade of R148;

- Upgrade of R405/R449;
- Upgrade of R403; and
- Upgrade of R406.
- Concept of improved orbital routes to be examined as a possible solution. This may distribute traffic currently utilising the M4/N4 who do not wish to use it but do so out of necessity and due to a lack of an alternative means to get them to their destination point.

Option 1 and Option 2 and will investigate the feasibility of a road-based alternative to the M4 corridor, however, it is unlikely that a wholly offline alternative will be viable in all locations. The exact extent and location of these options is not developed at this stage.

Options 3, Option 4a and Option 4b will investigate the feasibility of road-based upgrades to the current M4 corridor. These options may not be viable in all locations due to the proximity of the existing urban environment.

Option 5 will investigate the feasibility of improving the regional road network to provide a viable alternative to the M4 corridor, however, it is unlikely that this alternative will be viable in all locations due the proximity of the existing urban and human environment, topography and environmental constraints.

8.2.2 Alternatives - Non-Road Based Solutions

- **Alternative 1:** Enhancement of existing Bus Connects proposal within the study area;
- **Alternative 2:** Hard shoulder bus running between Junction 5 and Junction 7;
- **Alternative 3a:** Full bus lanes between Junction 5 and Junction 7 and widening into verges;
- **Alternative 3b:** Full bus lanes between Junction 5 and Junction 7 and widening into central median;
- **Alternative 4:** Enhancement of existing bus network on regional road network to Maynooth, Leixlip and Celbridge;

  Note: Park and Ride facility to be investigated in some/all bus locations.
- **Alternative 5: Rail Upgrade**
  - Light Rail (frequency, capacity, unrestricted etc.);
  - Heavy Rail (frequency, capacity, unrestricted etc.);

  Note: Park and Ride facility to be investigated in some/all rail locations.

- **Alternative 6: Demand Management**
  - Tolling; and
  - Ramp Metering.

The exact extent and location of these options is not developed at this stage and will be progressed during Phase 2.

Alternatives 1 to 5 will comprise of provision of public transport infrastructure. In conjunction with public transport improvements, **Alternative 6** would seek to utilise the existing asset as efficiently as possible through a series of incremental interventions aimed at relieving congestion, improving journey times and improving safety for all road users. This would initially focus on the implementation of demand management measures and thereby limit the provision of capacity enhancing infrastructure insofar as possible. It is important to note that the range of demand management measures available for consideration are varied and wide-ranging, but all with the intended purpose of reducing travel demand on the M4, such that it operates without congestion for longer and improves safety and journey time reliability. Demand management seeks to influence road user behaviour, to encourage individuals to make journeys off peak times, travel by a different mode such as cycling, walking and public transport, or avoid making the trip altogether. To achieve this objective, a range of both fiscal and non-fiscal measures can be considered which serve either to reduce or divert demand or achieve a combination of both.

Fiscal demand management measures may include:

- Road user charging – this may be variable, i.e. related to time of day, vehicle class, emissions class etc.;
- Parking charges;
- Public transport subsidies; and
- Fuel taxes.

Non-fiscal demand management measures may include:

- Access control and restriction (e.g. ramp metering);
- Public transport improvements;
- Traffic control measures (e.g. variable speed limits);
- Smarter travel measures (e.g. intelligent transport systems, incident detection);
- Traffic calming;
- Land use management and
- Travel restrictions.

9 Cost Estimate

9.1 Feasibility Working Cost

The Maynooth to Leixlip Project is a complex and highly constrained project. At Phase 1, it is not possible to have sufficient detail on the scale and/or nature of the transportation solution, or the timetable of the project to ultimately be delivered. As such, it is not possible to accurately produce a Feasibility Working Cost (FWC) that could be used as a basis for assigning a project budget. Therefore, no FWC is available at Phase 1 of the project.

10 Need for Intervention

10.1 Existing Transport Problems

There are traffic and congestion problems along the M4, particularly at peak times. The AADT between Junction 6 and Junction 8 increased by circa 19% between 2013 and 2019. The M4 serves strategic traffic and also the GDA. Due to a lack of modal shift and congestion, quality of life is being impacted because people are required to commute earlier to avoid congestion or alternatively have longer commutes because of congestion. These problems are going to be exacerbated with the number of planned developments in the study area resulting in significant future population increases.

Approximately 89% of the labour force in Kildare have their place of work in Kildare. This shows that there is significant local traffic within the GDA and wider commuter belt, which is impacting on the M4 capacity to act as a strategic route.

There is an extensive public transport network in the study area serving commuters. However, there is a high dependency on private cars as a preferred mode of transport (>60% for those living in Maynooth but working outside of Maynooth). Therefore, the modal shift from private car to public transport has not materialised. Accessibility to rail based public transport is an issue due to inadequate cyclist infrastructure and a general lack of availability of park and ride facilities. There is an issue regarding the availability of park and ride facilities for bus services. Bus services utilising the M4 must negotiate the same traffic volumes as private cars, which disincentivises take up of public transport alternatives to the private car. There may also be a perception that public transport may be convoluted and is not reliable.

Junction 7 Maynooth currently has geometric and safety issues particularly from a vulnerable road users' perspective. There are high volumes of vulnerable road users accessing Maynooth Business Park to the south of the junction from Maynooth town. These users need to navigate through the junction where they will interface with traffic using the slip roads and Straffan Roundabout. The problems at Junction 7 require intervention in the short to medium term.

10.2 Policy

From a policy perspective, the M4/N4 is part of the TEN-T comprehensive network and also specifically noted in the NPF, connecting Dublin to the west and northwest. The M4/N4 ability to act as this strategic link is compromised due to its utilisation for local GDA commuter purposes. The NDP also lists the project to be progressed through pre-appraisal and early planning. This requires a significant intervention to resolve the problems identified in this report. A short-term intervention in isolation will not suffice. Any intervention should also look to grasp the opportunity to enhance or complement the existing BusConnects proposals within the study area. The overall solution to the current and future transportation problems require a number of interventions which are integrated and connected and support a dedicated modal shift from private car to public transport. This may involve collaboration with other transportation bodies to deliver and facilitate an overall integrated solution.

The concept of improved existing orbital routes should also be examined as a possible alternative solution. This would distribute traffic currently utilising the M4/N4 who do not wish to use it but do so out of necessity and due to a lack of an alternative means to get them to their destination point.

Local policy documents reinforce the requirement to improve the safety and capacity at Junction 7 Maynooth and to examine the provision of a future improved connection to the M4, at this location or elsewhere near Maynooth. Optimisation and protection of Junction 6 is also referenced along with the examination of options for the delivery of an orbital link road from the M4 to the M3.

11 Conclusions and Recommendations

11.1 Key Findings of Feasibility Report

It is clear from the information examined during the preparation of this Feasibility Report that there are significant transportation issues along the existing corridor. The existing route and junctions are congested, journey time is variable and unreliable, vulnerable road users are not effectively accommodated and there are inadequate public transport links to support the commuting demand.

The resolution of the transportation issues along this strategic corridor is compatible with the Government's objectives in the National, Regional and Local policy documents. It is compatible with Project Ireland 2040 National Development Plan, Regional Planning Guidelines, Kildare County Development Plan and South Dublin County Development Plan. The resolution of these issues is essential to allow the corridor to function as a strategic and safe national route, whilst also ensuring that the objectives of the project are satisfied.

The key constraints identified within the feasibility study, such as the proximity of existing urban communities and environmental sites should not impede the progression of the project to Phase 2, but rather will impact on and be considered in the development of a viable and sustainable transport solution for this corridor.

11.2 Conclusions and Recommendations

The transportation issues within the study area are significant and action to resolve them needs to be progressed. Further work needs to be undertaken examining the problems in greater detail, identifying solutions and quantifying their merit and benefit.

The existing issues identified will not improve in the future without intervention to address the base problems. Feasible solutions identified in this report need to be further examined and fully appraised during Phase 2, together with any further solutions that may align with project objectives. These solutions combined with recommendations from the Greater Dublin Area Transport Strategy 2016 – 2035, Bus Connects and other projects need to be examined further. Transportation options which increase the mode share of cyclists, pedestrians and public transport users need to be examined such that a holistic solution accommodating all transport users is obtained.

The protection and enhancement of existing amenities and quality of life within the study area needs to be considered when assessing options and resolutions to the existing transportation issues.

Improving the transportation network to meet all the objectives outlined in the Project Brief is not at any cost.

The total financial cost of the proposed project must represent value for money and realise sufficient benefit to justify costs, so that the project is deliverable in an appropriate timescale to prevent the existing transport network issues from exacerbating.

MAYNOOTH TO LEIXLIP PROJECT

Appendix 3.1

Stage 1 Shift 1 - Elements

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Maynooth to Leixlip Project

Phase 2 Stage 1 Options

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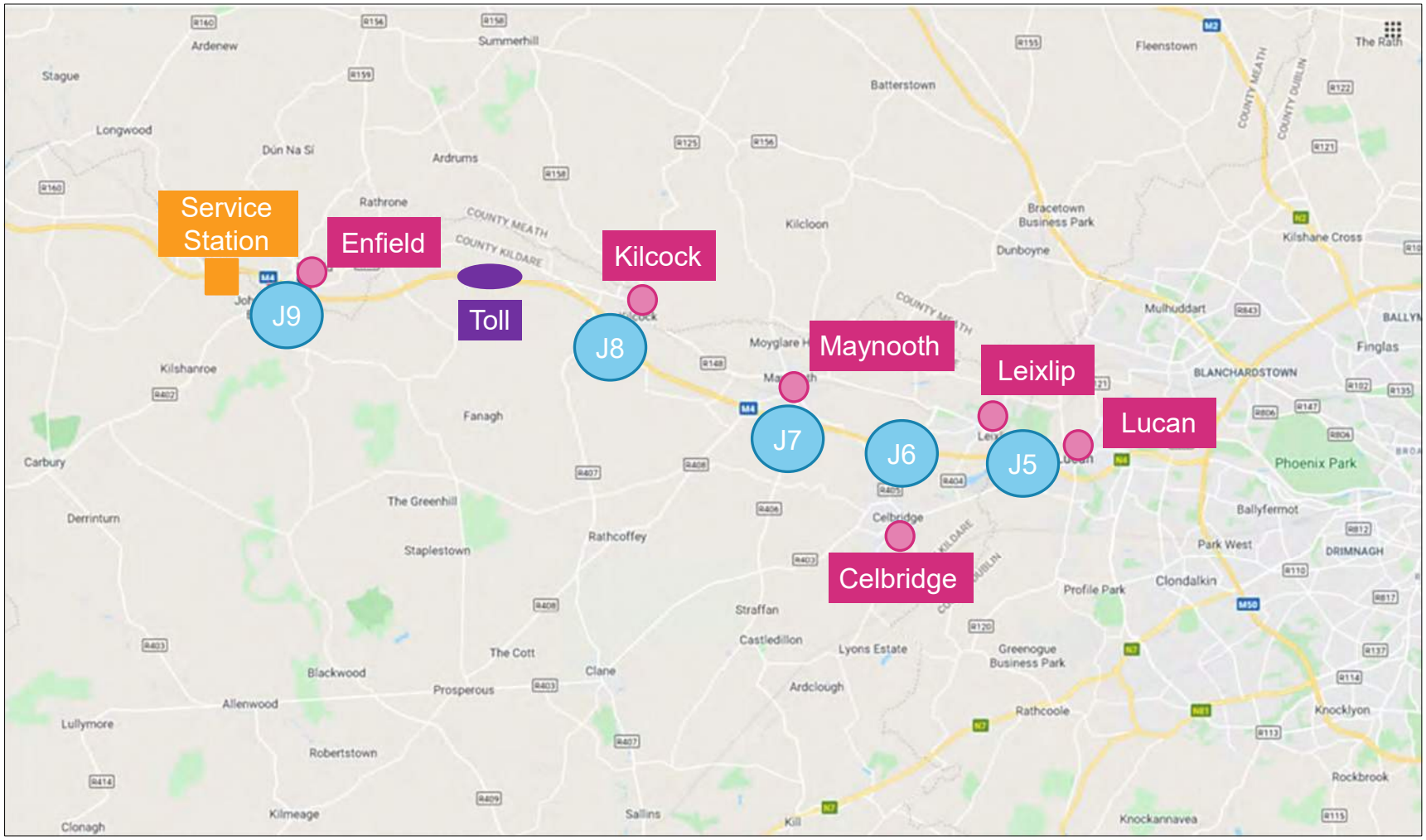
Project Overview - Wider Commuter Belt and GDA



Project Overview - Wider Commuter Belt and GDA

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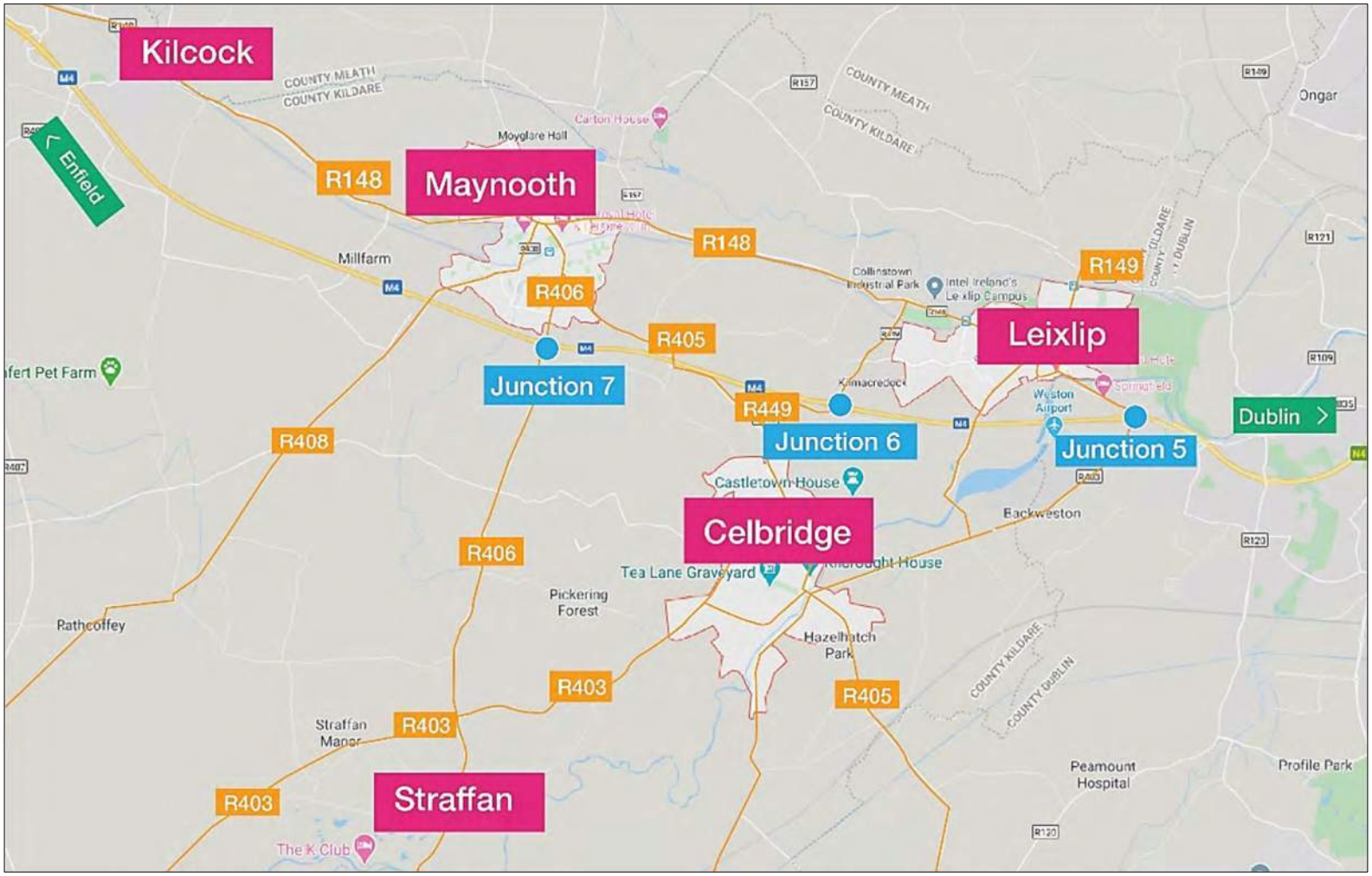
Project Overview



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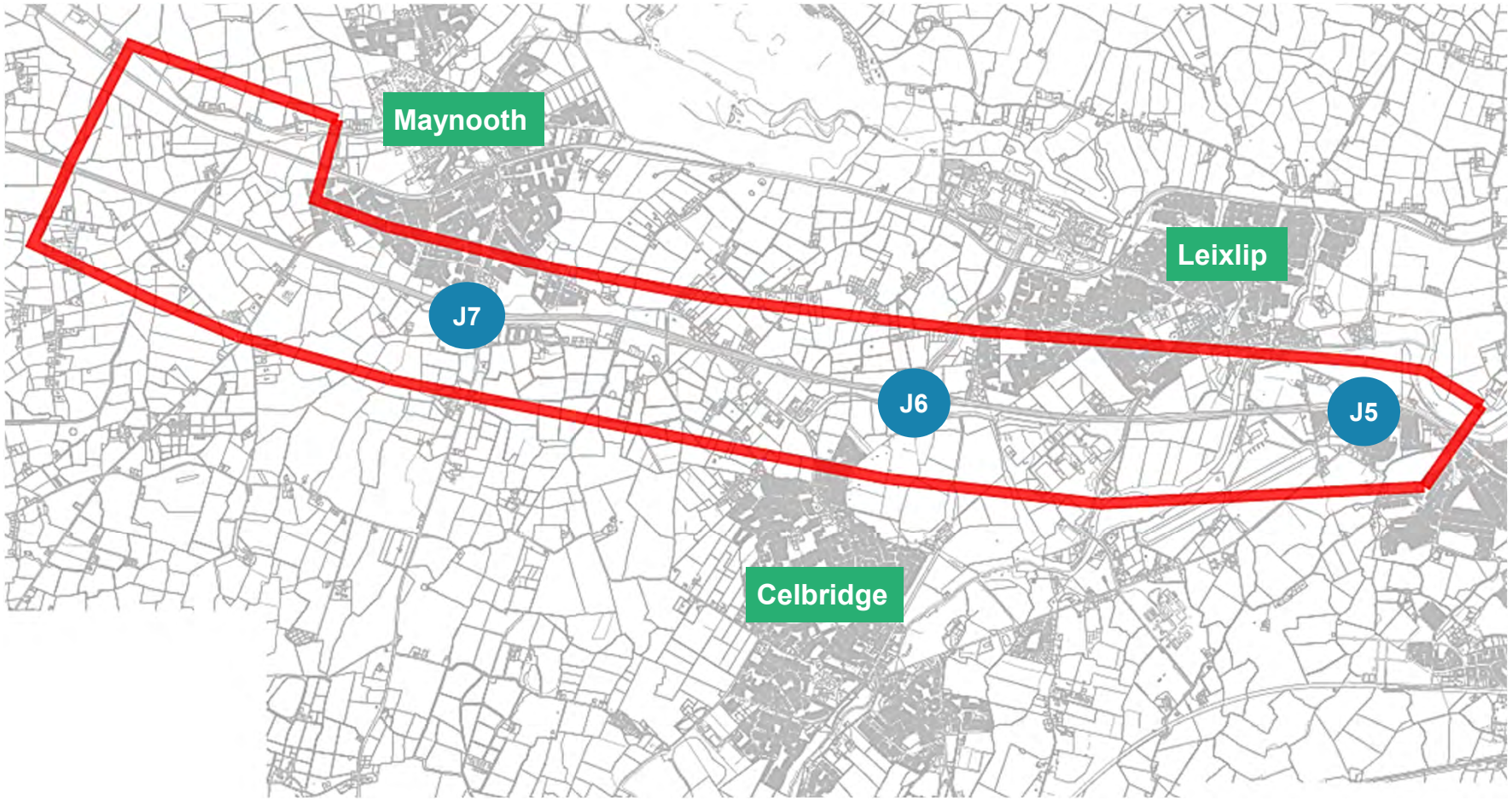
Phase 2 Study Area



Phase 2 Study Area

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Phase 2 Study Area

Phase 2 Study Area

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Need for Intervention

Existing Transport Problems

- Congestion on the M4, particularly at peak times
- AADT between J6 and J8 increased by 19% between 2013 and 2019
- M4 currently serves both strategic traffic and also local GDA traffic
- This is impacting on the M4 capacity to act as a strategic route
- Extensive public transport network in the study area
- High dependency on private cars (>60% for Maynooth commuters)
- Bus services utilising the M4 must negotiate the same traffic volumes as private cars
- Modal shift from private car to public transport has not materialised
- J7 Maynooth has geometric and safety issues

Policy

- M4/N4 is part of the TEN-T comprehensive network
- Specifically noted in the NPF and NDP
- Opportunity to enhance or complement the existing BusConnects proposals within the study area
- A number of interventions may be required which are integrated and connected
- Intervention will need to support a dedicated modal shift from private car to public transport
- This may involve collaboration with other transportation bodies to deliver and facilitate an overall integrated solution.
- Local policy documents reinforce the requirement to improve the safety and capacity at J7 Maynooth and optimisation and protection of J6 Celbridge
- The concept of improved existing orbital routes should also be examined as a possible alternative solution

MAYNOOTH TO LEIXLIP PROJECT

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- Provide the infrastructure to support an improved balance of transport modes
- Support greater road based user integration and connectivity with all other transport modes

- Provide improved accessibility to the GDA public transport network from regions outside of the GDA
- Support improved connectivity for all road users to public transport
- Enable the successful creation of place making and assist in the generation of vibrant communities

- Improve infrastructure in, across and adjacent to the M4/N4 corridor which may form barriers to physical activity and in particular linkage between key local trip attractors including education, work, residential, leisure and natural environment.
- Support the provision for cycle parking and infrastructure at key public transport nodes and destinations
- Support the creation of a healthy environment conducive to active travel

- Enable the provision of a safer travelling environment for all road users, including vulnerable road users

- Facilitate an increase in modal shift from private car to public transport and walking/cycling thus supporting a transition towards low carbon and climate resilience

- Provide a more reliable and resilient transport solution
- Manage congestion on the M4 corridor
- Provide the infrastructure to enable transport solutions to move more people more efficiently
- Support the protection of the economic prospects of Maynooth, Leixlip, Celbridge, Kilcock, Enfield and their rural hinterland
- Facilitate effective strategic traffic movement, including from regional centres of Athlone and Sligo
- Facilitate effective freight movement

Project Objectives

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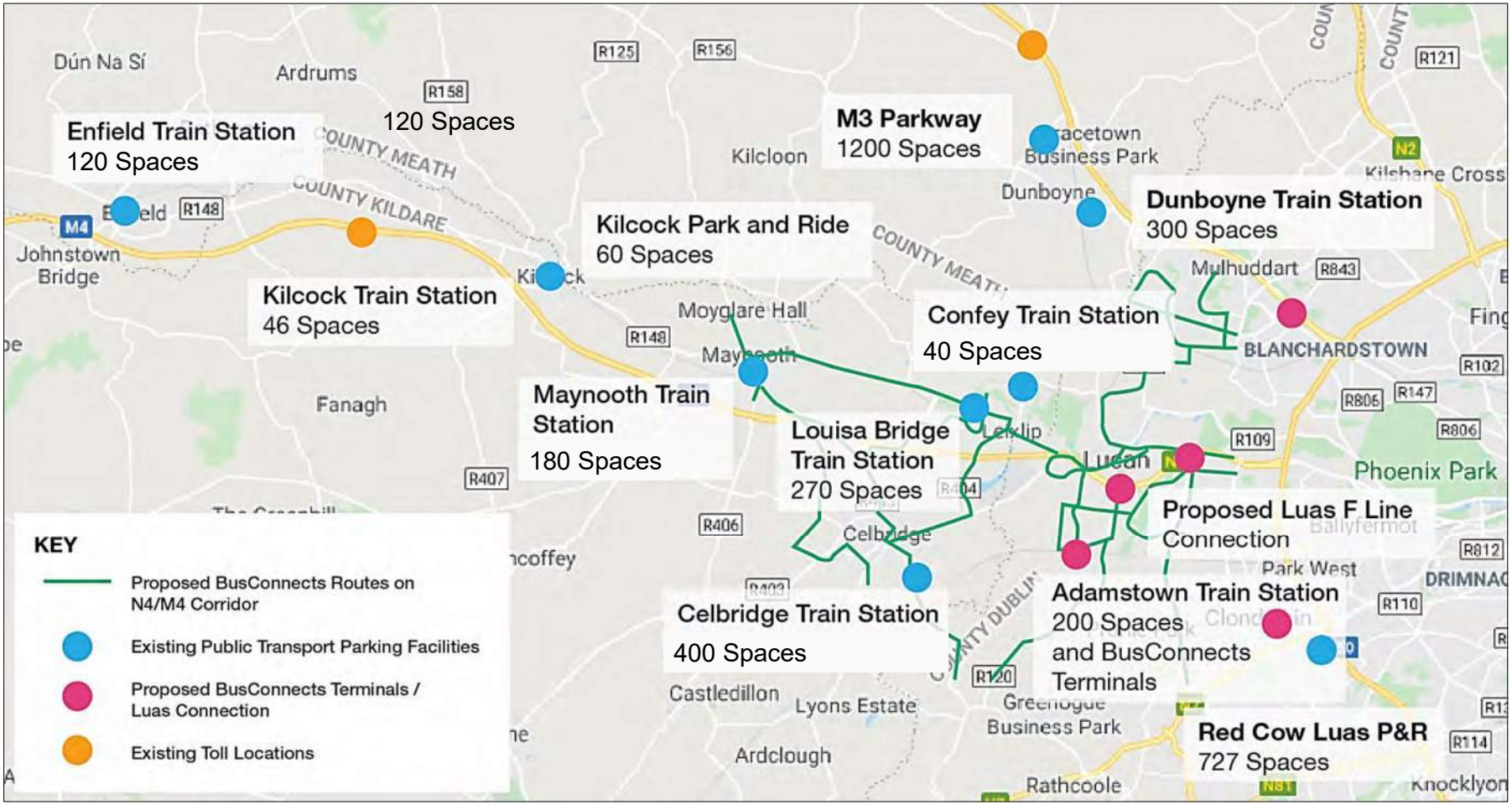
Existing and Currently Proposed Transport Hubs



Existing and Currently Proposed Transport Hubs

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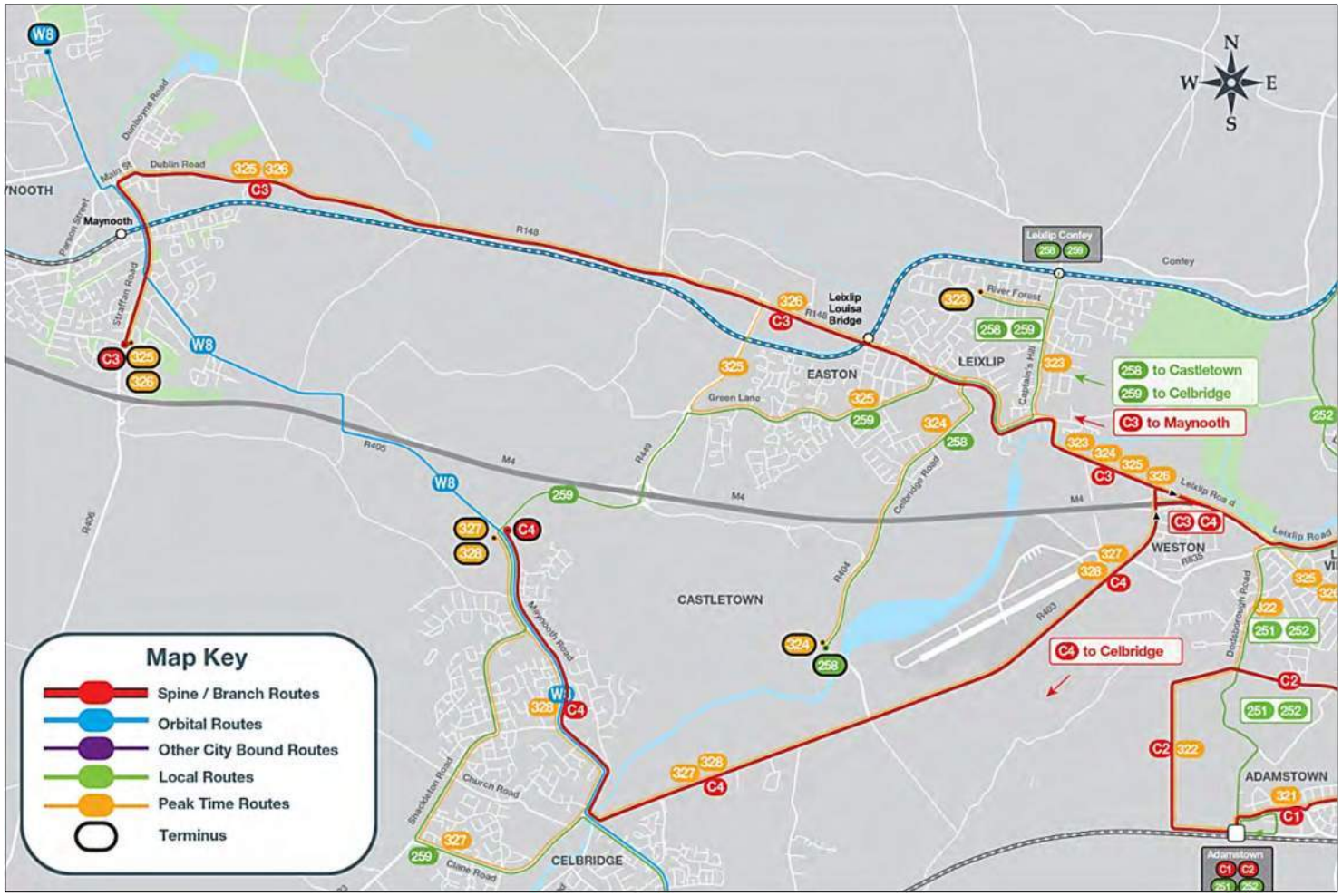
BusConnects Proposals



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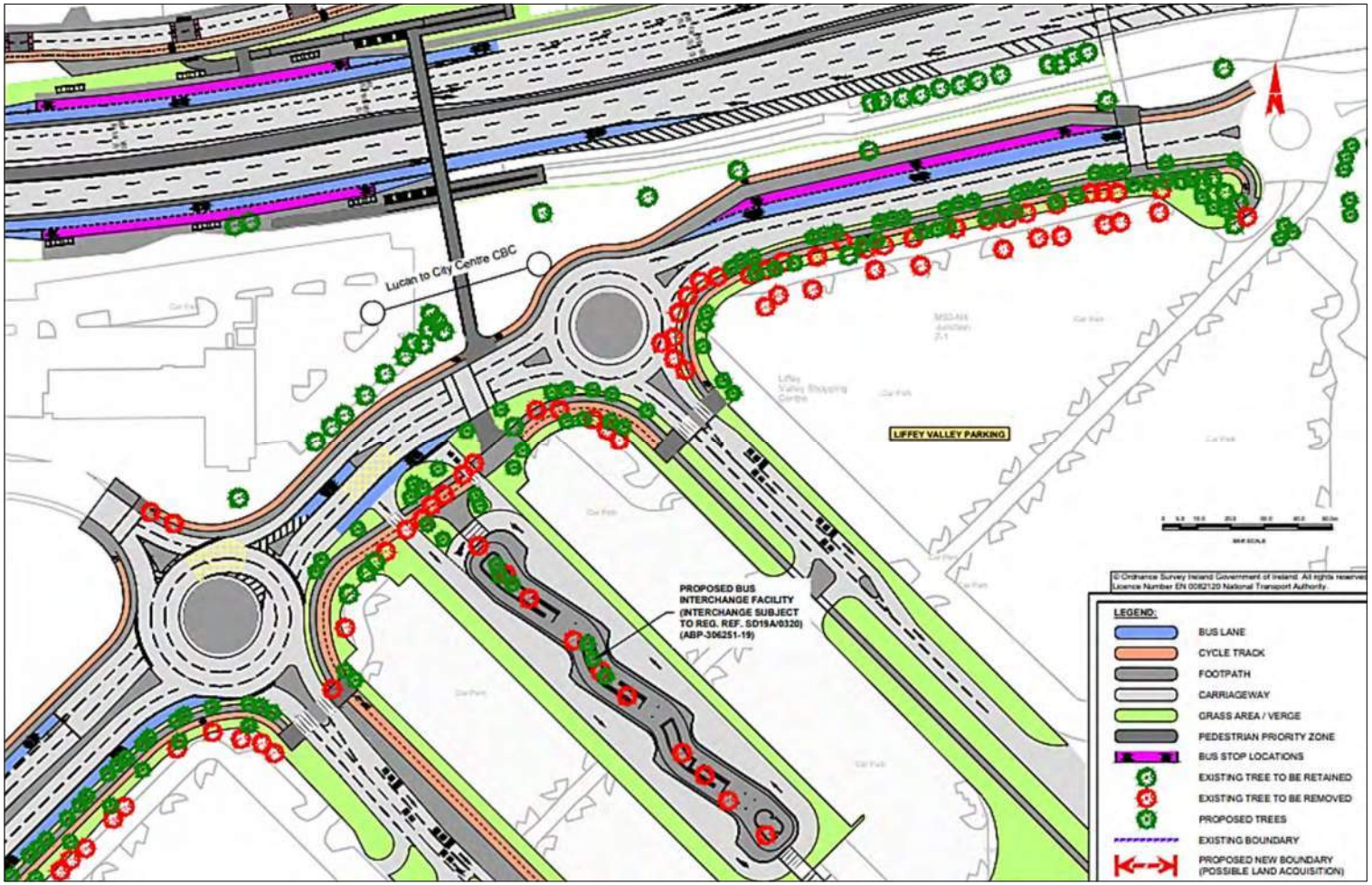
BusConnects - Proposed Liffey Valley Bus Interchange



BusConnects - Proposed Liffey Valley Bus Interchange

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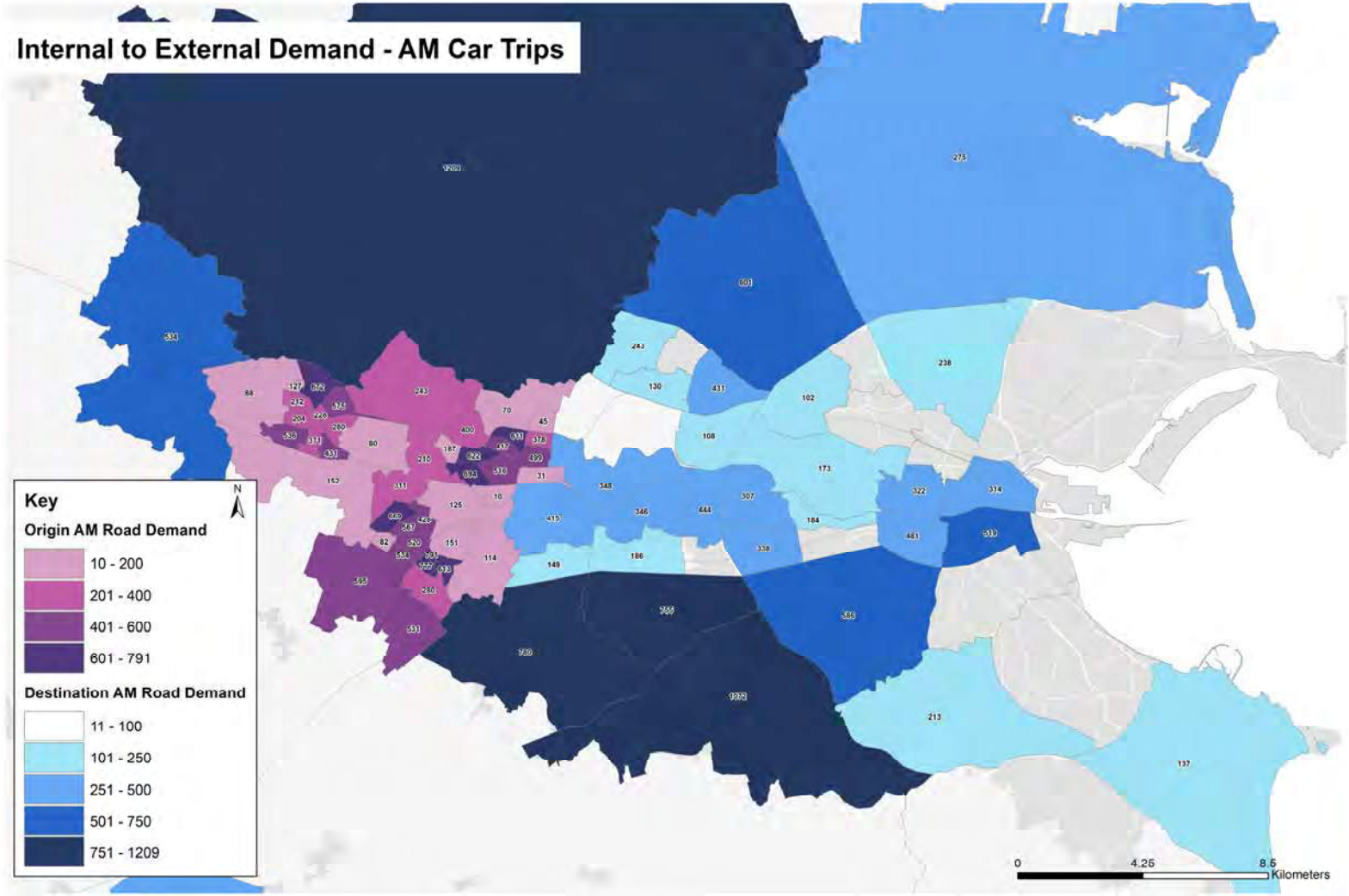
Travel Demand

AM Travel Demand – All Car Trips



AM Travel Demand – All Car Trips

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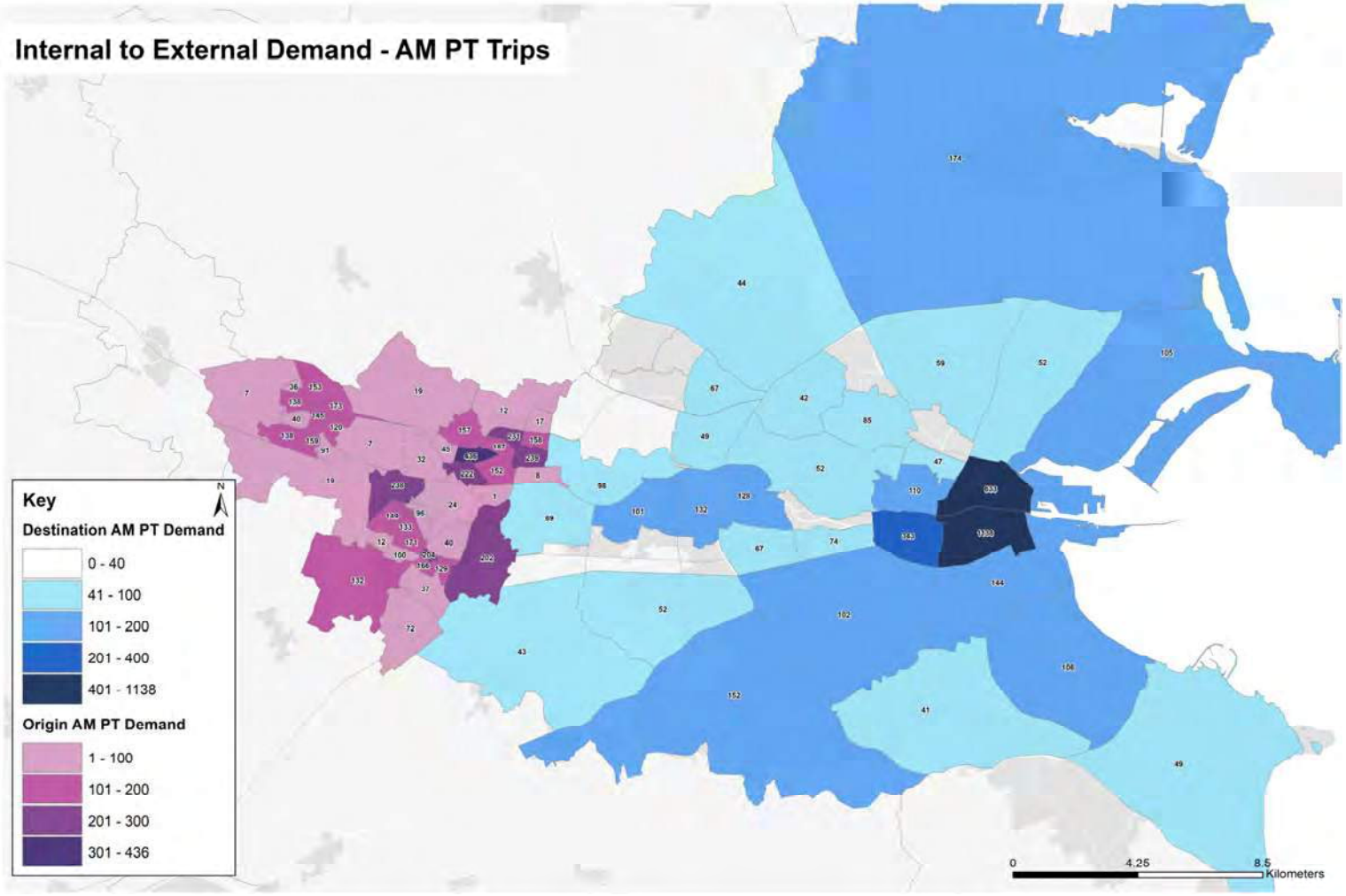
AM Travel Demand – Public Transport Trips



AM Travel Demand – Public Transport Trips

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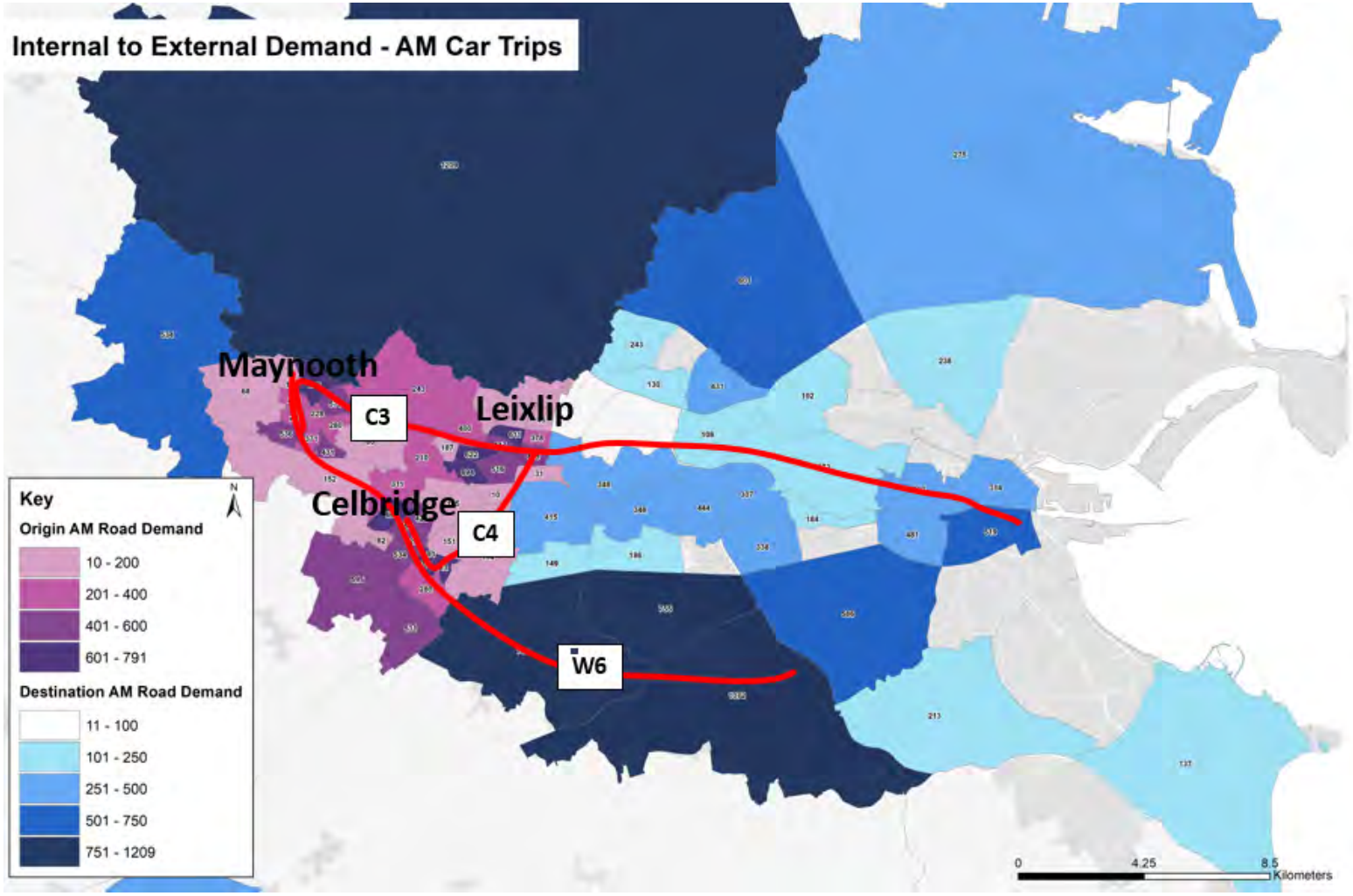
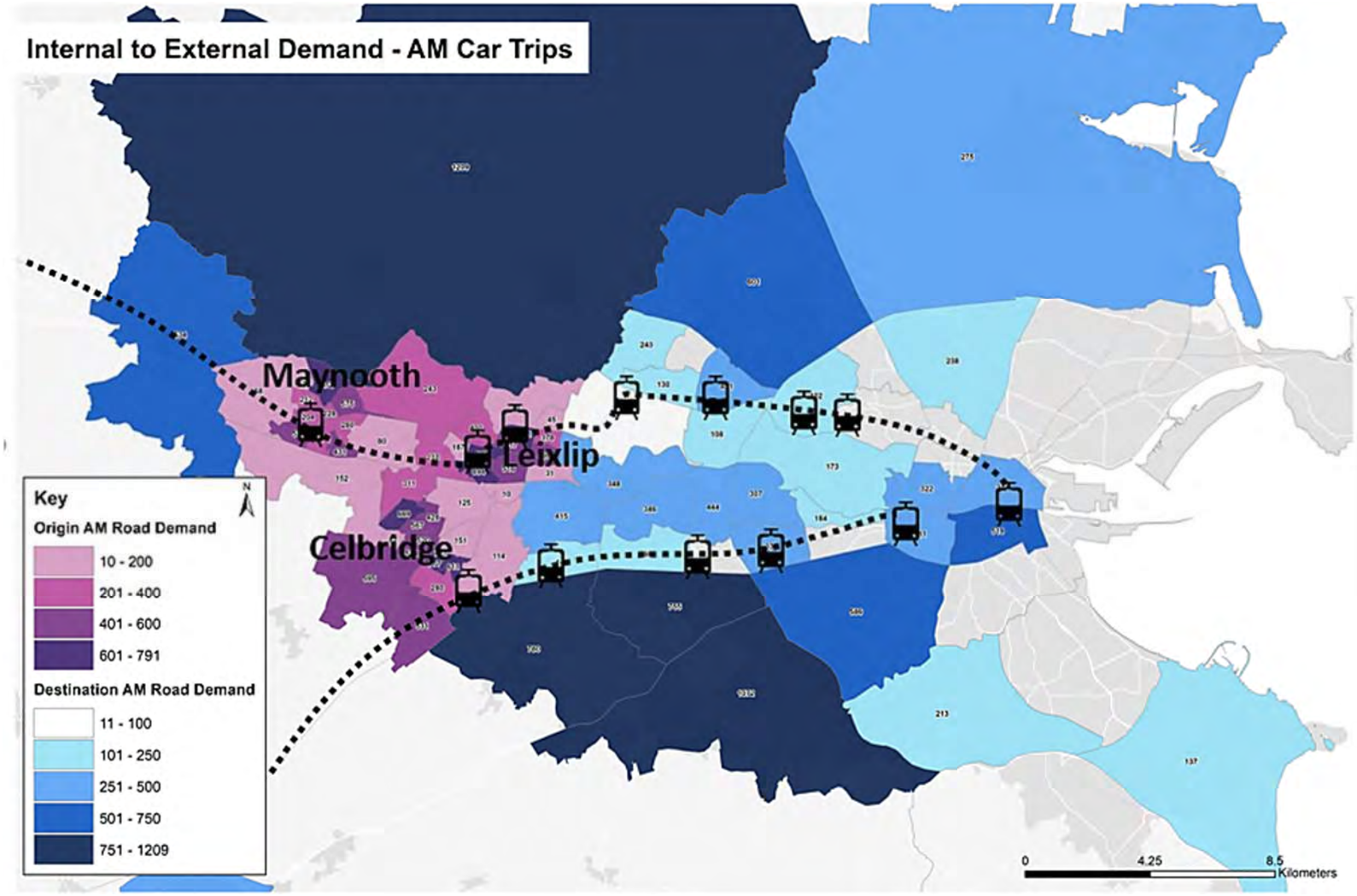
AM Travel Demand (all Car Trips) and BusConnects Routes



AM Travel Demand (all Car Trips) and Rail Line



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Phase 2 – Stage 1 and Stage 2 Process Flow Chart

Phase 2 – Stage 1 and Stage 2 Process Flow Chart

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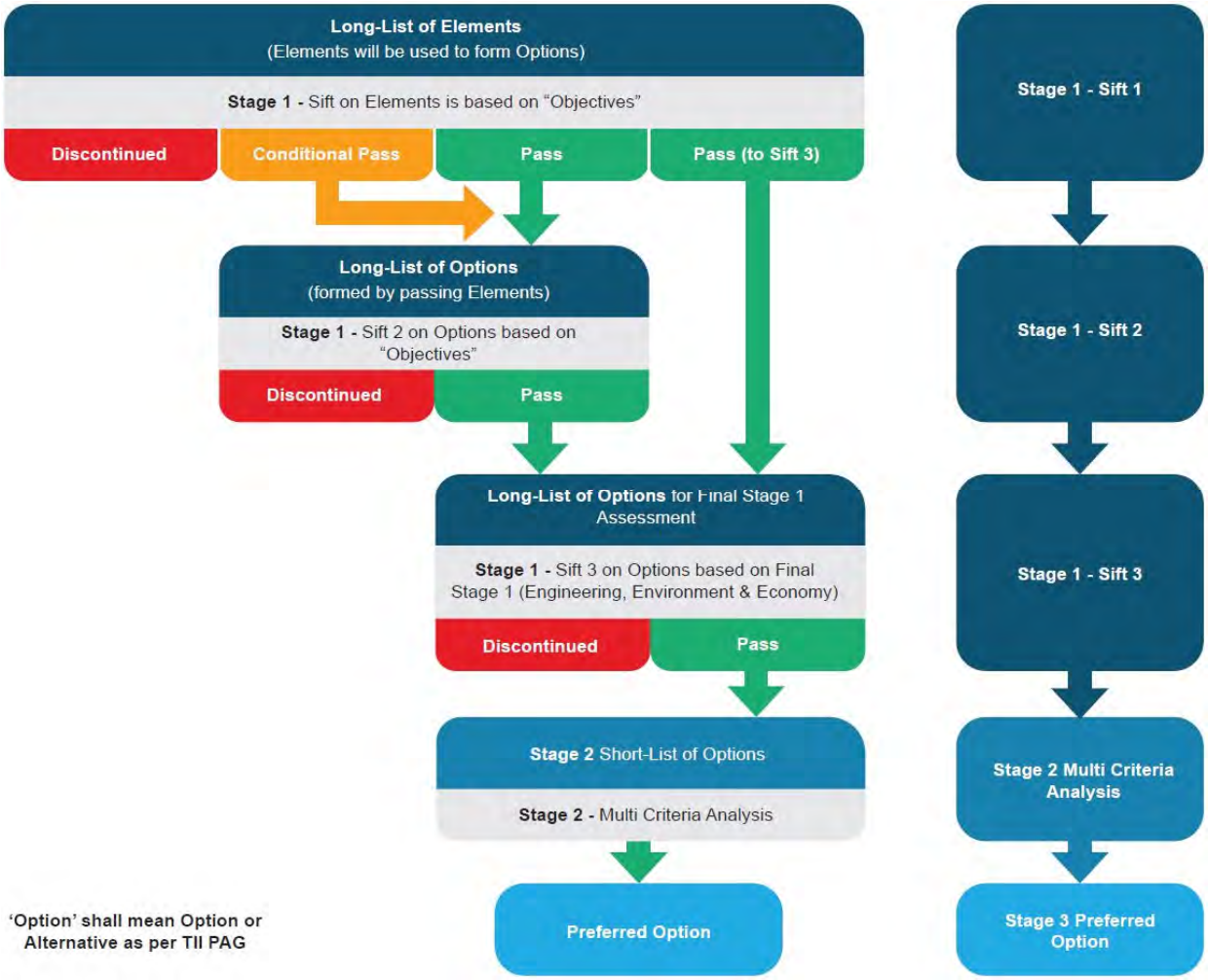
Phase 2 – Stage 1 and Stage 2 Process Flow Chart



Phase 2 – Stage 1 and Stage 2 Process Flow Chart

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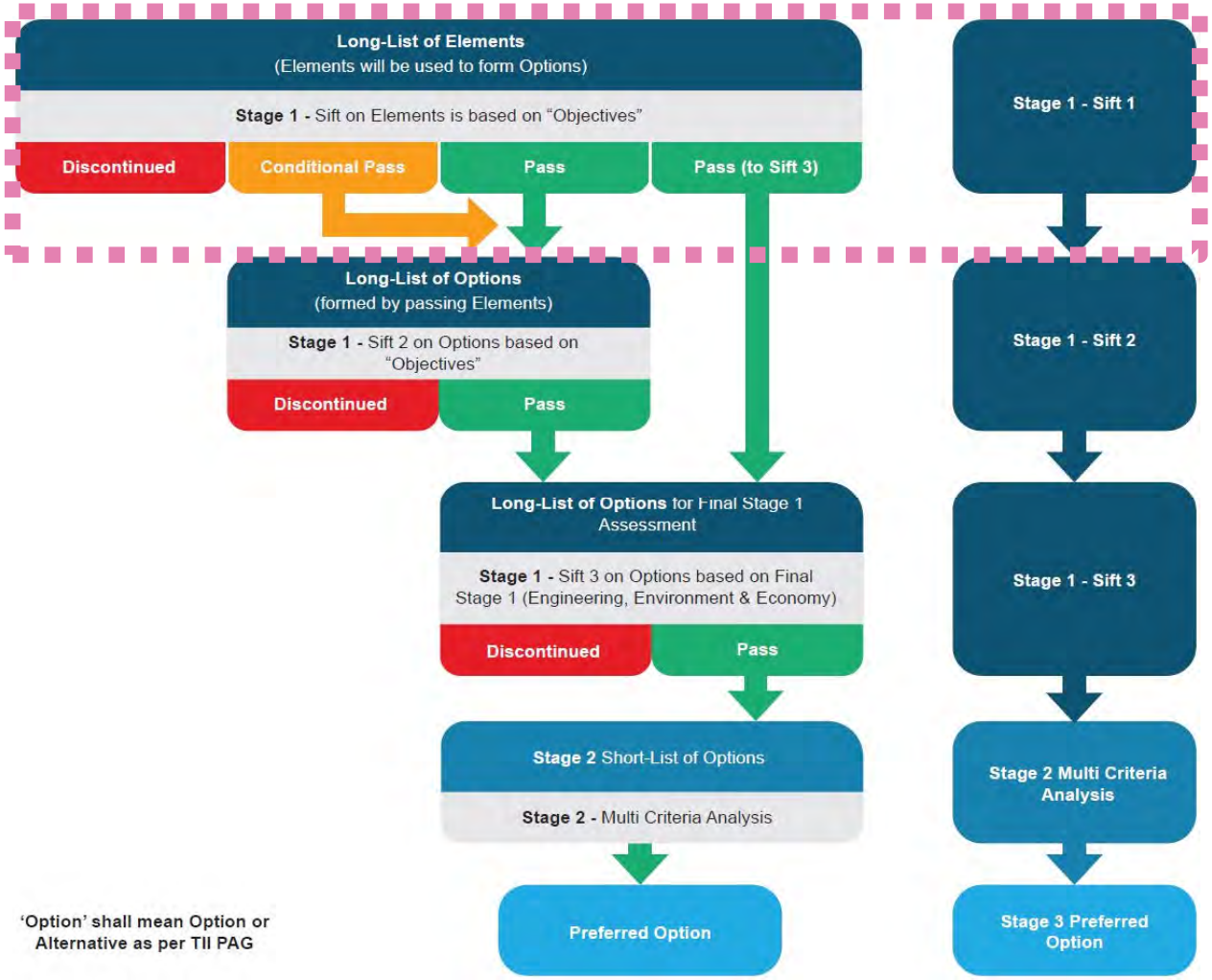
Stage 1 – Sift 1 on Elements

Stage 1 – Sift 1 on Elements



Stage 1 – Sift 1 on Elements

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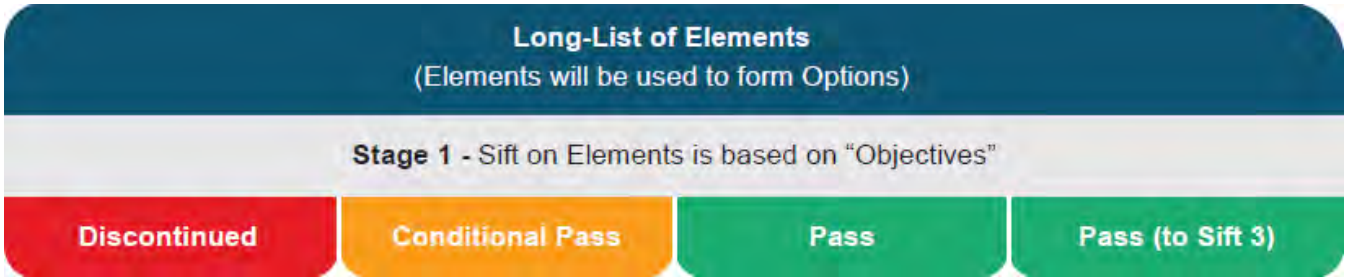
Stage 1 – Sift 1 Process



Outcome	Description
Pass (to Sift 3)	These are passed to Sift 3 when sufficient design development and detail will be available to accurately appraise.
Pass	These will typically be the base of any "core" Option i.e. Option on their own and/or combined with another Option
Conditional Pass	These are considered insufficient on their own to be a "core "Option and must be joined to be sufficient
Discontinued	These are discontinued typically either (a) as they fail to meet primary objective or (b) there is another similar element/Option but it provides greater benefits or alignment with the objectives

"Option" shall mean options or alternatives in the context of TII PAG

MAYNOOTH TO LEIXLIP PROJECT

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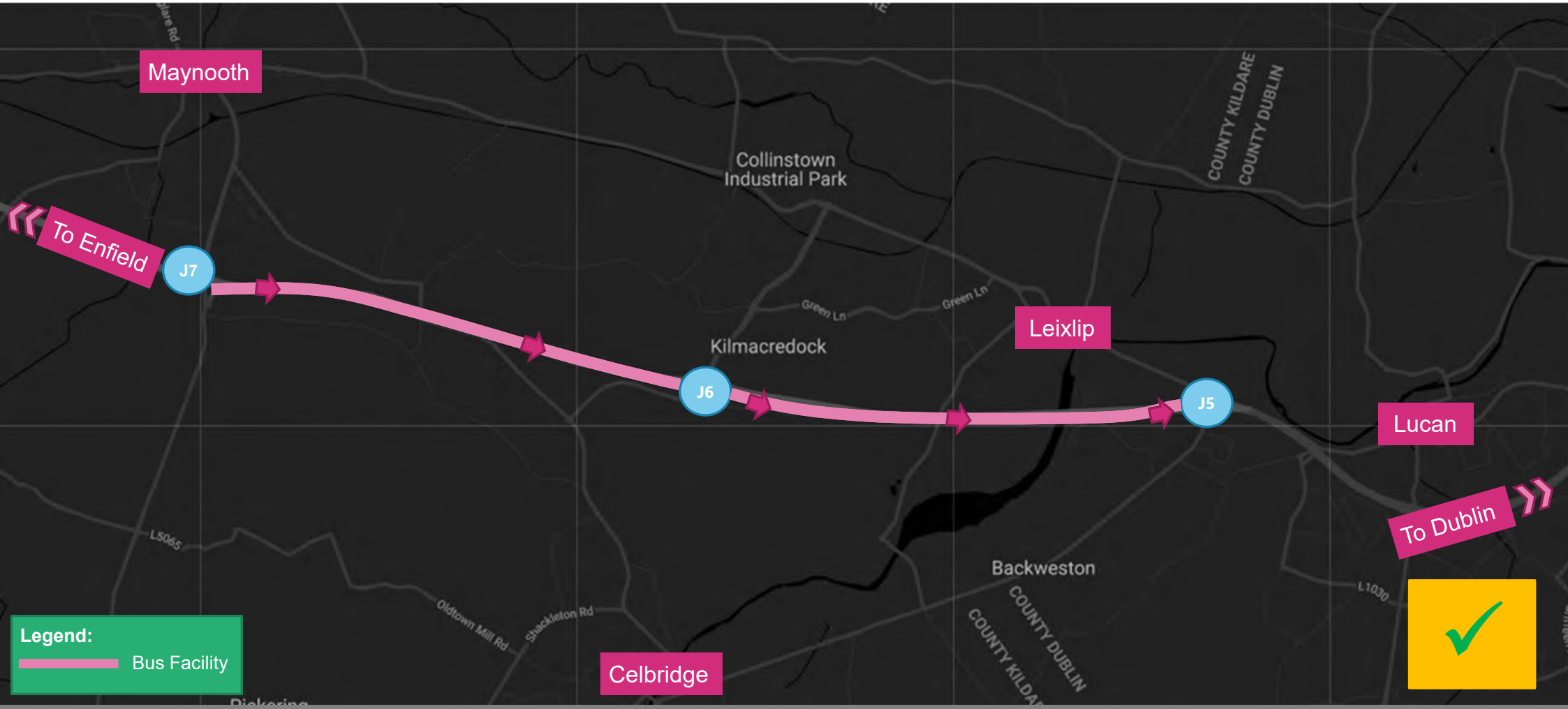
Public Transport (Bus)

Current Public Transport Proposals

- **Dart +** : The Dart + West project includes proposals for up to 12 trains per hour per direction during Peak Periods on the existing Maynooth Line, which would double existing frequencies. The project also includes plans to remove several level crossings which will result in journey time savings.

- **Bus Connects**: Core Bus Corridors (C3 and C4) and Orbital Routes (W6) with frequencies of every 30 mins (C3 and C4) and 1 Hour (W6)

B1.1 – Bus Facility added from J5 to J7/or J6* (Eastbound only)



*The exact extent of the intervention will be determined at a later stage, based on assessment results

Bus Based Elements

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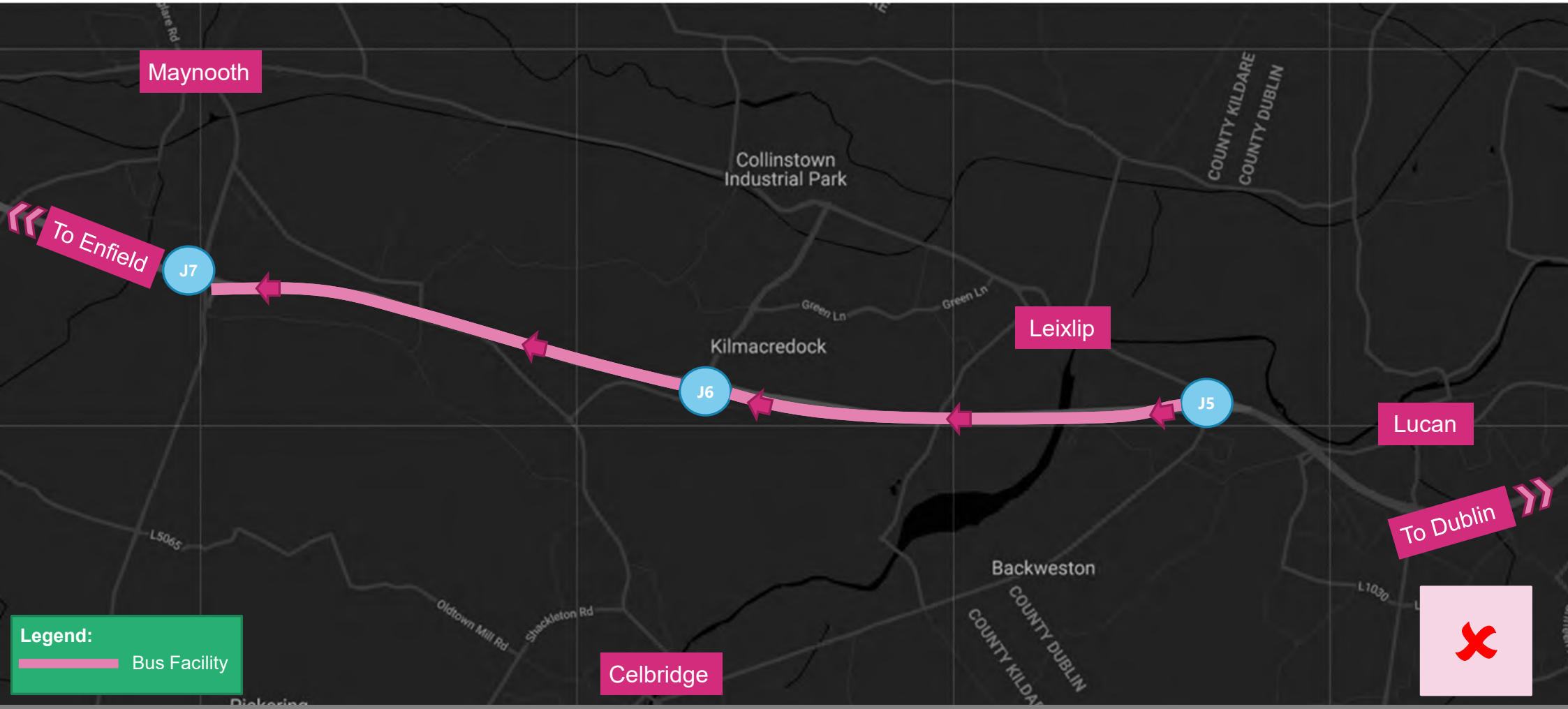
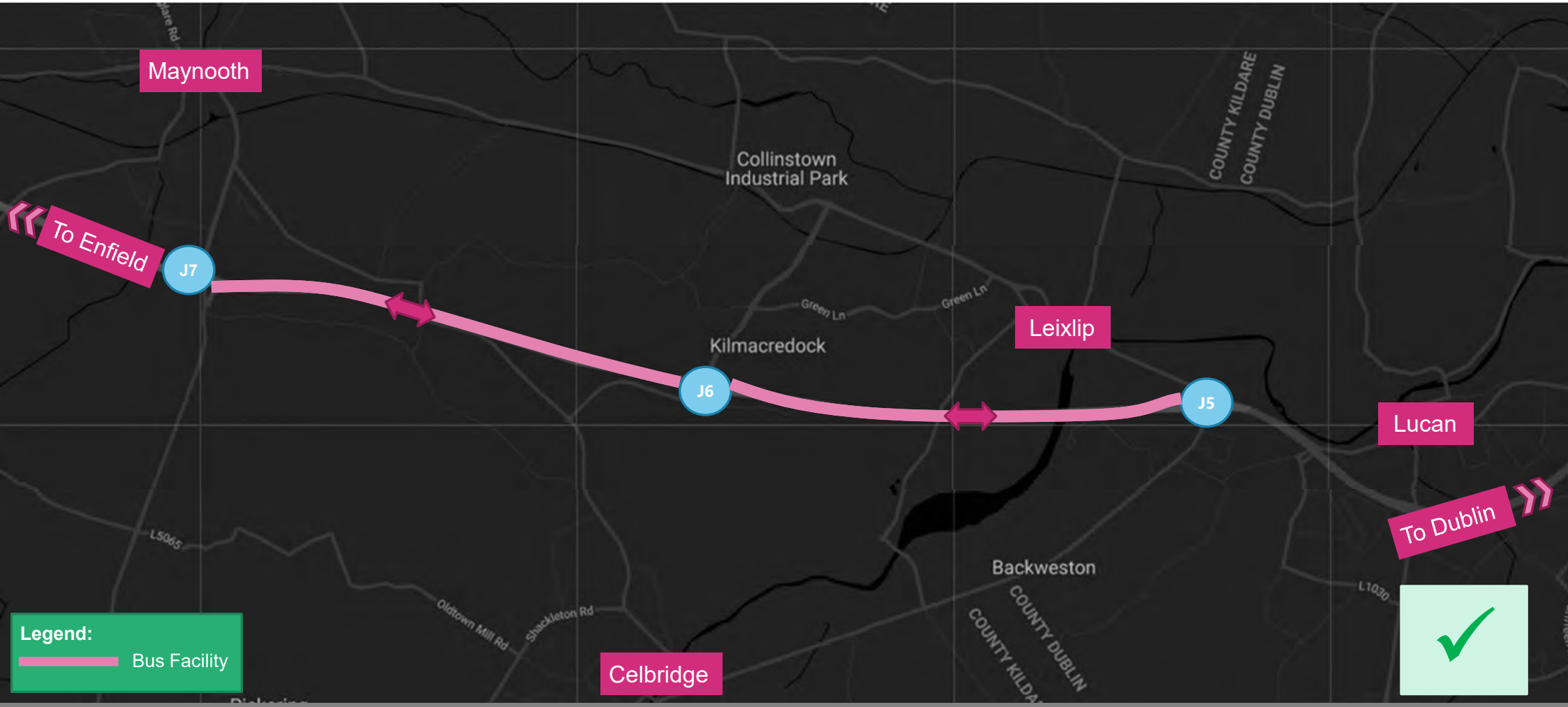
B2.1 – Bus Facility added from J5 to J7/or J6* (Westbound only)



*The exact extent of the intervention will be determined at a later stage, based on assessment results

B3.1 – Bus Facility added from J5 to J7/or J6* (both directions)

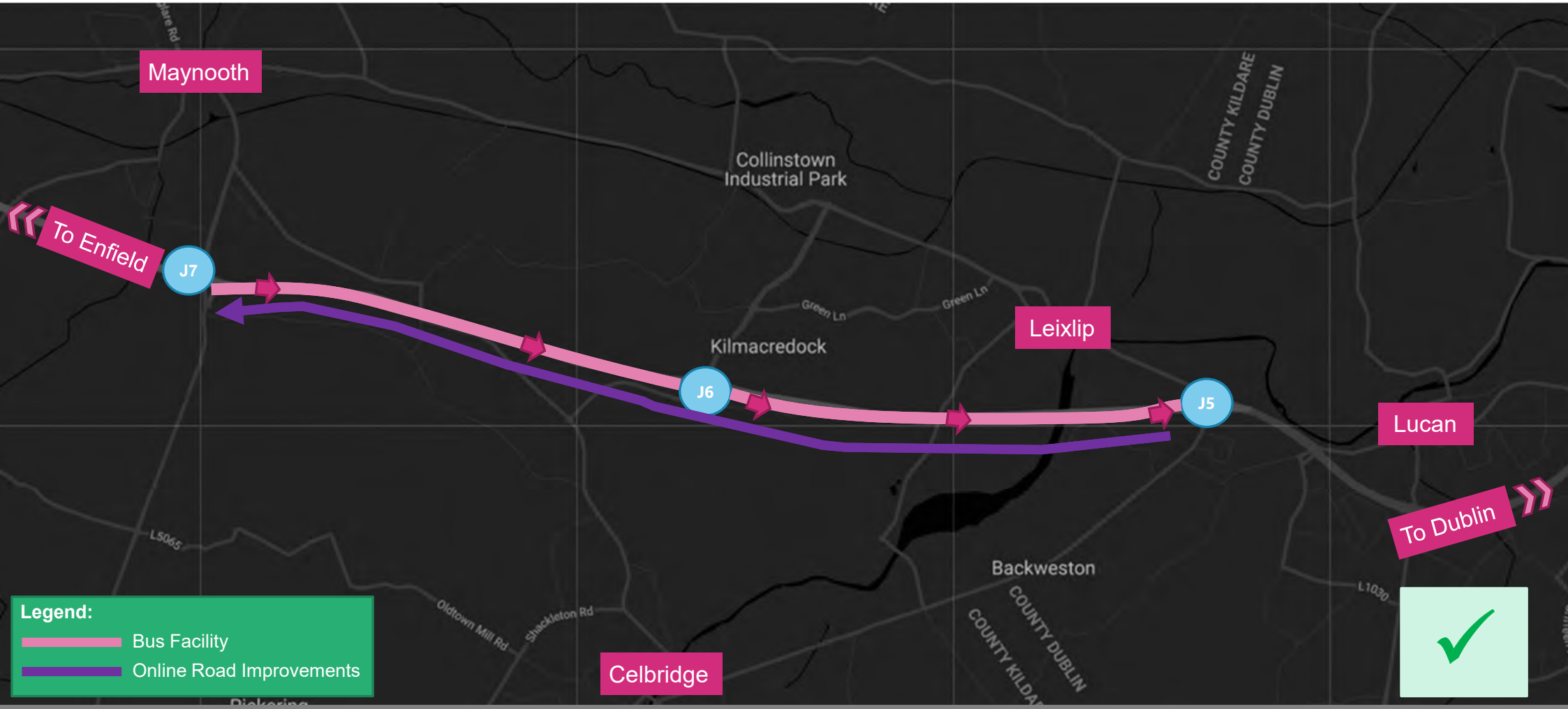


*The exact extent of the intervention will be determined at a later stage, based on assessment results

Bus Based Elements

ARUP

B4.1 – Bus Facility added from J5 to J7/or J6* (EB Bus + WB extra lane)

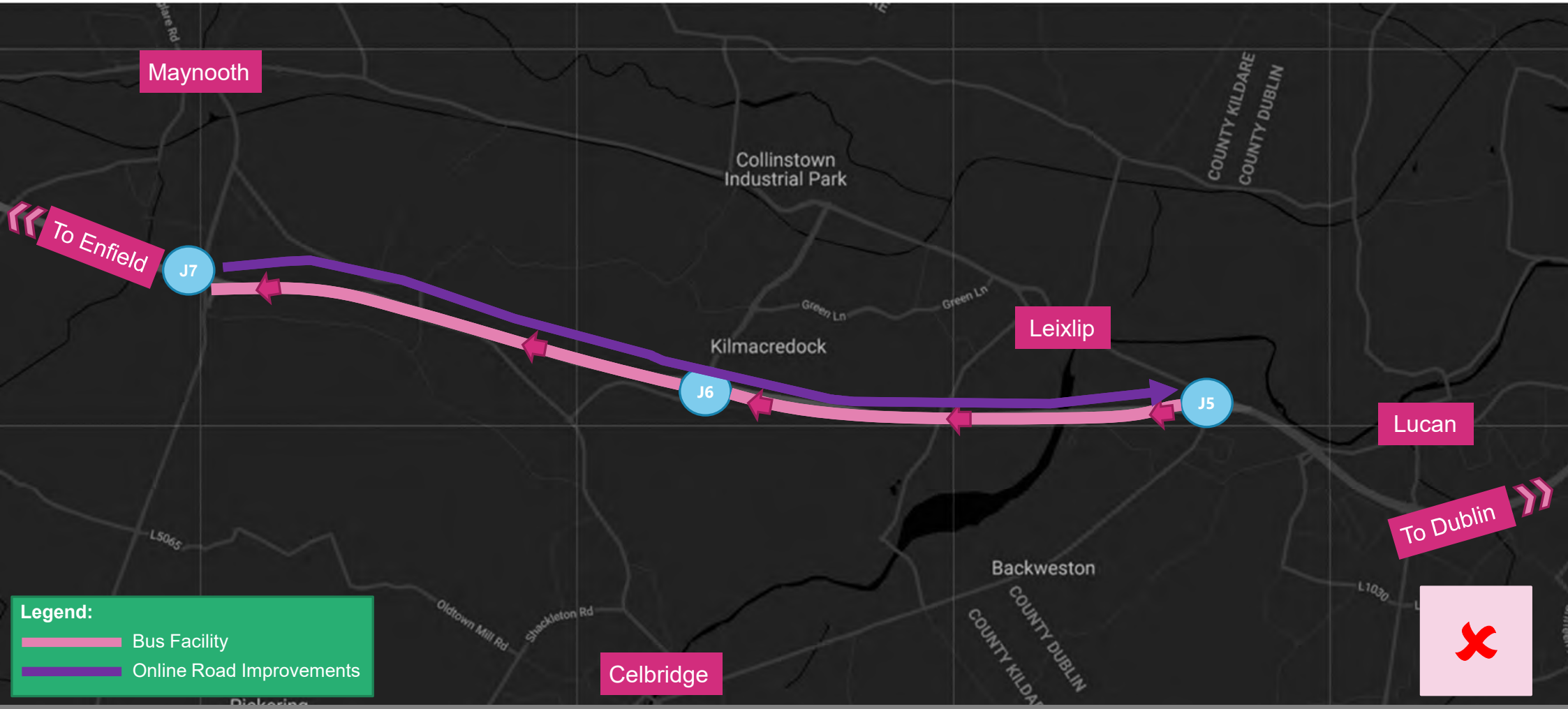


*The exact extent of the intervention will be determined at a later stage, based on assessment results

Bus Based Elements

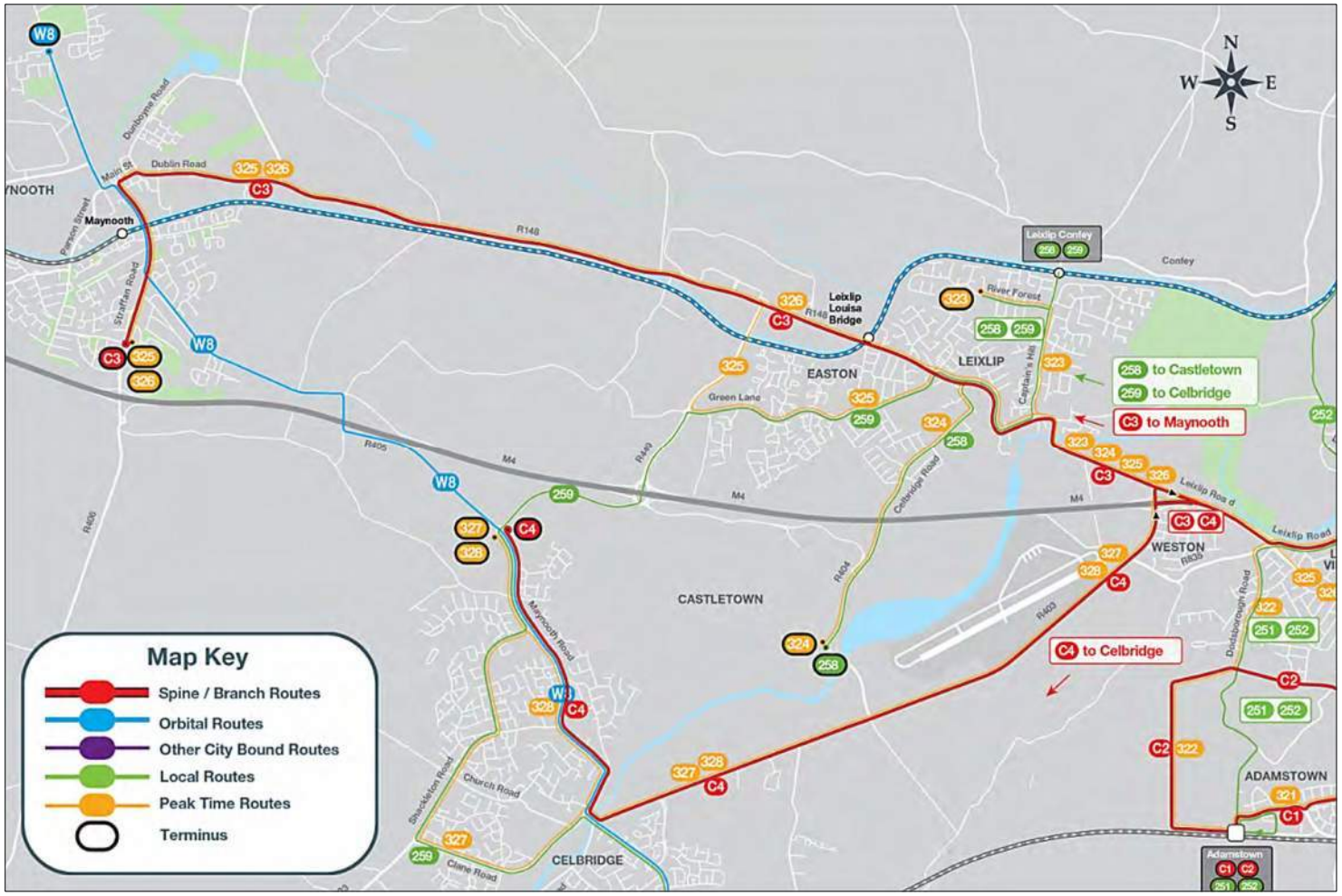
ARUP

B5.1 – Bus Facility added from J5 to J7/or J6* (WB Bus + EB extra lane)



*The exact extent of the intervention will be determined at a later stage, based on assessment results

B6.1 – Enhanced Bus Infrastructure



This element would include enhancements to the existing bus infrastructure. Map shows proposed BusConnects network.

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Park and Ride

Park and Ride Based Elements

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Park and Ride Overview

Understanding the 3 Categories of Park and Ride

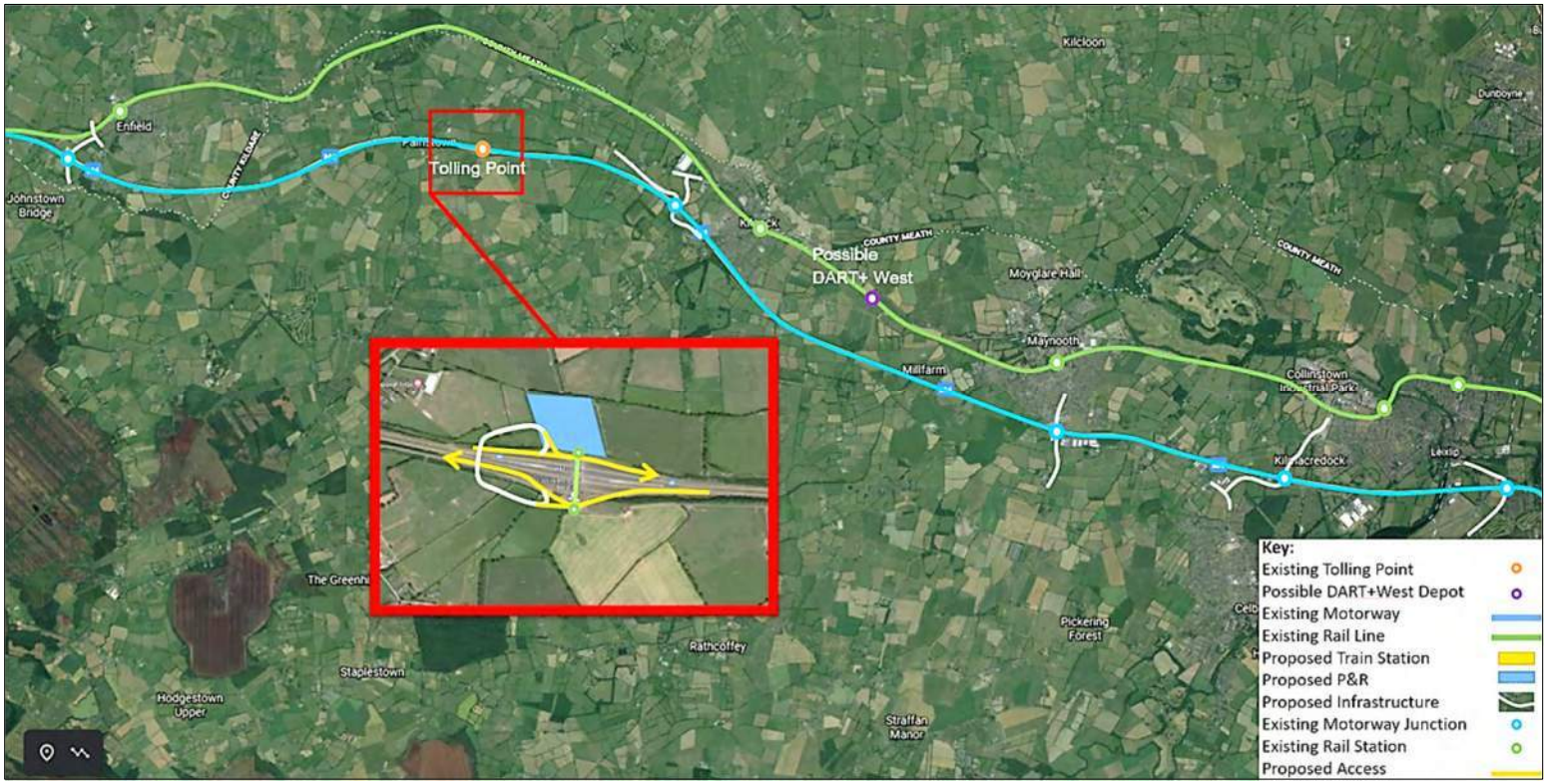
NTA
Údarás Náisiúnta Iompair
National Transport Authority

Type	Strategic Park and Ride PR Option 1	Local Mobility Hubs PR Option 2	Local Park and Ride PR Option 3
Function	To facilitate the modal shift of long distance car trips to public transport, at an early opportunity. To serve a wide hinterland of a strategic corridor to an urban centre	To serve urban and suburban areas. They seek to expand the local catchment of public transport services by catering for access to stops / stations for a range of mobility options To provide the opportunity to interchange between the car and public transport modes as well as between sustainable transport modes.	To provide parking facilities at transport nodes such as railway stations and bus stations serving smaller towns and villages on the regional public transport network
Key Characteristics	Located on an interchange between the National Roads Network and high quality high capacity public transport. Large in scale (500 car parking spaces +).	Include car parking, high quality bicycle parking, walking and cycling links to good quality walking and cycling networks and dedicated car club and car sharing facilities.	Small in scale. Local park and ride should also tie into the local walking and cycling networks.
Things to avoid	Should not encourage people who would otherwise access public transport locally, to drive further to access a site, thus adding to congestion. Existing users of the public transport should not be unduly affected by increased patronage associated with park and ride usage.	While mobility hubs include car parking, the site should not be dominated by it. Should not encourage people who would otherwise access public transport locally, to drive further to access a site, thus adding to congestion.	Should not become destination parking for the town or village.

PR1.1 - Combined Rail and Bus Based P&R (Enfield)

Rail Service	Bus Service	Positives	Negatives
Existing Train Station Current Rail Frequency – 60 minutes (peak hour) Journey Time to City Centre - ~70 minutes	Proposed Frequency – 10 minutes (peak hour) Journey Time to City Centre* - ~ 60 minutes Journey Time to Liffey Valley* - ~ 30 minutes Bussing Requirements 12/13 buses	Mixed Mode Opportunities Limited Infrastructure Required	Poor Rail Frequencies Indirect Access to Train Station Significant Bussing Requirements Possibly reduced demand due to location being outside of GDA and away from major population centre further east

PR 1.2 - Bus Based P&R (Tolling Point)



Rail Service	Bus Service	Positives	Negatives
No rail service	Proposed Frequency – 10 minutes (peak hour) Journey Time to City Centre* - ~ 55 minutes Journey Time to Liffey Valley* - ~ 25 minutes Bussing Requirements 5/6 buses Existing Coach Services would also stop at this P&R location	Location avails of existing coach/bus services using the M4 corridor Users would save on toll costs improving the desirability of the P&R site Reduced Bussing Requirement	Significant Infrastructure Required (new overbridge and pedestrian bridge) Road users would avail of the M4 motorway without having to pay the toll

PR 1.3 - Combined Rail and Bus Based P&R (Kilcock)

Rail Service (assume New Train Station)	Bus Service	Positives	Negatives
Current Rail Frequency – 60 minutes (peak hour) Journey Time to City Centre - ~55 minutes	Proposed Frequency – 10 minutes (peak hour) Journey Time to City Centre* - ~ 50 minutes Journey Time to Liffey Valley* - ~ 20 minutes Bussing Requirements 10/11 buses	Mixed Mode Opportunities Reasonable Infrastructure Required (New Station) Great access to new Train Station	Poor Rail Frequencies High Bussing Requirements

ARUP

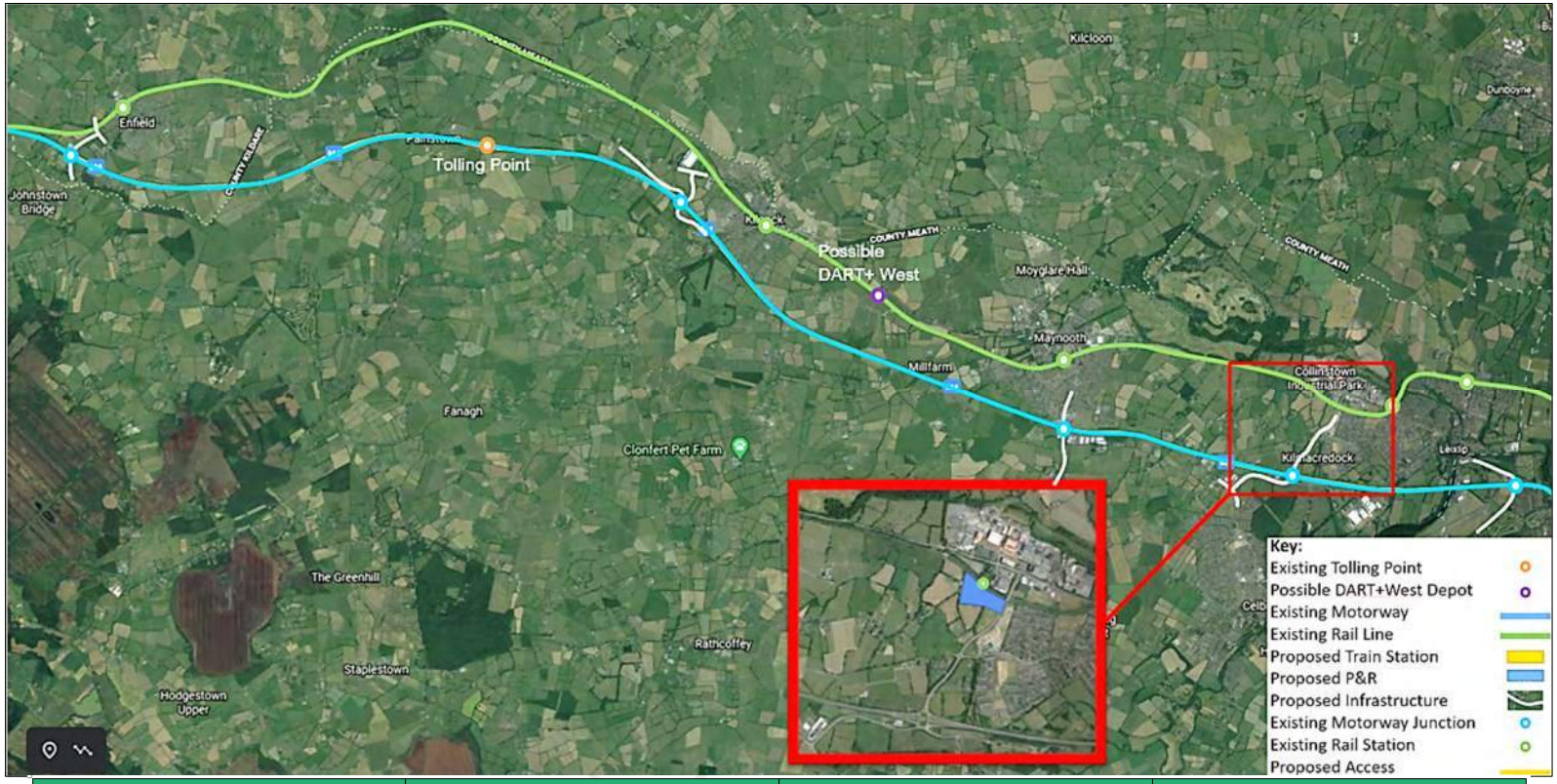
PR 1.4 - Combined Rail and Bus Based P&R (West Maynooth)

Rail Service (assume New Train Station)	Bus Service	Positives	Negatives
Current Rail Frequency** – 15 minutes (peak hour) – requires extending Maynooth service to proposed depot Journey Time to City Centre** - ~50 minutes	Proposed Frequency – 10 minutes (peak hour) Journey Time to City Centre* - ~ 45 minutes Journey Time to Liffey Valley* - ~ 15 minutes Bussing Requirements 9/10 buses	Mixed Mode Opportunities Great Access to New Train Station Good Synergy with Depot proposals and with the need to update the existing Maynooth Interchange Located beyond the current congested zone Access DART+ West Higher frequency and capacity	High Bussing Requirements Significant Infrastructure Required – New Interchange, New local roads, New station Linkage with BusConnects network will need to be reviewed

Park and Ride Based Elements

ARUP

PR 1.5 - Rail Based P&R (Collinstown)



Rail Service (assume New Train Station)	Bus Service	Positives	Negatives
Current Rail Frequency** – 15 minutes (peak hour) – Journey Time to City Centre** - ~45 minutes	Maynooth BusConnects Services	Great Access to New Train Station	Potential Development Land New Infrastructure Required, including a new train station Parking located within the edge of the current congested zone Limited Bus Services (Maynooth BusConnects services)

Park and Ride Based Elements

ARUP

PR 1.6 - Bus Based P&R (Junction 6)

Rail Service	Bus Service	Positives	Negatives
No Rail Service proposed	Proposed Frequency – 10 minutes (peak hour) Journey Time to City Centre* - ~ 35 minutes Journey Time to Liffey Valley* - ~ 7 minutes Bussing Requirements 7/8 buses	Good access to the city centre and new interchange hub at Liffey Valley Reduced number of buses	Parking located within the edge of the current congested zone Potential upgrade to the Interchange required

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PR1.7 – P&R at Junction 5 (Bus Based)

Park and Ride Based Elements

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PR1.8 – P&R at each Junction (Bus Based)

Park and Ride Based Elements

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PR 2.1 – Local Mobility Hubs

Understanding the 3 Categories of Park and Ride

NTA
Údarás Náisiúnta Iompair
National Transport Authority

Type	Strategic Park and Ride PR Option 1	Local Mobility Hubs PR Option 2	Local Park and Ride PR Option 3
Function	To facilitate the modal shift of long distance car trips to public transport, at an early opportunity. To serve a wide hinterland of a strategic corridor to an urban centre	To serve urban and suburban areas. They seek to expand the local catchment of public transport services by catering for access to stops / stations for a range of mobility options To provide the opportunity to interchange between the car and public transport modes as well as between sustainable transport modes.	To provide parking facilities at transport nodes such as railway stations and bus stations serving smaller towns and villages on the regional public transport network
Key Characteristics	Located on an interchange between the National Roads Network and high quality high capacity public transport. Large in scale (500 car parking spaces +).	Include car parking, high quality bicycle parking, walking and cycling links to good quality walking and cycling networks and dedicated car club and car sharing facilities.	Small in scale. Local park and ride should also tie into the local walking and cycling networks.
Things to avoid	Should not encourage people who would otherwise access public transport locally, to drive further to access a site, thus adding to congestion. Existing users of the public transport should not be unduly affected by increased patronage associated with park and ride usage.	While mobility hubs include car parking, the site should not be dominated by it. Should not encourage people who would otherwise access public transport locally, to drive further to access a site, thus adding to congestion.	Should not become destination parking for the town or village.

Park and Ride Based Elements

ARUP

PR 3.1 – Local Park and Ride

Understanding the 3 Categories of Park and Ride

NTA
Údarás Náisiúnta Iompair
National Transport Authority

Type	Strategic Park and Ride PR Option 1	Local Mobility Hubs PR Option 2	Local Park and Ride PR Option 3
Function	To facilitate the modal shift of long distance car trips to public transport, at an early opportunity. To serve a wide hinterland of a strategic corridor to an urban centre	To serve urban and suburban areas. They seek to expand the local catchment of public transport services by catering for access to stops / stations for a range of mobility options To provide the opportunity to interchange between the car and public transport modes as well as between sustainable transport modes.	To provide parking facilities at transport nodes such as railway stations and bus stations serving smaller towns and villages on the regional public transport network
Key Characteristics	Located on an interchange between the National Roads Network and high quality high capacity public transport. Large in scale (500 car parking spaces +).	Include car parking, high quality bicycle parking, walking and cycling links to good quality walking and cycling networks and dedicated car club and car sharing facilities.	Small in scale. Local park and ride should also tie into the local walking and cycling networks.
Things to avoid	Should not encourage people who would otherwise access public transport locally, to drive further to access a site, thus adding to congestion. Existing users of the public transport should not be unduly affected by increased patronage associated with park and ride usage.	While mobility hubs include car parking, the site should not be dominated by it. Should not encourage people who would otherwise access public transport locally, to drive further to access a site, thus adding to congestion.	Should not become destination parking for the town or village.

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2040

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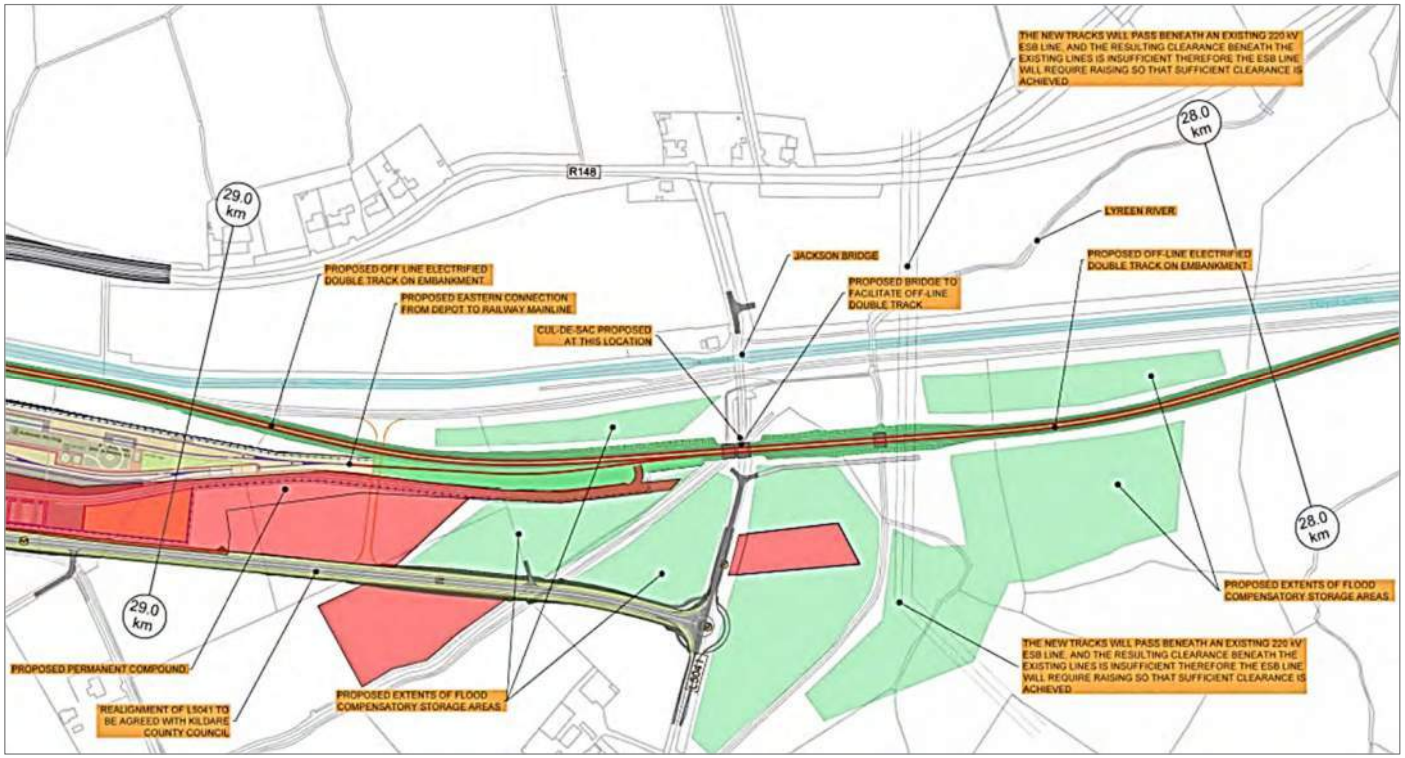
Rail

RL1 - Benefit Analysis of DART+West Programme on the M4/N4 Corridor



This figure represents a current draft proposal which is subject to change

- Includes proposals for up to 12 trains per hour per direction during peak periods, doubling the existing frequencies.
- Also includes plans to remove several level crossings which will result in journey time savings.
- Included in Do-Min Transport Model.

RL2 – Test Regional Rail Improvements

- Items to be assessed to provide enhanced strategic rail services would include:
  - Frequency
  - Speed
  - Reliability
- The above items would be enhanced and included in a improved Regional Rail element. This represents a practicable Regional Rail Improvement within the existing rail corridor constraints.
- This would be in addition to the scope of the Dart + West Project
- Limitations of the improvement:
  - Services would operate within the current rail corridor boundary, meaning using the existing track and provision for new track or overtaking bays only where space within the existing rail corridor boundary permits.
  - Operate at a speed possible on the existing track
  - Operate at a frequency that is practical based on the existing/proposed services on the rail line.

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Active Travel

Active Travel Based Elements

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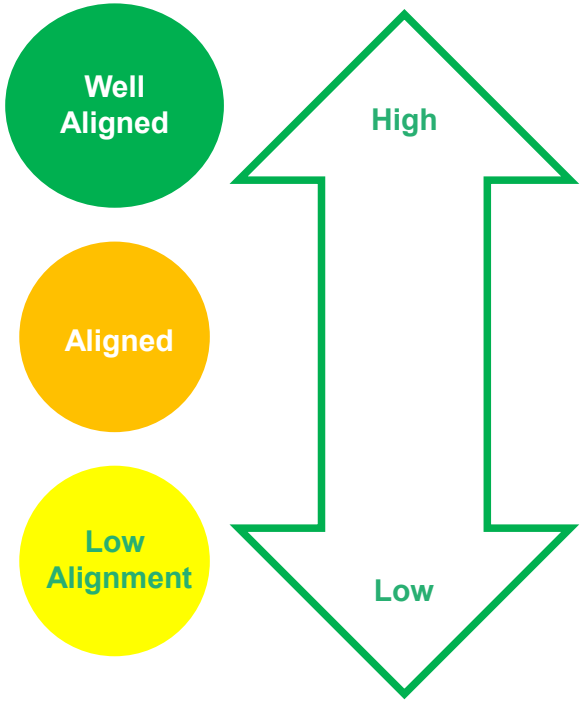
Active Travel – Context and Application

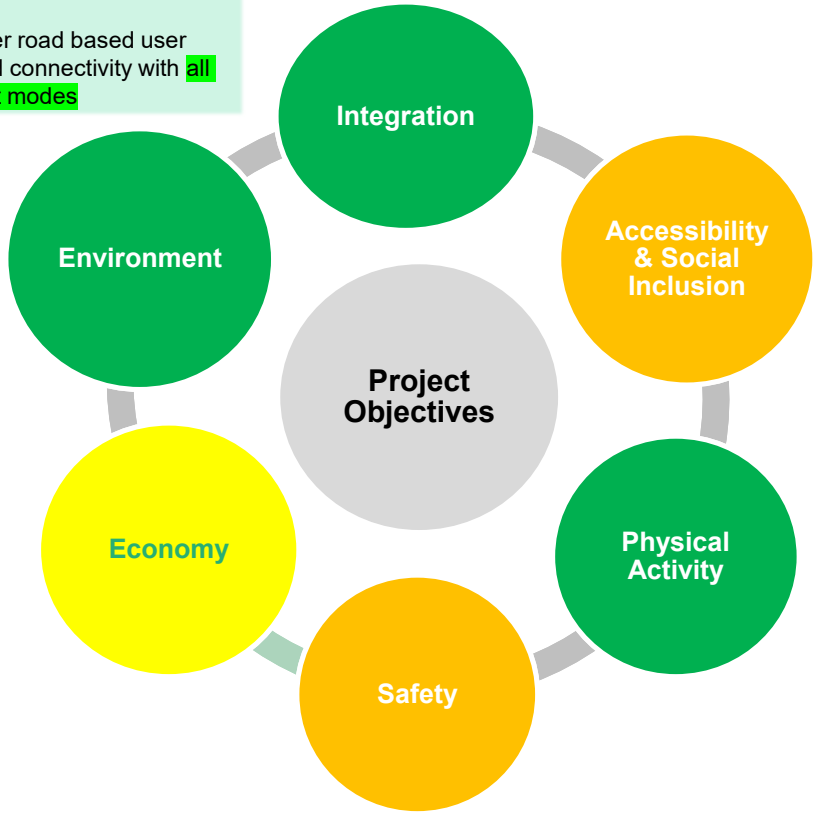
- How would Active Travel align with meeting or supporting the Project Objectives



Active Travel – Alignment with Project Objectives

- Provide the infrastructure to support an improved balance of transport modes
- Support greater road based user integration and connectivity with all other transport modes

- Facilitate an increase in modal shift from private car to public transport and walking/cycling thus supporting a transition towards low carbon and climate resilience



- Provide improved accessibility to the GDA public transport network from regions outside of the GDA
- Support improved connectivity for all road users to public transport
- Enable the successful creation of place making and assist in the generation of vibrant communities

- Provide a more reliable and resilient transport solution
- Manage congestion on the M4 corridor
- Provide the infrastructure to enable transport solutions to move more people more efficiently
- Support the protection of the economic prospects of Maynooth, Leixlip, Celbridge, Kilcock, Enfield and their rural hinterland
- Facilitate effective strategic traffic movement, including from regional centres of Athlone and Sligo
- Facilitate effective freight movement

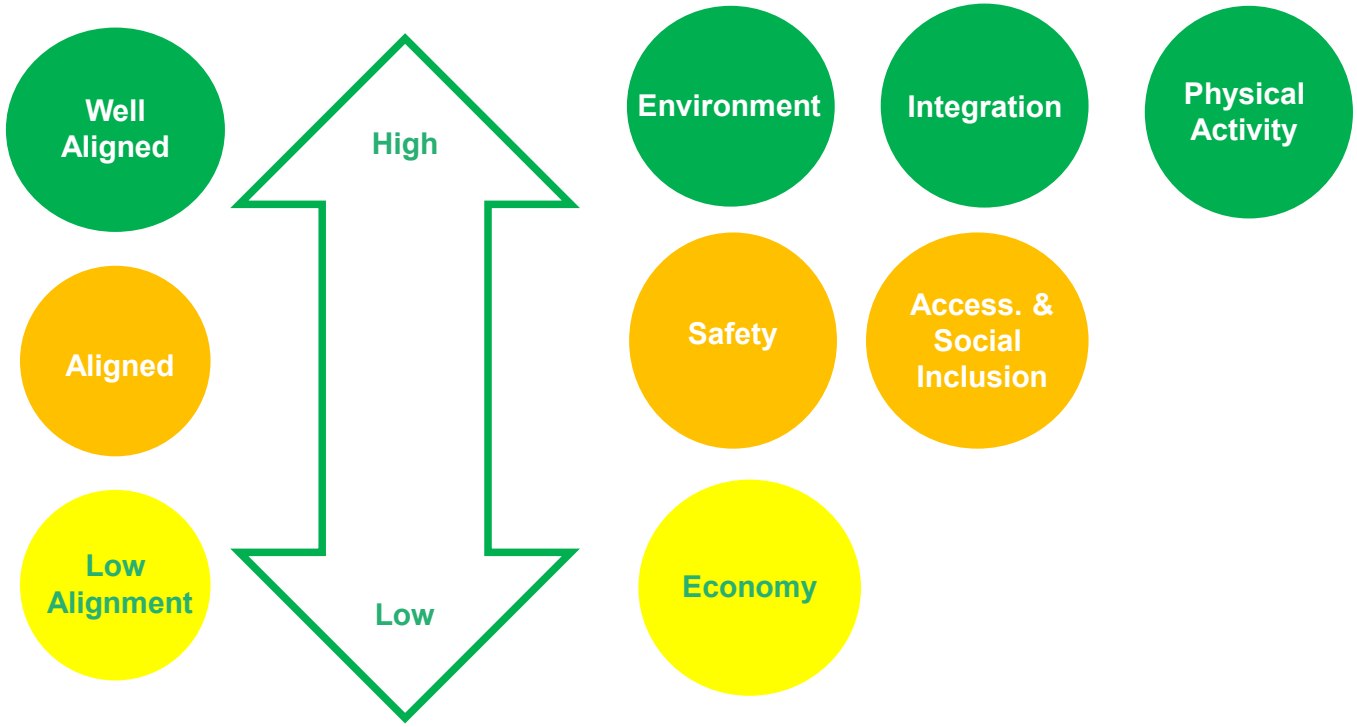
- Improve infrastructure in, across and adjacent to the M4/N4 corridor which may form barriers to physical activity and in particular linkage between key local trip attractors including education, work, residential, leisure and natural environment.
- Support the provision for cycle parking and infrastructure at key public transport nodes and destination
- Support the creation of a healthy environment conducive to active travel

Enable the provision of a safer travelling environment for all road users, including vulnerable road users

Active Travel – Alignment with Project Objectives

ARUP

Active Travel – Alignment with Project Objectives Summary



Active Travel – Alignment with Project Objectives Summary

ARUP

Active Travel – Corridor for Consideration

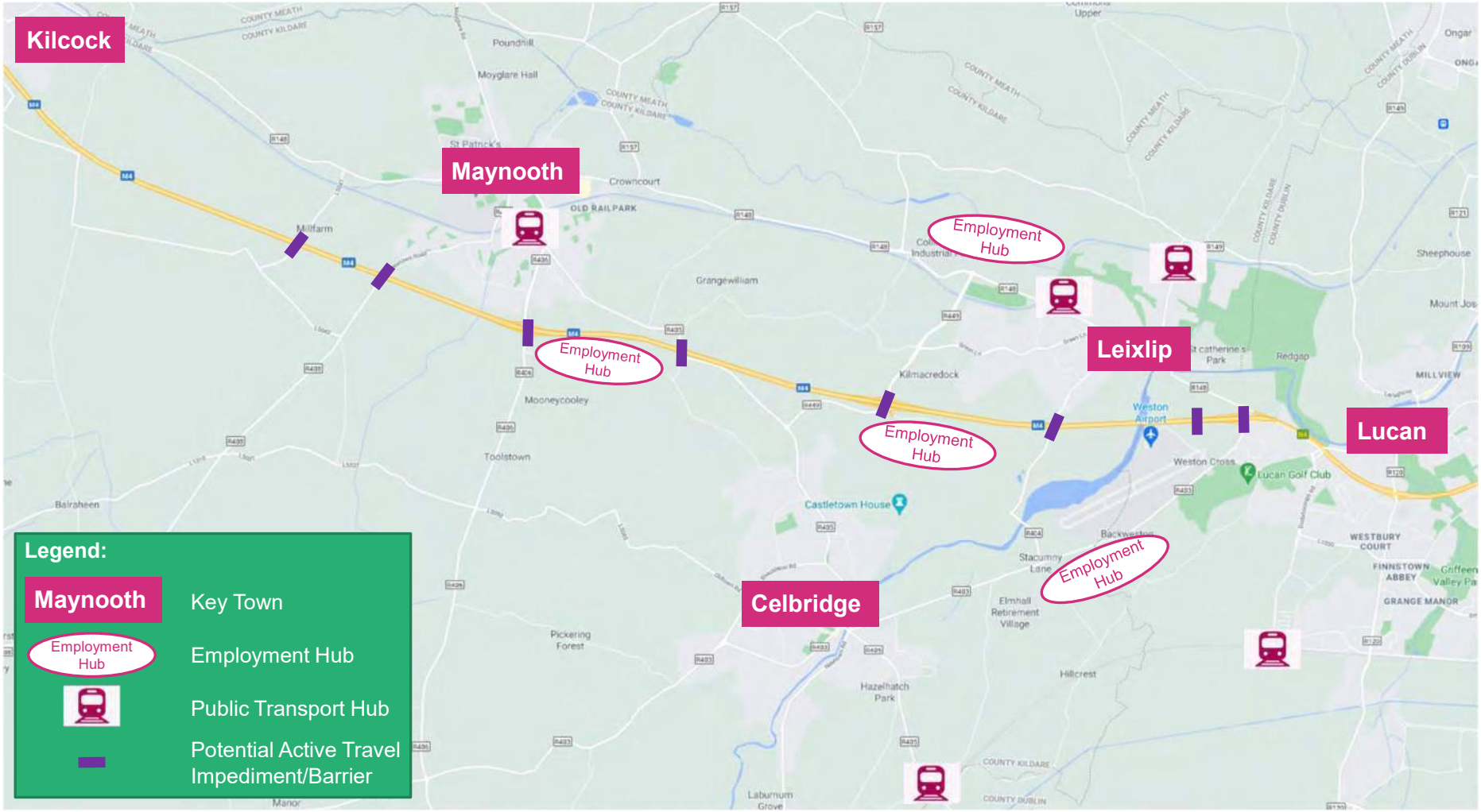
We must consider corridors first because:

1. We are in a motorway environment (no walking and cycling).
2. Corridor study is linear and runs east west (primary function is to serve strategic traffic), with Active Travel serving settlements and trip attractors north, south, east and west.
3. Potential severance by the motorway environment.

> *"Improve infrastructure in, across and adjacent to the M4/N4 corridor which may form barriers to physical activity and in particular linkage between key local trip attractors including education, work, residential, leisure and natural environment."* ***Physical Activity sub-objective 1***

The above demonstrates a need to establish a potential corridor of interest for this project to consider Active Travel interventions.

Active Travel – Trip Attractors



Active Travel – Trip Attractors

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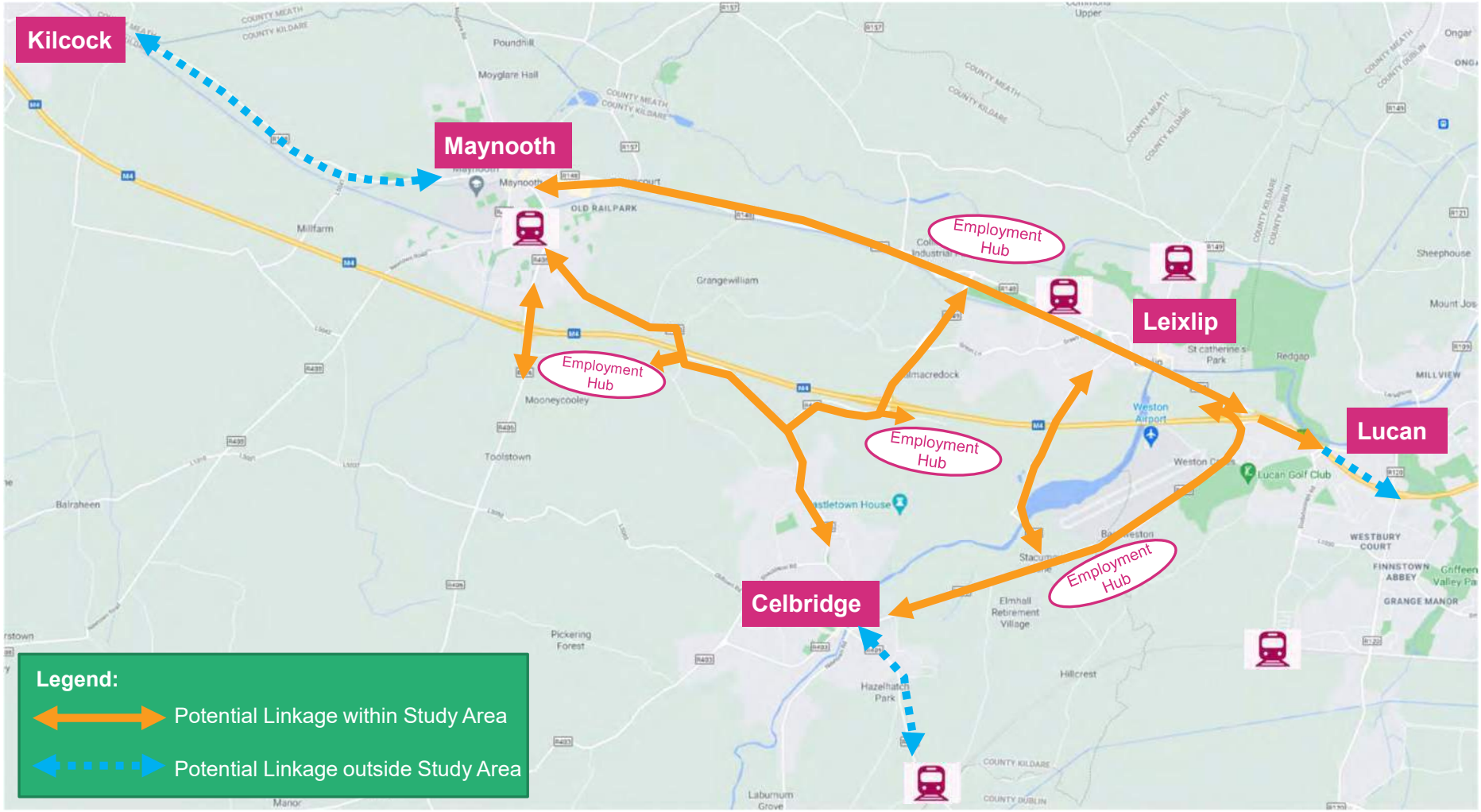
Active Travel – Potential Key Linkages



Active Travel – Potential Key Linkages

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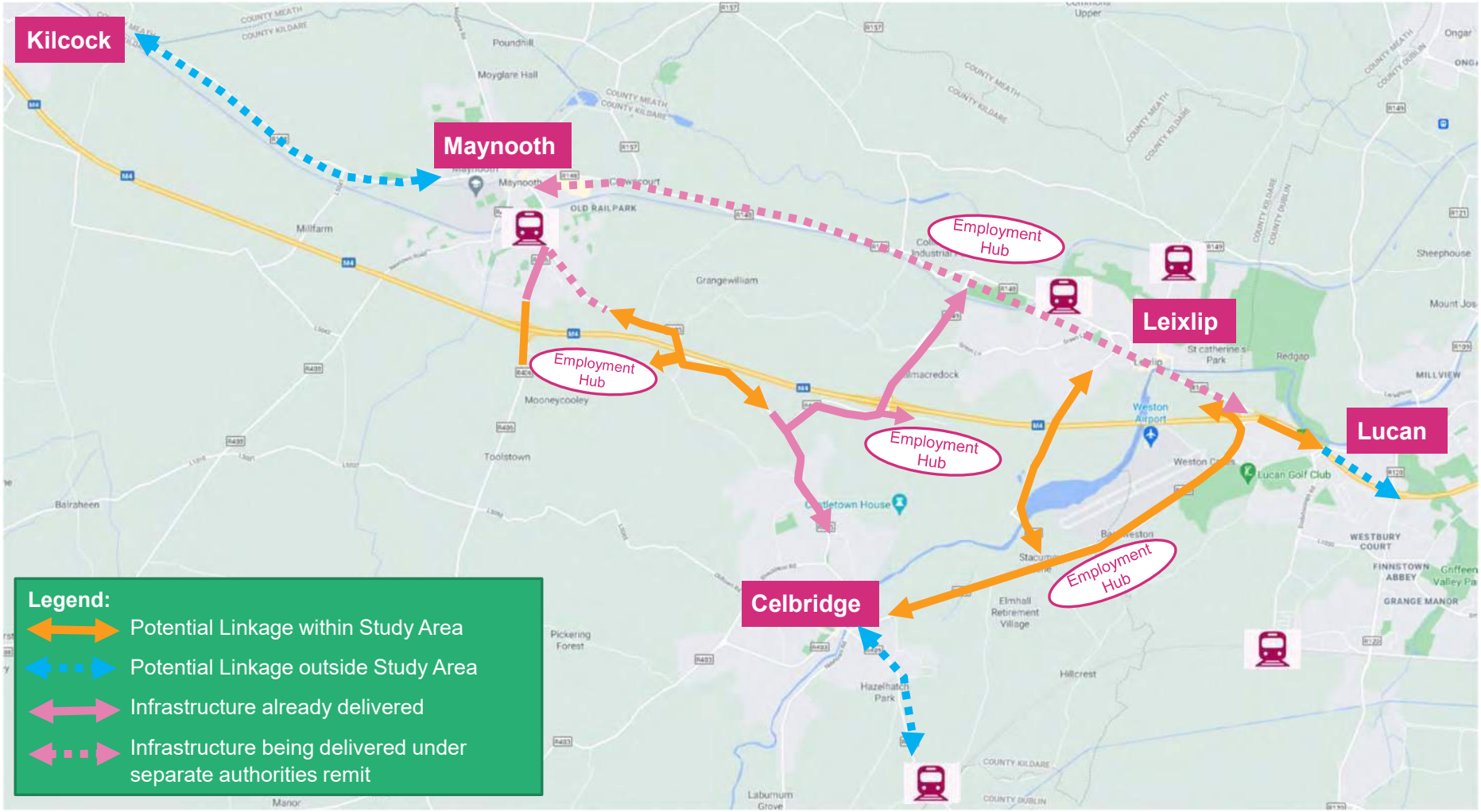
Active Travel – Potential Key Linkages outside Urban Areas



Active Travel – Potential Key Linkages outside Urban Areas

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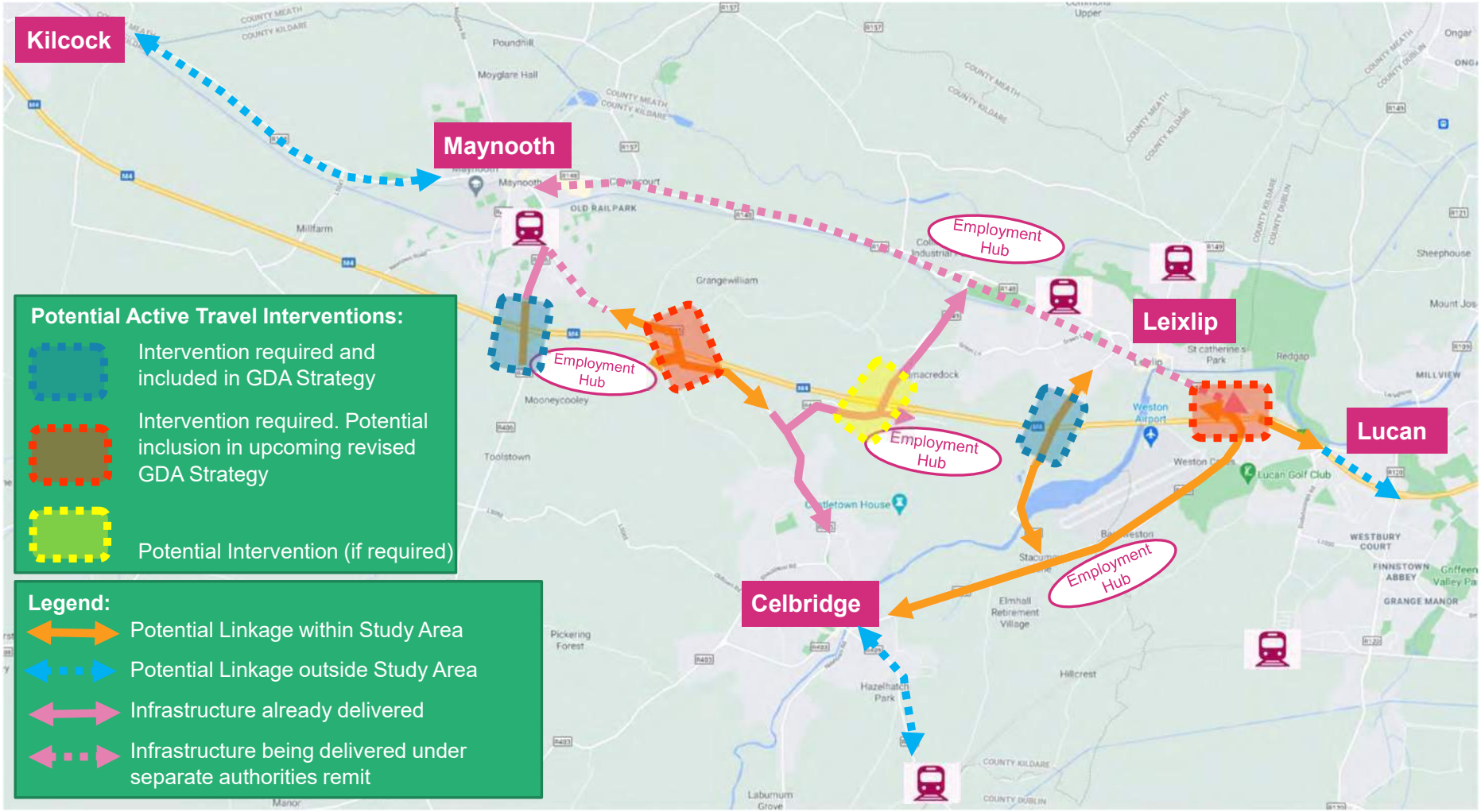
Active Travel – Potential Key Linkages outside Urban Areas



Active Travel – Potential Key Linkages outside Urban Areas

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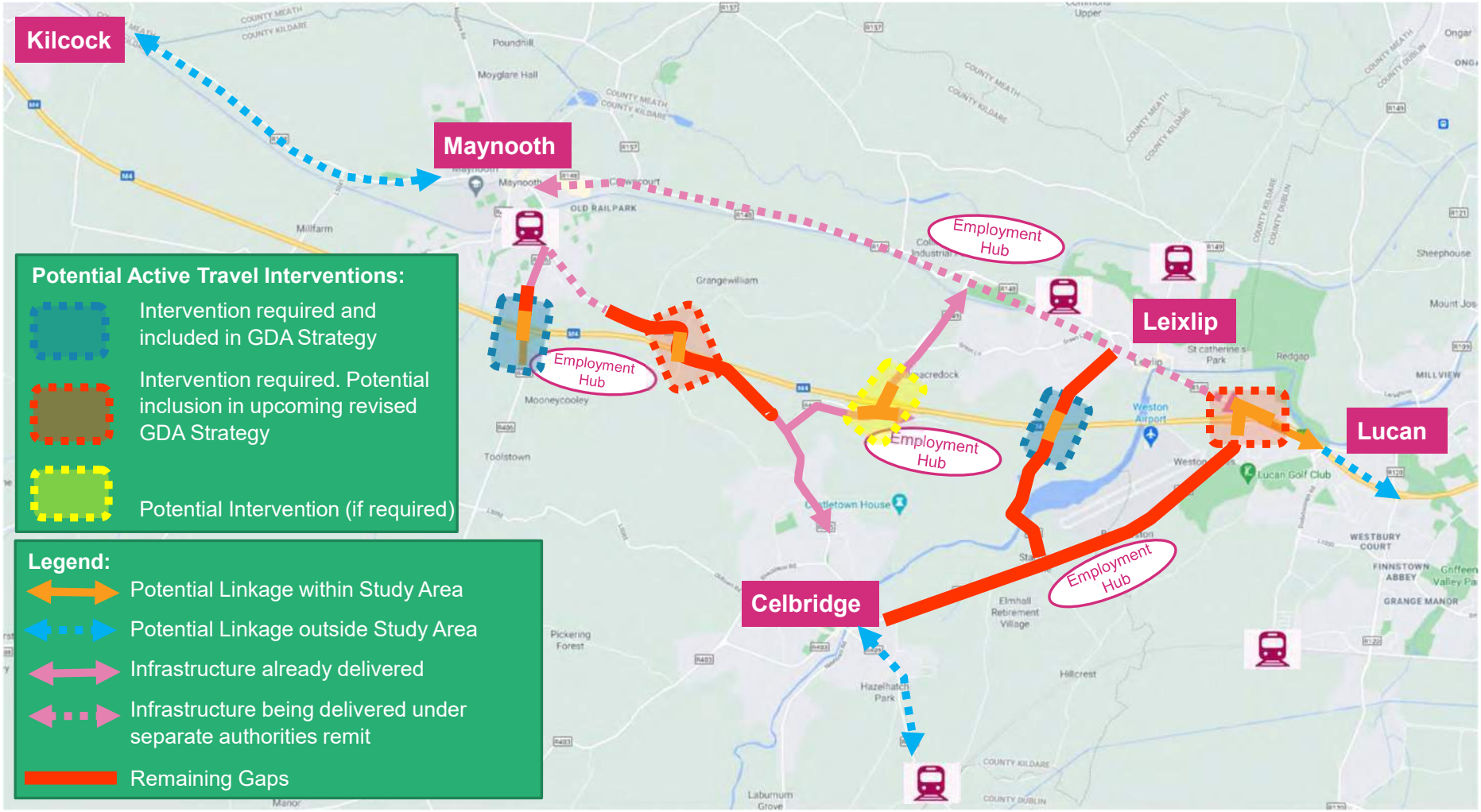
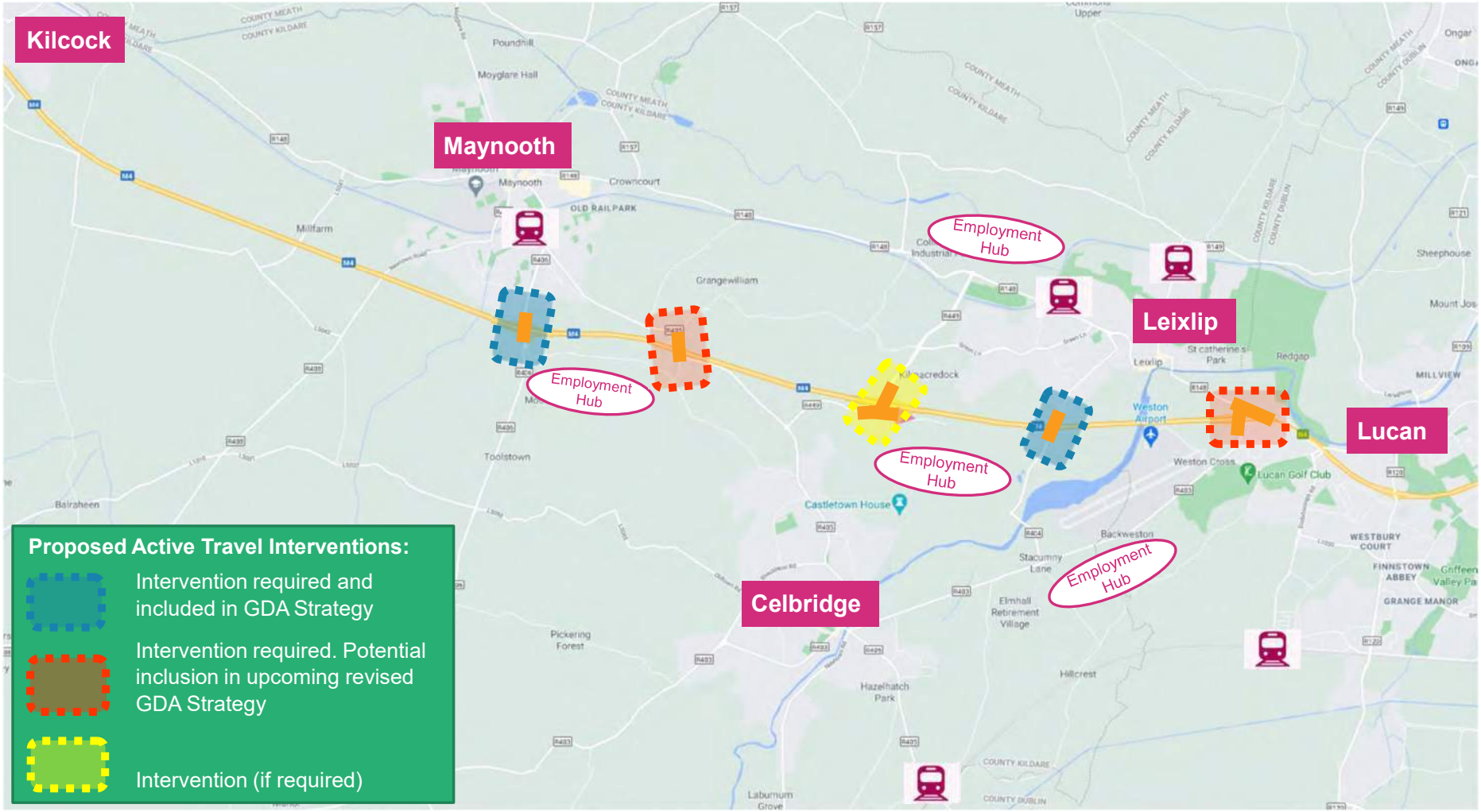
Active Travel – Potential Key Linkages outside Urban Areas



Active Travel – Potential Key Linkages outside Urban Areas

ARUP

Active Travel – Proposed Interventions



Active Travel – Proposed Interventions

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Active Travel – Project Objectives (Physical Activity)

The proposed Active Travel Interventions also addresses Physical Activity sub-criteria (a)

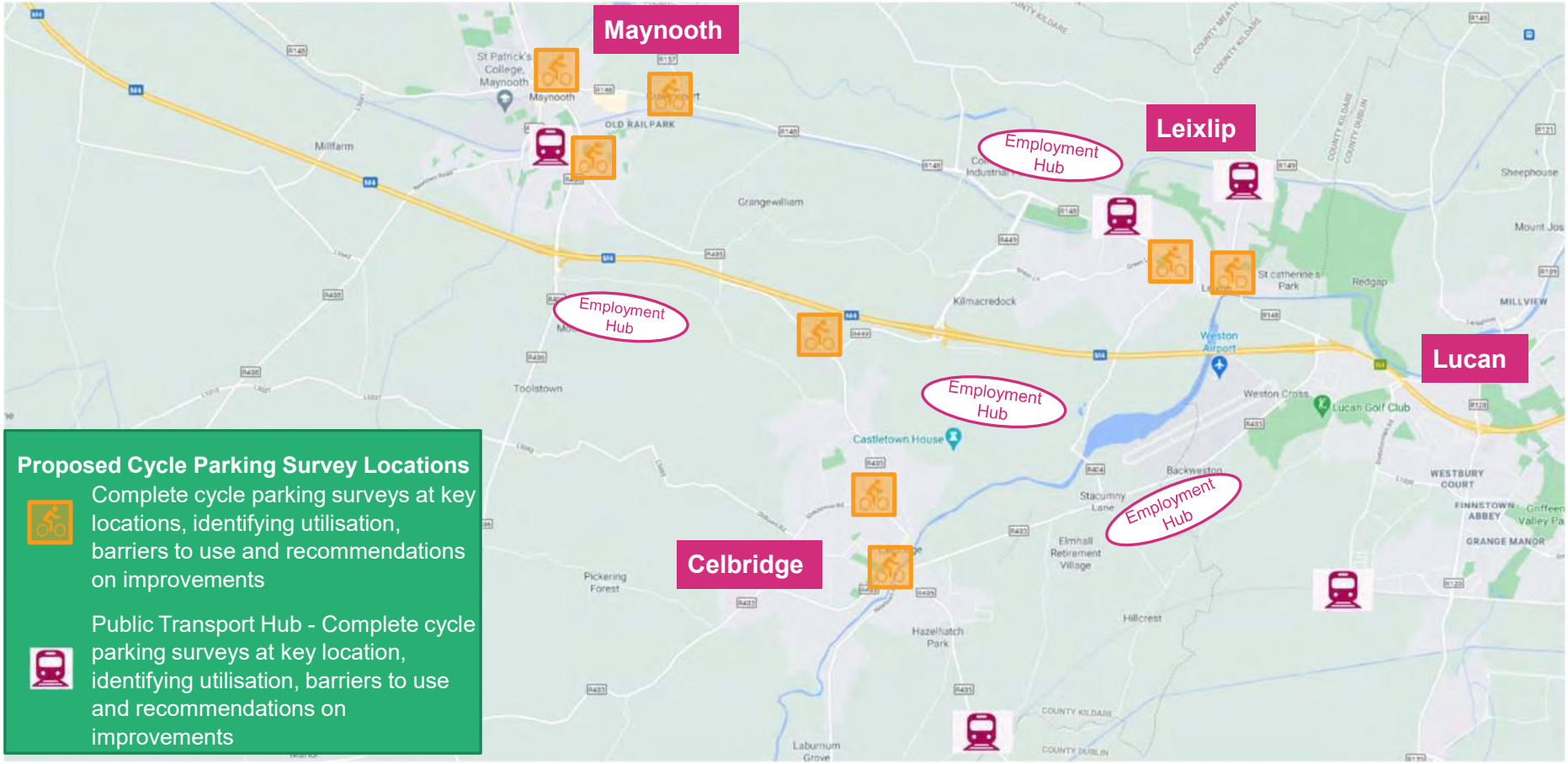
a) Improve infrastructure in, across and adjacent to the M4/N4 corridor which may form barriers to physical activity and in particular linkage between key local trip attractors including education, work, residential, leisure and natural environment. ✓

b) Support the provision for cycle parking and infrastructure at key public transport nodes and destinations. ?

c) Support the creation of a healthy environment conducive to active travel.

Active Travel – Cycle Parking and Infrastructure Provision

Physical Activity sub-criteria (b): Support the provision for cycle parking and infrastructure at key public transport nodes and destinations



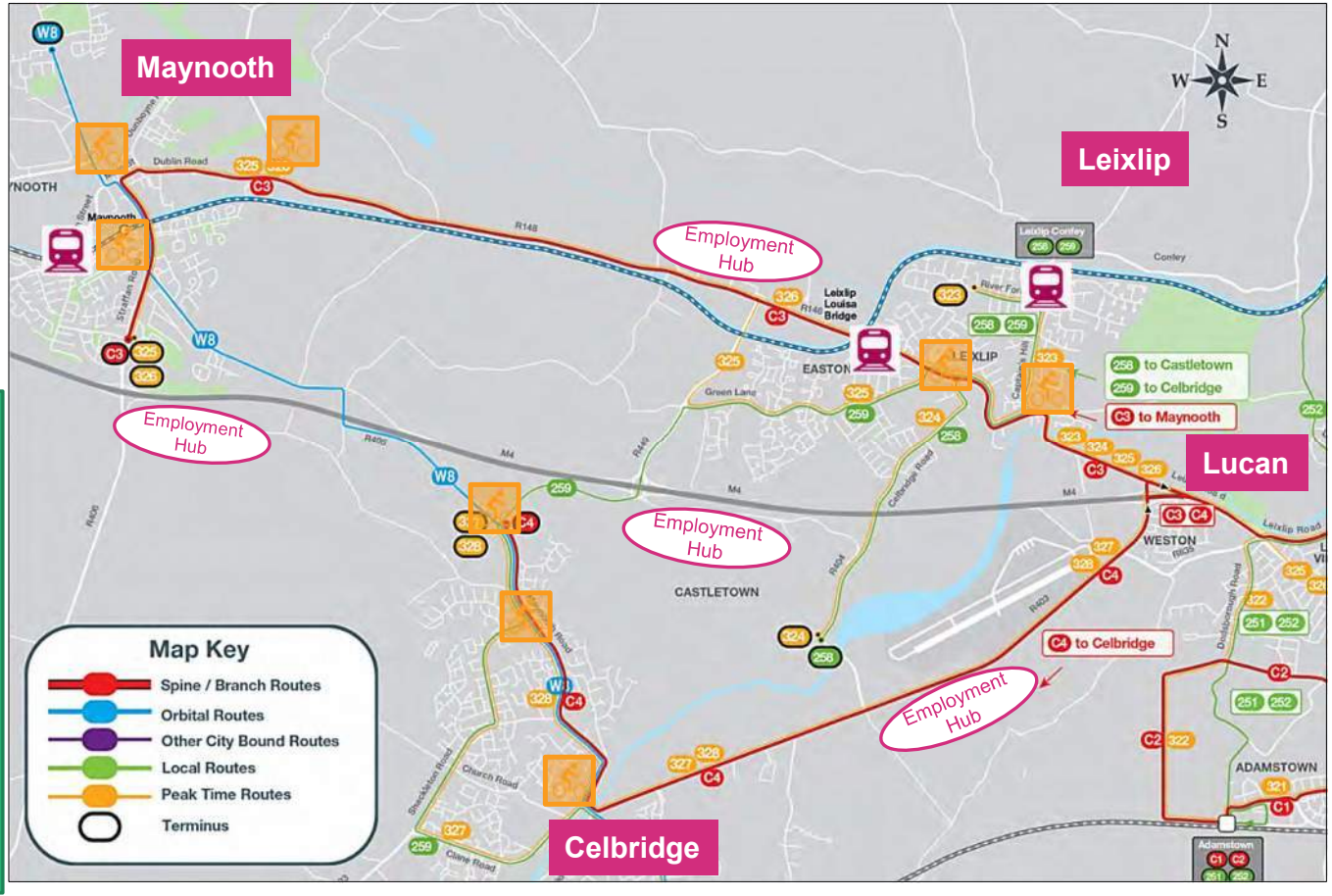
Active Travel – Cycle Parking and Infrastructure Provision

Physical Activity sub-criteria (b): Support the provision for cycle parking and infrastructure at key public transport nodes and destinations

Proposed Cycle Parking Survey Locations

Complete cycle parking surveys at key locations, identifying utilisation, barriers to use and recommendations on improvements

Public Transport Hub - Complete cycle parking surveys at key location, identifying utilisation, barriers to use and recommendations on improvements



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Active Travel – Project Objectives (Physical Activity) Summary

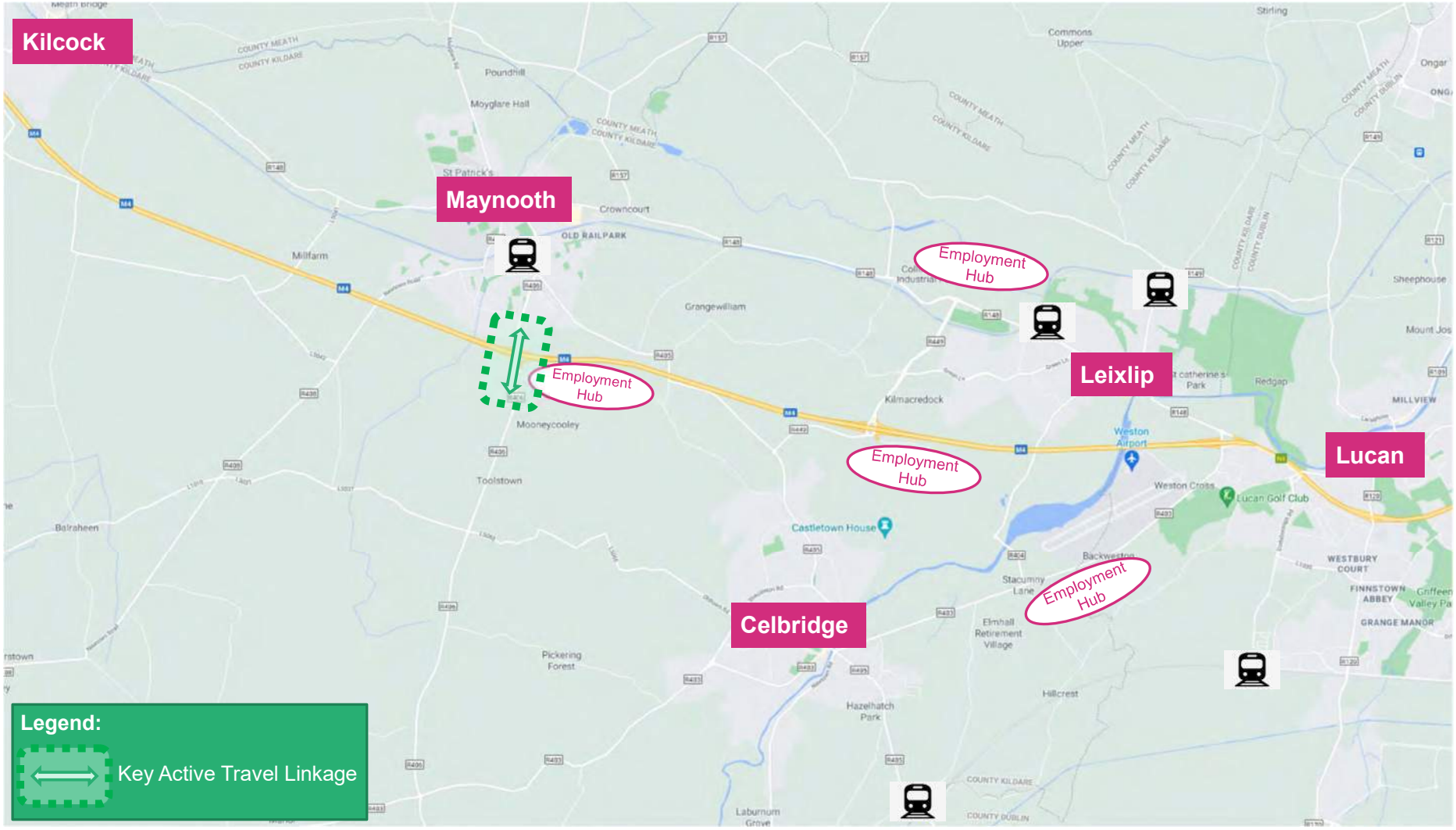
The proposed Active Travel Interventions now addresses Physical Activity sub-criteria (a) and (b). Combined interventions for Physical Activity sub-criteria (a) and (b), would partially address (c)

a) Improve infrastructure in, across and adjacent to the M4/N4 corridor which may form barriers to physical activity and in particular linkage between key local trip attractors including education, work, residential, leisure and natural environment. ✓

b) Support the provision for cycle parking and infrastructure at key public transport nodes and destinations ✓

c) Support the creation of a healthy environment conducive to active travel ✓

AT1.1 – Active Travel Enhancement at Junction 7 on the R406



Active Travel Based Elements

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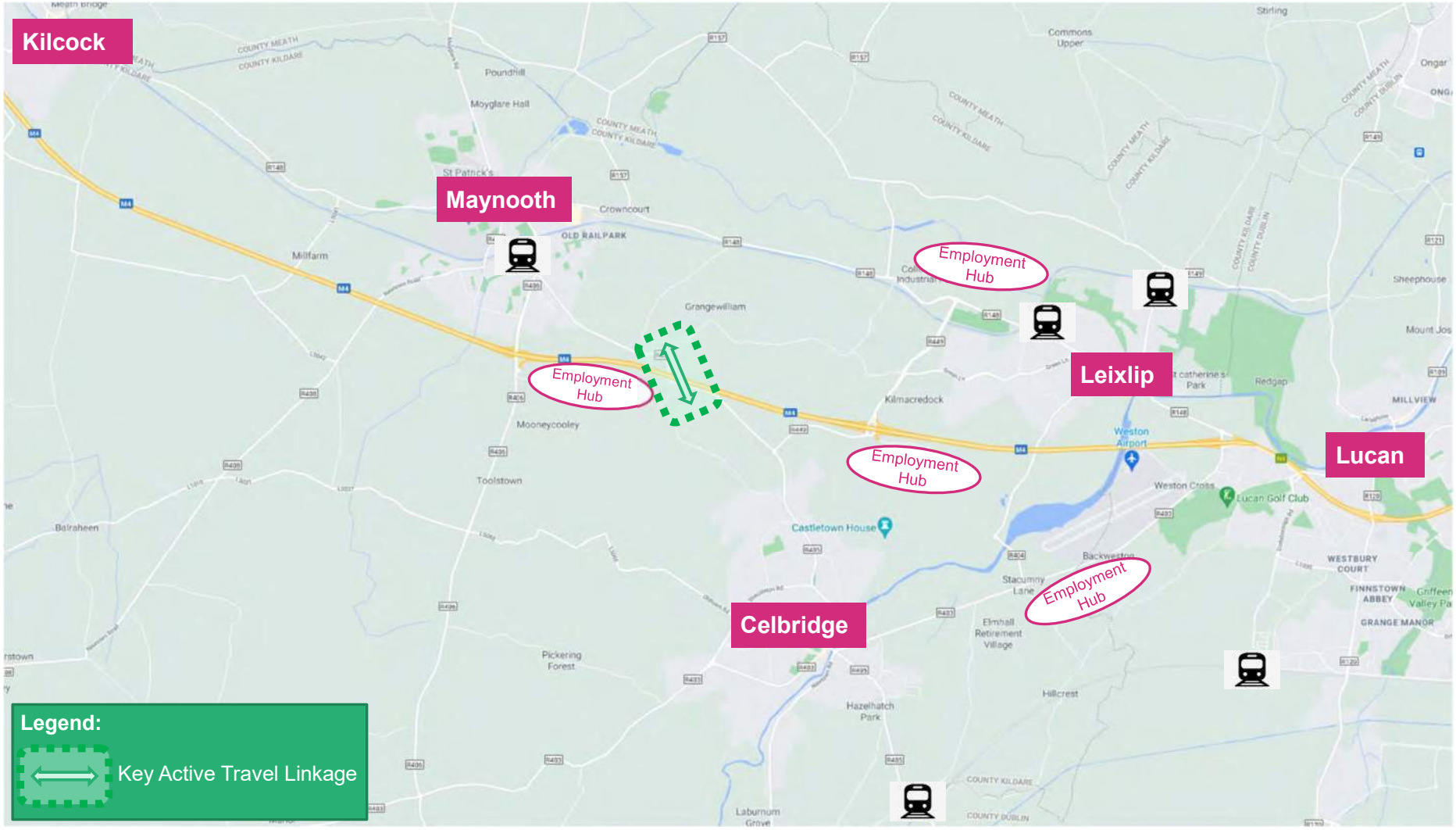
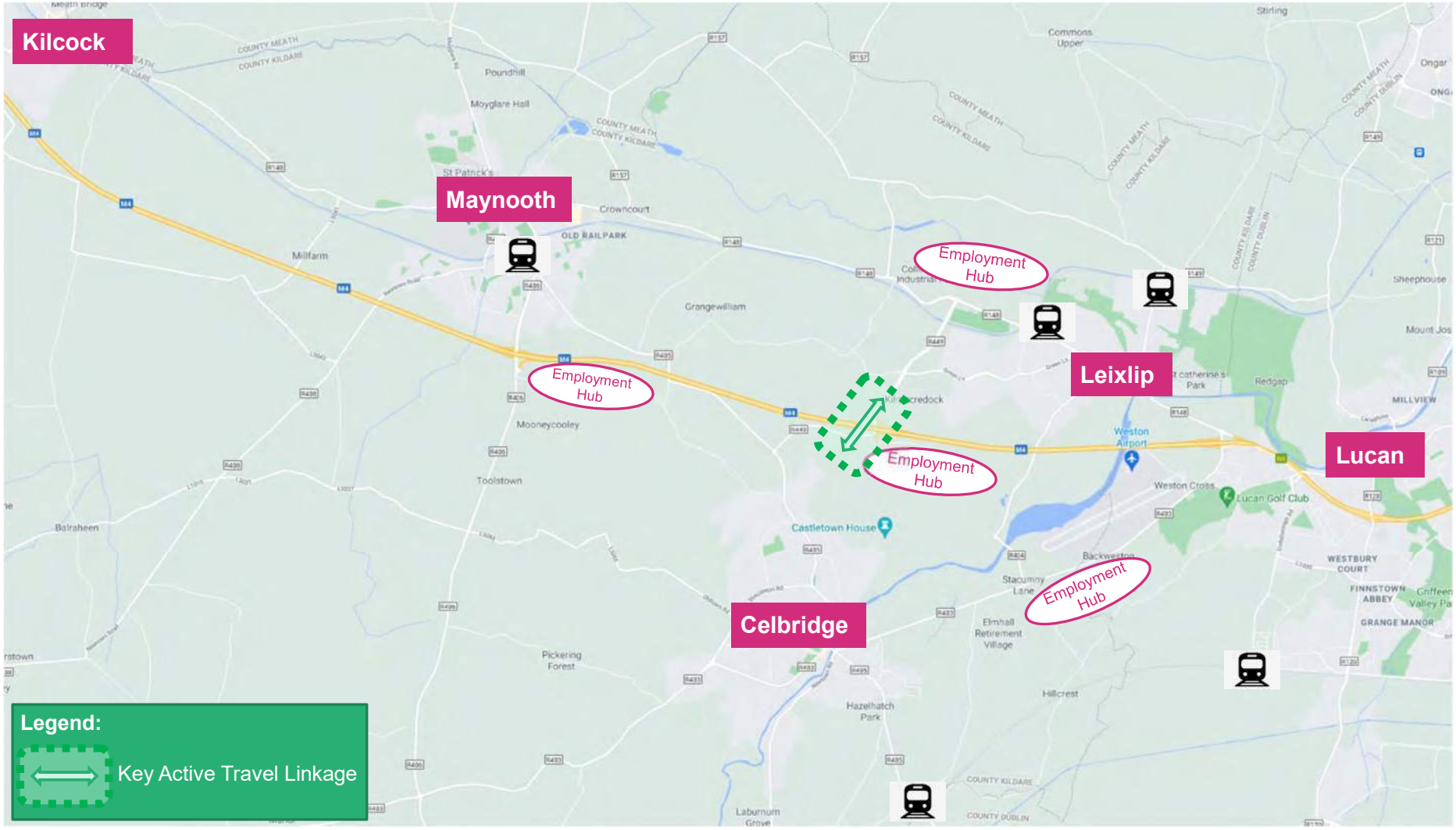
AT1.2 – Active Travel Enhancement on the R405 Overbridge



Active Travel Based Elements

ARUP

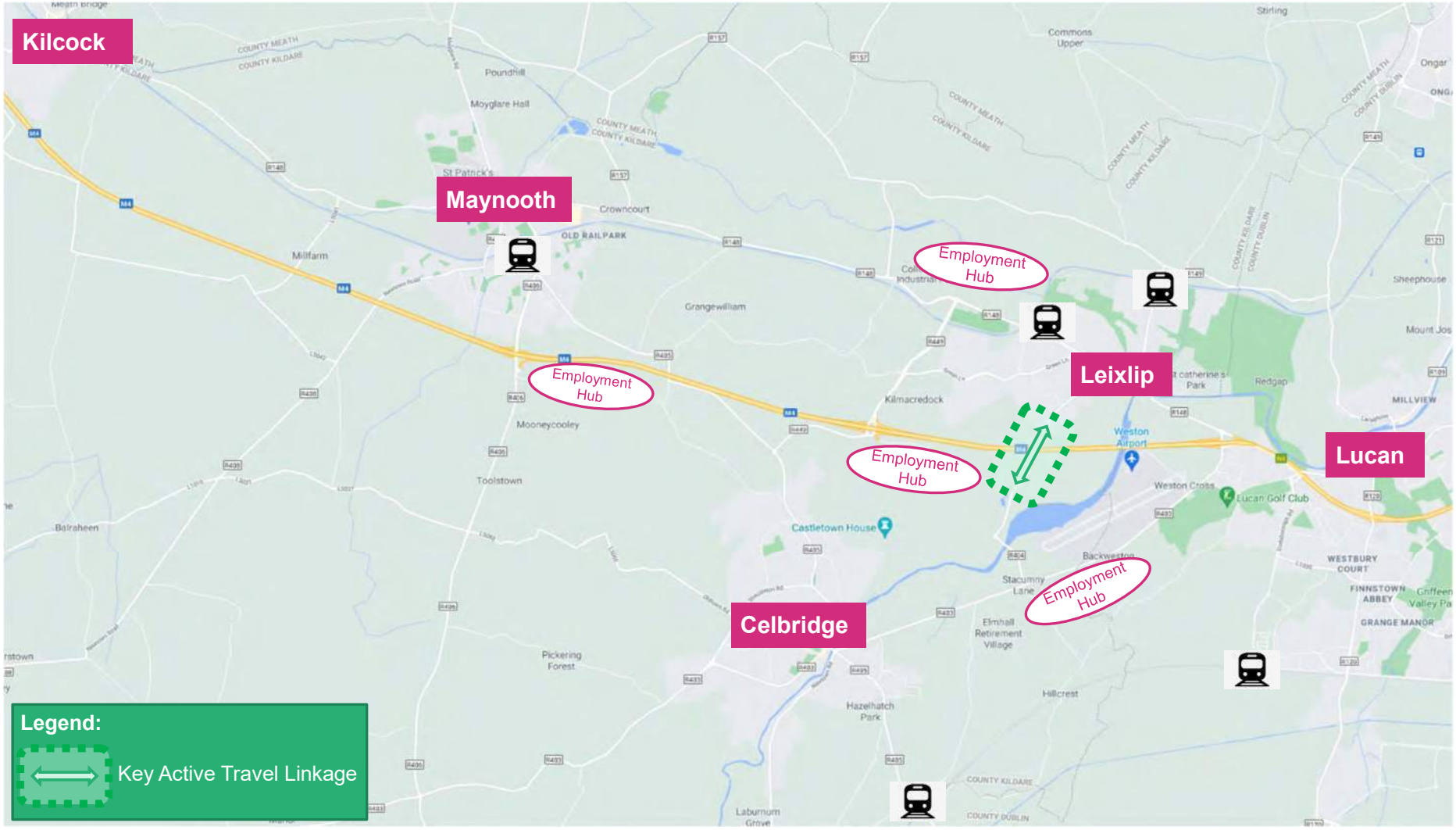
AT1.3 – Active Travel Enhancement at Junction 6 on the R449



Active Travel Based Elements

ARUP

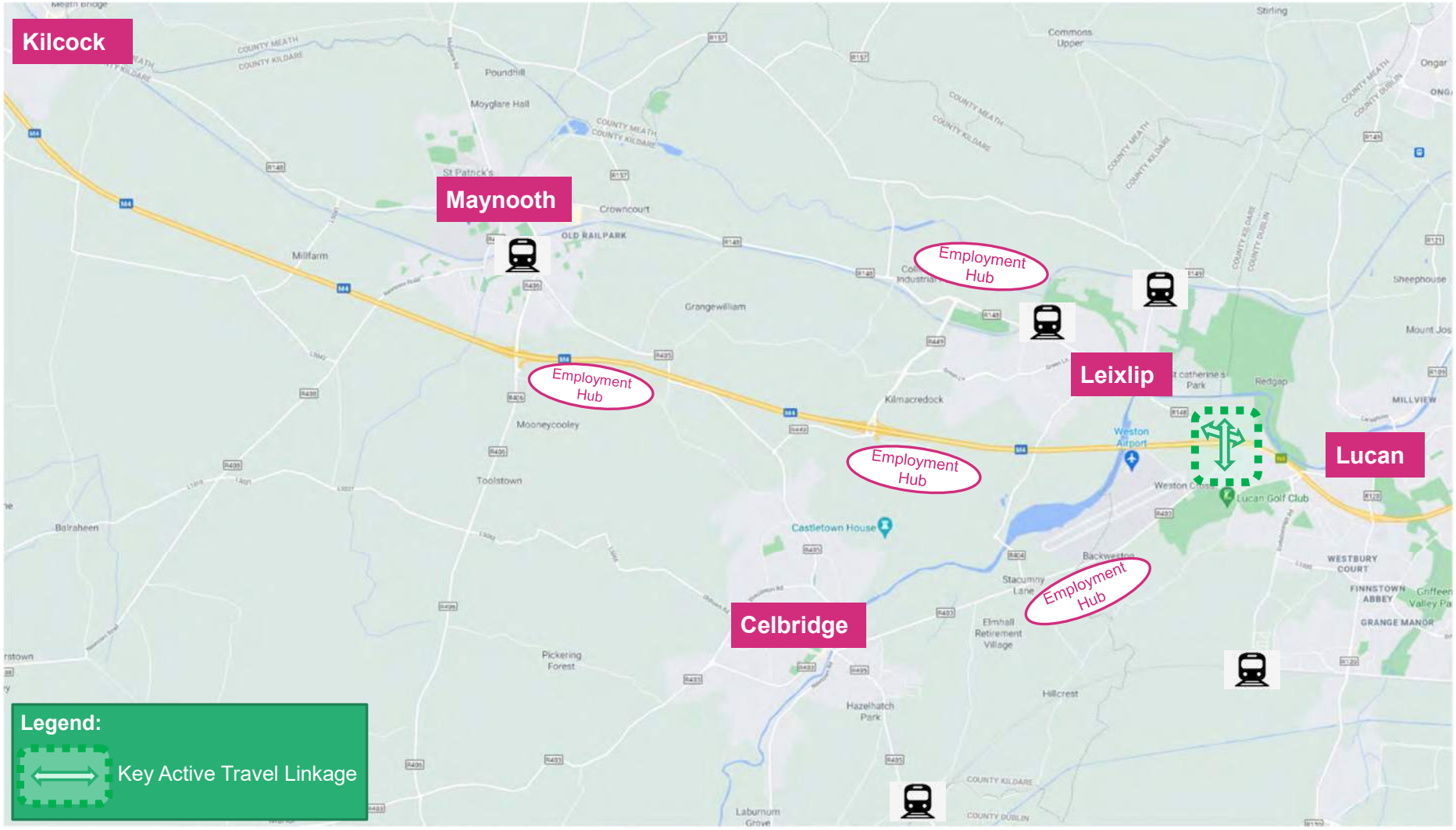
AT1.4 – Active Travel Enhancement on the R404 Overbridge



Active Travel Based Elements

ARUP

AT1.5 – Active Travel Enhancement at Junction 5



Active Travel Based Elements

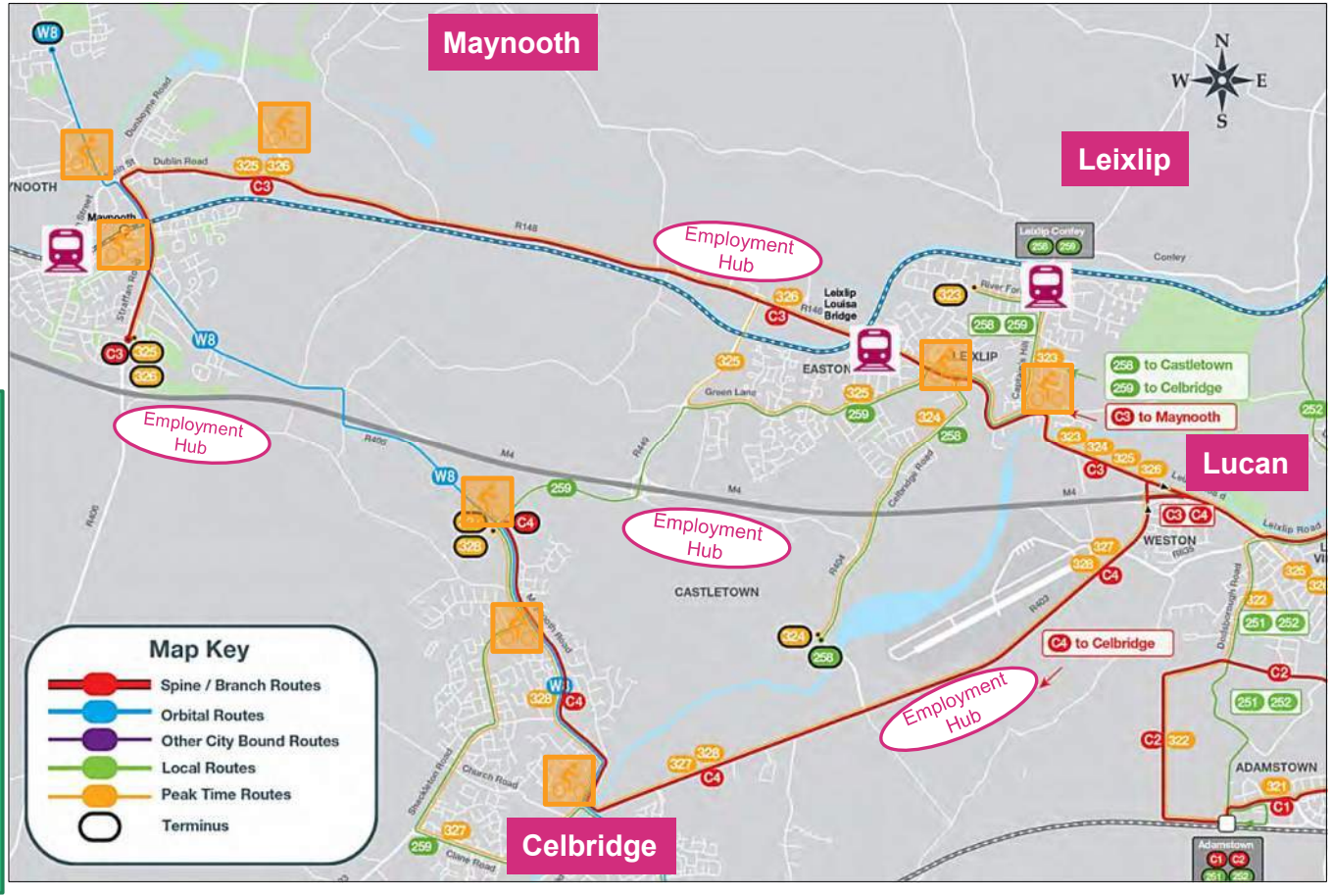
ARUP

AT2.1 – Support the Provision for Cycle Parking and Infrastructure at Key Public Transport Nodes and Destinations

Proposed Cycle Parking Survey Locations

Complete cycle parking surveys at key locations, identifying utilisation, barriers to use and recommendations on improvements

Public Transport Hub - Complete cycle parking surveys at key location, identifying utilisation, barriers to use and recommendations on improvements



Active Travel Based Elements

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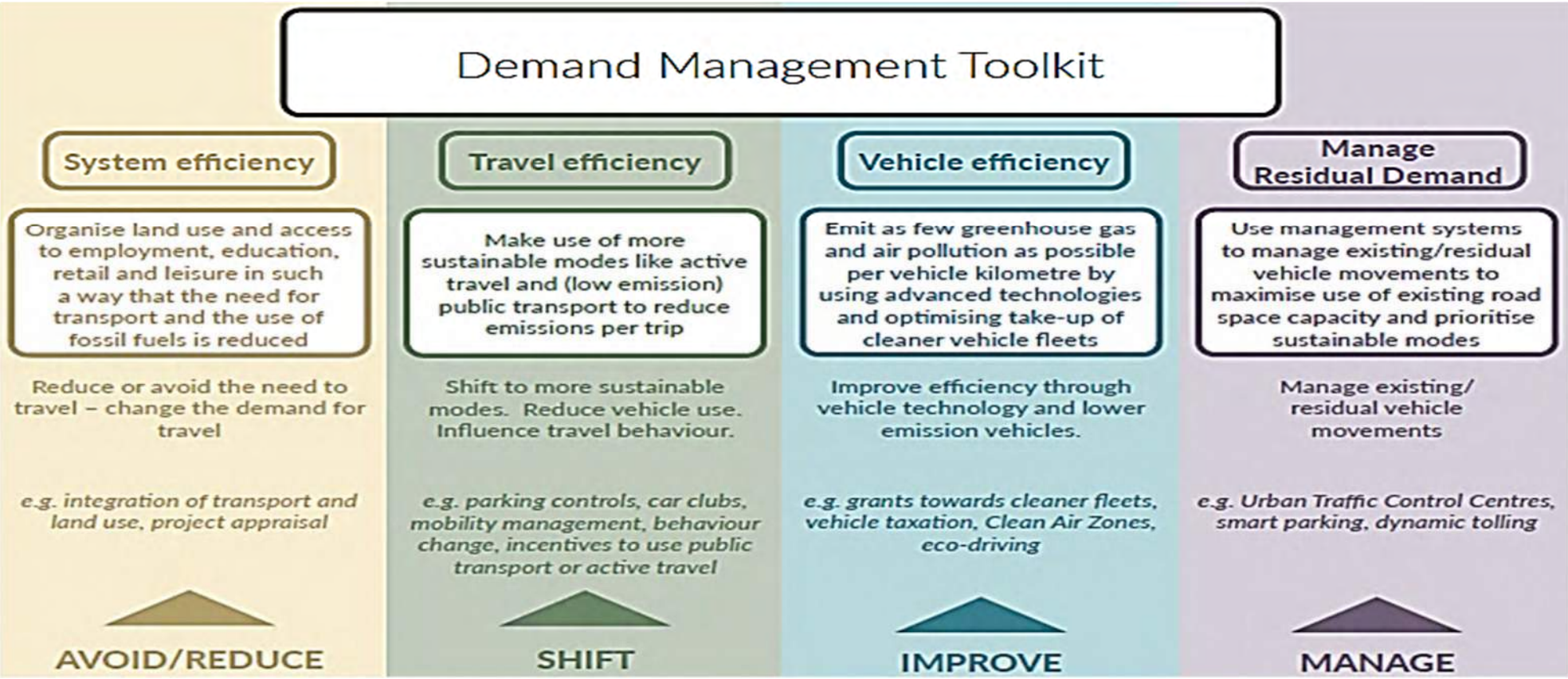
Demand Management

Demand Management Overview



- Refer to Excel Spreadsheet for details

MAYNOOTH TO LEIXLIP PROJECT

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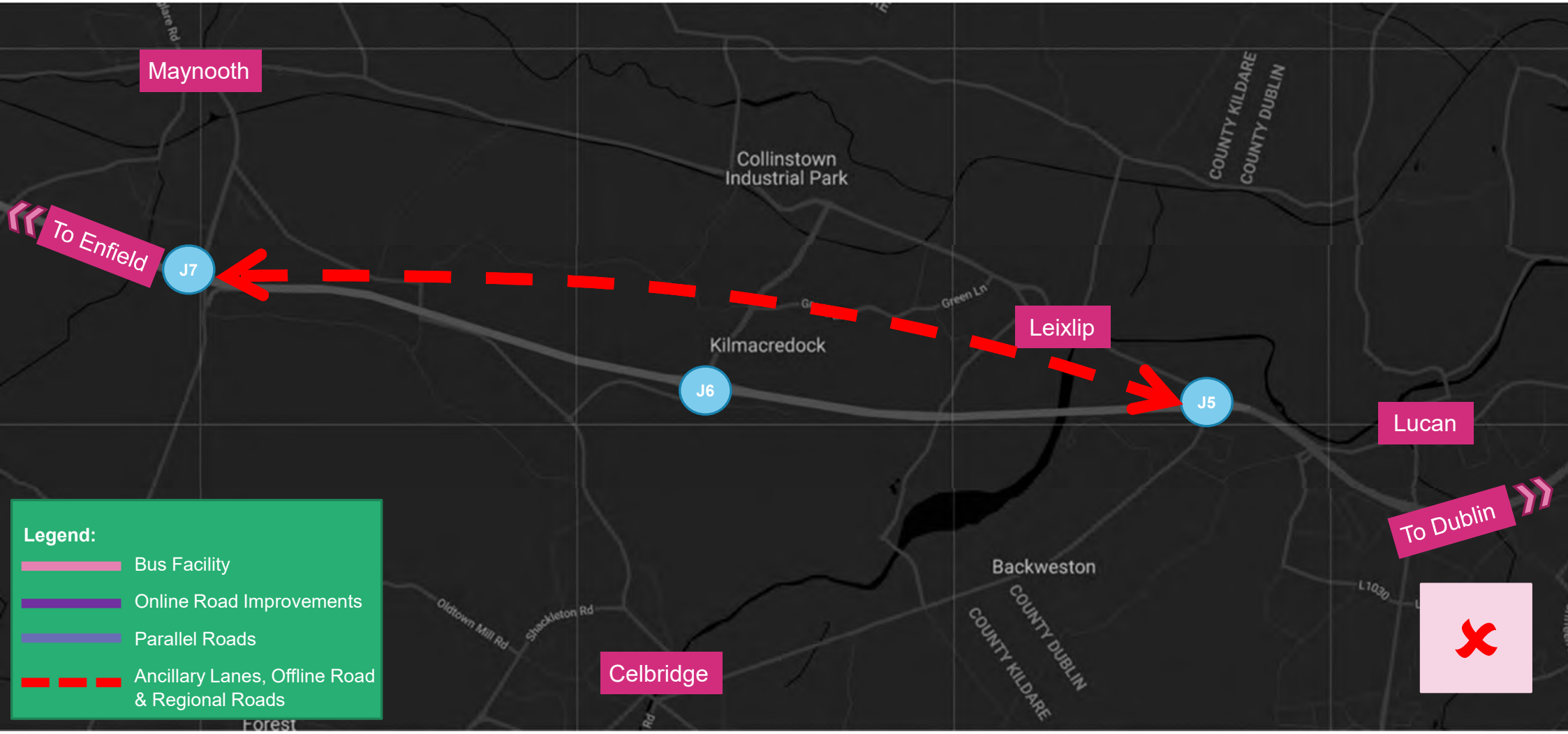
Road

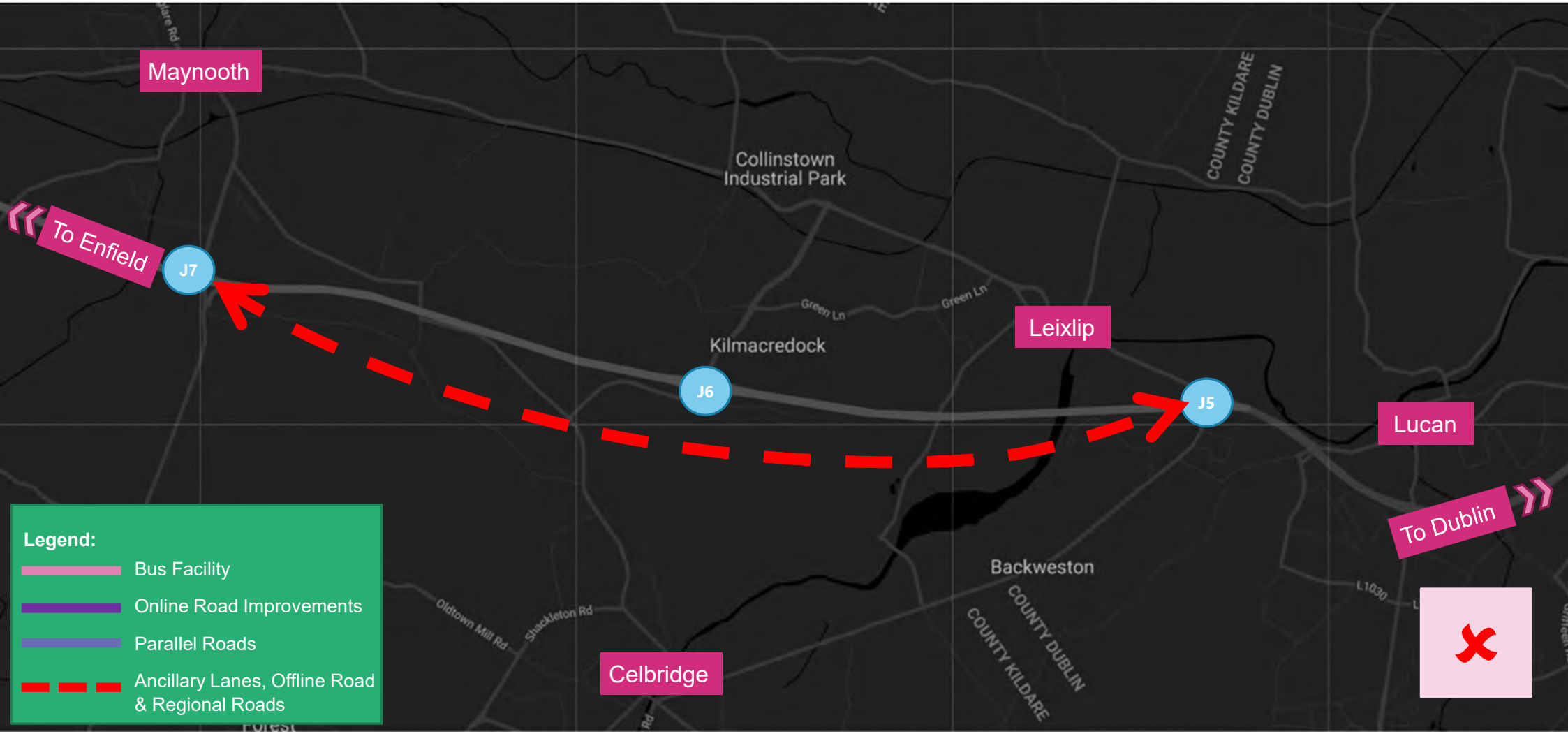
RD1.1 - Offline to the North



Road Based Elements

ARUP

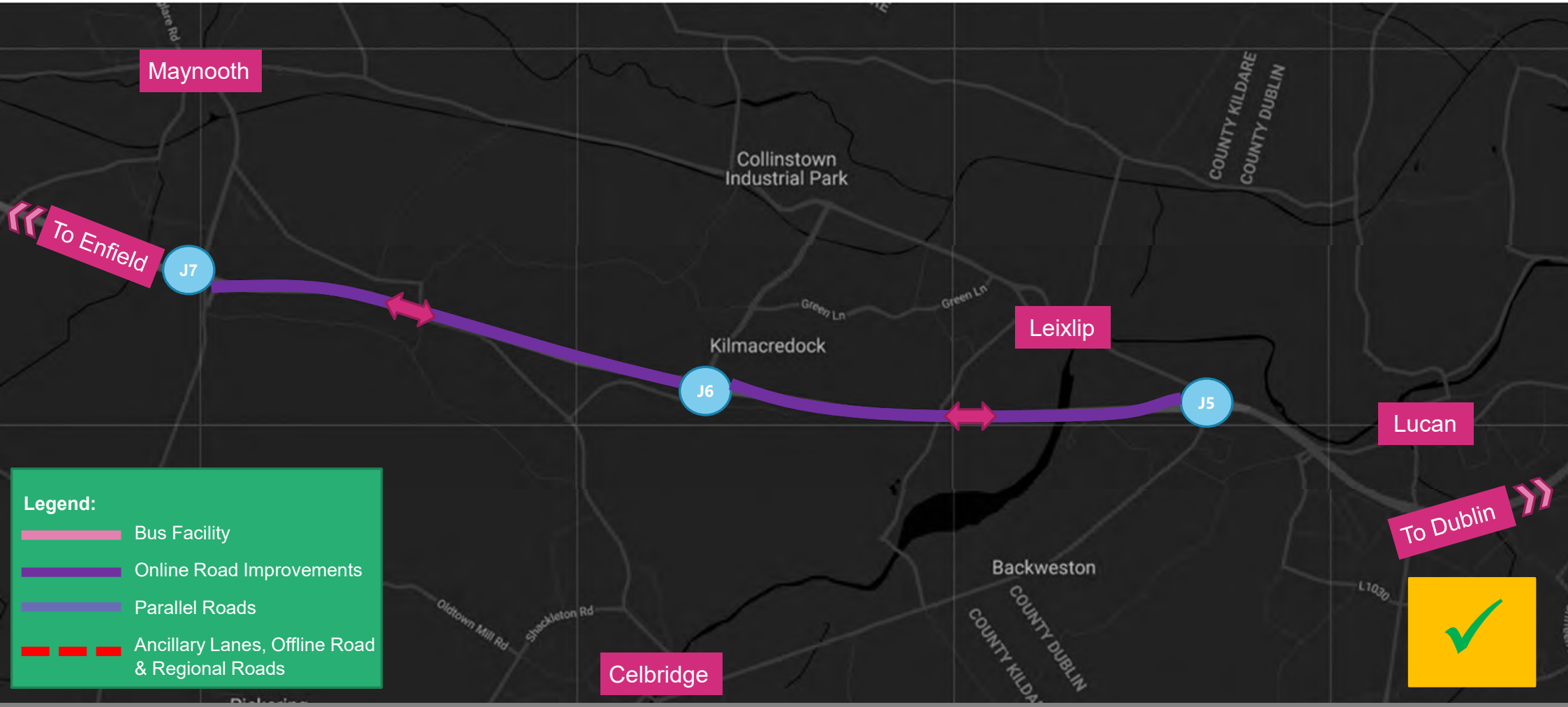
RD2.1 - Offline to the South



Road Based Elements

ARUP

RD3.1 – Online Widening to 3 Lanes from J5 to J7/or J6* (Both Directions)

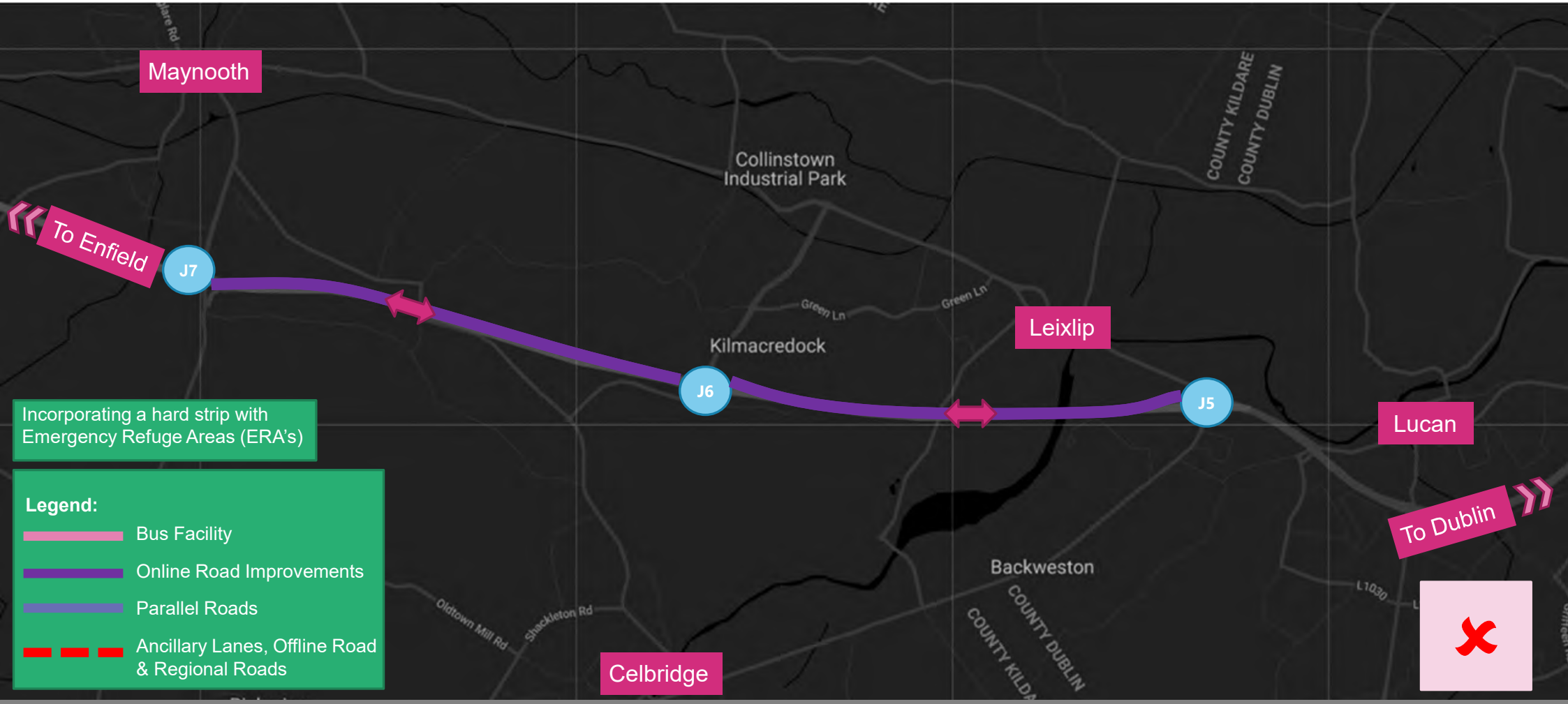


*The exact extent of the intervention will be determined at a later stage, based on assessment results

Road Based Elements

ARUP

RD3.2 – Online Widening to 3 Lanes from J5 to J7/or J6* (Both Directions)



*The exact extent of the intervention will be determined at a later stage, based on assessment results

Road Based Elements

ARUP