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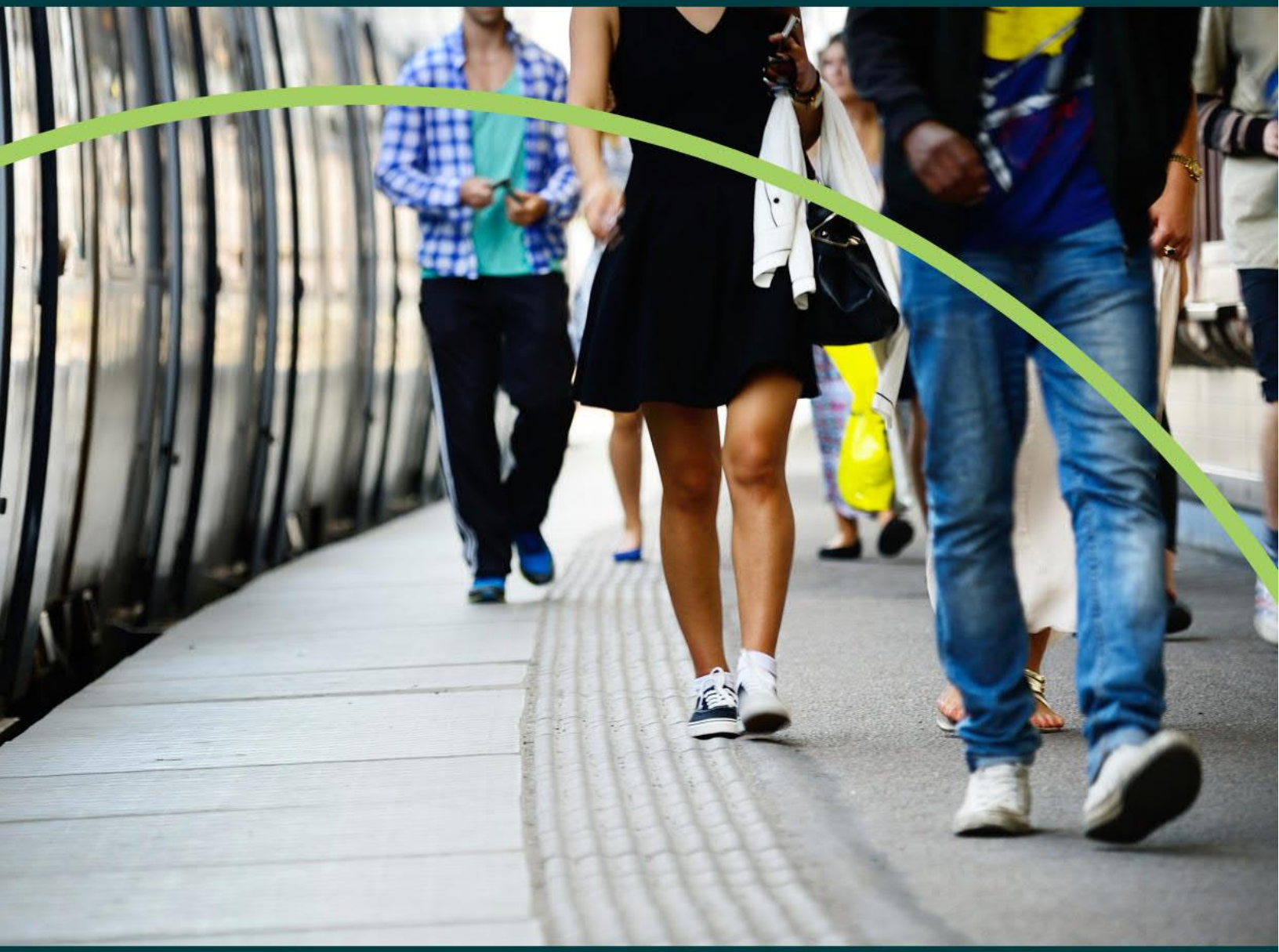

NAVAN RAIL LINE ASSESSMENT REPORT

PACE TO NAVAN

September 2021

Delivering a better world

Quality information

Prepared by	Checked by	Approved by	Verified By
DL	MF	SD	DC

Revision History

Rev	Revision date	Details	Authorised	Position
01	22/06/21	Initial Draft for discussion		
02	28/07/21	V2	Damien Lambert	PM
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Distribution List

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CONTENTS

FIGURES

TABLES

Definition of terms

AA	Appropriate Assessment
AAT	Agglomeration Analysis Tool
ACA	Architectural Conservation Area
BCR	Benefit to Cost Ratio
BEMU	Battery-Electric Multiple Unit
CAF	Common Appraisal Framework
CBA	Cost-Benefit Analysis
CBC	Core Bus Corridor
CFRAMS	Catchment Flood Risk Assessment and Management Study
CIÉ	Córas Iompair Éireann
CME	Chief Mechanical Engineer
cSAC	Candidate Special Area of Conservation
cSPA	Candidate Special Protection Area
DHLGH	Department of Housing, Local Government and Heritage
DMU	Diesel Multiple Unit
DoT	Department of Transport
DPER	Department of Public Expenditure and Reform
DTTaS	Department of Transport, Tourism and Sport
EFEU	Economic and Financial Evaluation Unit
EIAR	Environmental Impact Assessment Report
EMRA	Eastern and Midland Regional Assembly
EMU	Electric Multiple Unit
ERM	NTA's East Regional Model
ESRI	Economic and Social Research Institute
FEMFRAMS	Fingal East Meath Flood Risk Assessment and Management Study
GDA	Greater Dublin Area
GHG	Greenhouse Gas
GNP	Gross National Product
GVA	Gross Value Added
HGV	Heavy Goods Vehicle
IÉ	Iarnród Éireann Irish Rail

IM	Infrastructure Manager
IMMAC	Infrastructure Manager Multi-Annual Contract
LAP	Local Area Plan
LGV	Light Goods Vehicle
LVIA	Landscape and Visual Impact Assessment
MCA	Multi-Criterial Analysis
MCC	Meath County Council
NDP	National Development Plan
NIS	Natura Impact Statement
NPF	National Planning Framework
NPO	National Policy Objectives
NPV	Net Present Value
NSO	National Strategic Outcomes
NTA	National Transport Authority
O&M	Operation and Maintenance
OPW	Office of Public Works
PAG	Project Appraisal Guidelines
PSC	Public Spending Code
PSO	Public Service Obligation
PT	Public Transport
PVB	Present Value of Benefits
PVC	Present Value of Costs
RSA	Roads Safety Authority
RSES	Regional Spatial and Economic Strategy
RU	Railway Undertaking
SAC	Special Area of Conservation
SCSI	Society of Chartered Surveyors Ireland
SIFLT	Strategic Investment Framework for Land Transport
SPA	Special Protection Area
STP	Strategic and Transport Planning
TII	Transport Infrastructure Ireland
TUBA	Transport User Benefit Appraisal

1. Executive summary

To inform the review of the Transport Strategy for the Greater Dublin Area 2016– 2035, the National Transport Authority (NTA) commissioned AECOM to re-assess the extension of the railway to Navan, in collaboration with Meath County Council.

1.1 Strategic rationale

Navan is the administrative centre and largest urban centre in County Meath and has experienced rapid population growth over the last two decades. Navan is one of the fastest growing towns in the country, with its population increasing by 20% between 2006 and 2016 alone, contributing to a projected population for Meath of up to 250,000 by 2040. This growth, particularly in the eastern and northern parts of Navan, has contributed to a situation where a large proportion of the population leave home every day to travel to their place of work, a large proportion of which is in Dublin. The report documents the impact this commute has on the quality of life of the people of Meath in terms of its social, health, economic and environmental impacts.

Navan is located approximately 45km north west of Dublin city centre and occupies a strategically important position within Meath, in the north east of the country. The town and Meath today have the capacity to accommodate substantial further population and employment growth through regeneration, consolidation, and high-quality development. To build an economically vibrant and environmentally sustainable town with the ability to attract domestic and foreign investment, the development of high capacity, efficient public transport links between Meath and the Dublin Metropolitan Area is required.

While a bus option may have provided a level of connectivity for the past few decades, as the population of Meath grows, and as the main economic corridor between Navan and Dublin grows in influence and becomes more congested, an alternative, more reliable corridor will be required.

Rail represents a viable alternative over a bus-based option and has significant qualitative and quantitative benefits which are examined as part of this assessment.

The assessment has also demonstrated how the project supports the objectives of national policies, including Project Ireland 2040 and the Climate Action and Low Carbon Development Act. It has also highlighted the important role the rail line plays in the development of Meath and Navan, as referenced in their respective development plans.

1.2 Scope

The assessment has been undertaken to:

- Validate that the preferred route for the Navan Rail line identified in the draft Environmental Impact Statement (EIS) prepared by Irish Rail in 2011 remains available for construction, has not been compromised and that this route remains a reasonable representation of the optimum route for a rail link to Navan.
- Establish the strategic rationale for the project and illustrate how the project aligns with local and national development priorities.
- Develop cost forecasts for the project.
- Establish and agree population and employment projections for County Meath.
- Determine the level of demand for the project now and into the future.
- Provide a comprehensive assessment of the benefits of the project including its economic, environmental, and societal impacts.

1.3 Options

The assessment includes an analysis of three options:

- Rail Route Option A: The rail line follows the existing historical alignment and runs adjacent to the M3 at Dunshaughlin (where a station is located west of the M3) before continuing on to Navan.
- Rail Route Option B: The rail line follows the existing historical alignment, deviating near Dunshaughlin, where the line will cross over the M3 twice (in order to place a station to the east of Dunshaughlin town centre) before resuming following the historical alignment to continue on to Navan.
- Bus-Based Option C: The bus option will be a high-capacity coach-type bus with a 15-minute frequency. The bus will mostly follow the M3 corridor, stopping at

Navan North, Navan, Kilmessan, Dunshaughlin, Dunboyne, Clonee, Blanchardstown, and multiple stops in Dublin city.

The rail options considered are as proposed in the 2011 Environmental Impact Statement[1] (EIS), Natura Impact Statement (NIS) and draft Railway Order (RO) prepared by Iarnród Éireann (IÉ), and the 2009 Feasibility Study[2], in the case of Option A. Option B is based on the alignment included in the 2009 Feasibility Study only.

1.4 Route validation

The aim of the route validation exercise was to establish that the rail alignments proposed in the 2011 draft RO, the 2011 EIS and the 2011 Natura Impact Statement (NIS) for Option A, and the 2009 Feasibility Study for Option B remain available for construction and have not been compromised during the intervening period, and that the preferred alignment (as indicated by Meath County Council previously) remains a reasonable representation of the optimum route.

Based on a review of publicly available planning information and input from Meath County Council, a review of new developments along each alignment over the last decade was undertaken. This review has identified a number of constraints for Option A and Option B which would need further investigation should the project be developed further. In summary, Option A continues to be the preferred option, as it has been protected by Meath County Council and therefore has been less affected by new development over the last decade.

[1] Environmental Impact Statement, Roughan & O'Donovan – AECOM Alliance, 2011
[2] Navan Railway Line Feasibility Study 2008/09, Roughan & O'Donovan Faber Maunsell

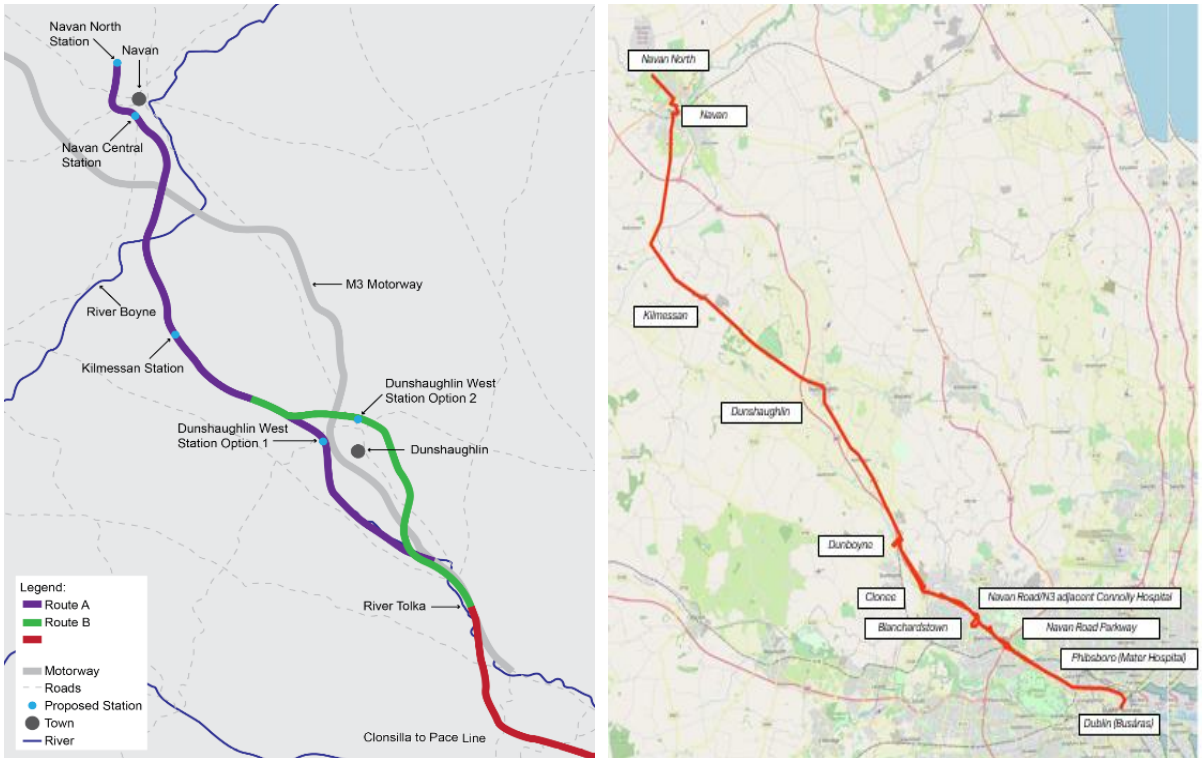


Figure 1-1 Rail Route Options A and B (left) and Bus–Based Option C (right) option alignments

Table 1-1 Rail and Bus options summary

Criteria	Rail Route Option A	Rail Route Option B	Bus-Based Option C
Length (km)	33.4 km	33.6 km	36.6 km
Service Headway (mins)	30 minutes at peak times	30 minutes at peak times	15 minutes
Peak Capacity (passengers per hour per direction)	2,536	2,536	368
Vehicles	DMU service transitioning to BEMU in 2045	DMU service transitioning to BEMU in 2045	High-capacity double decker coaches

It is also important to note that this validation exercise has drawn heavily on previous work undertaken, in particular the Environmental Impact Assessment (EIA) conducted to inform the 2011 EIS. However, as new requirements now apply with respect to biodiversity, flood risk and landscape and visual, and as the legislation governing environmental assessment has changed over the last decade, a new EIAR (Environmental Impact Assessment

Report), Appropriate Assessment (AA) screening and NIS should be prepared to develop a complete understanding of these constraints should the project be progressed.

1.5 Social and economic impacts

The social and economic impacts the provision of a rail connection between Navan and Dublin city would have on local communities and people across Meath have been documented. These include improvements in safety, modal and land use integration, the environment, and accessibility and social inclusion.

It is evident from this assessment that the delivery of the project and the provision of efficient, reliable and resilient rail services can support the economic growth of the region by attracting new businesses to Meath and by supporting growth of the tourism, sport and freight sectors locally.

As the rate of incidents per passenger-kilometre for rail is approximately 1% of road, the extension of rail services will also improve the safety of journeys between Meath and Dublin.

The project will improve modal integration and connectivity with Dublin Bus, Luas, DART, Commuter and InterCity rail, and Bus Éireann services while also integrating with planned projects like MetroLink at Glasnevin and Luas Finglas at Broombridge.

Rail services will also increase the attractiveness of planned development within the vicinity of the proposed new stations, especially high-density transport-orientated developments.

While there is a need for a new Environmental Impact Assessment Report (EIAR) (due to changes in legislation since 2011), based on the previous environmental assessment carried out in 2011, it is evident that the project will bring about improvements in air quality and a reduction in greenhouse gas emissions once operational. There will be negative impacts from increases in noise and vibration (related to the construction and operation of the rail service) and increased visual impacts, however over time and with the application of appropriate mitigation measures these impacts would be minimised.

Similarly, the potential negative impacts on biodiversity as well as cultural, archaeological, and architectural heritage sites along the route would be minimised with the application of appropriate mitigation measures.

A potential negative impact on existing soils and groundwater was identified, resulting from excavations and the construction of embankments. However, with the development of the proposed rail alignment along the historical alignment, the relatively small take of agricultural land required and the application of mitigation measures would mitigate these impacts

The development of rail services to Navan will provide an attractive choice to vulnerable groups including young people, disabled people and the elderly. For those living within deprived areas, it will facilitate improved access to third level education and employment opportunities in Dublin.

Frequent, reliable, and higher speed rail services to Dublin will allow those living in Meath and working in Dublin to commute efficiently, reducing travel times and stress and allowing individuals more time to spend at home, and a greater opportunity to engage with their local communities and businesses.

1.6 Passenger demand and time savings

The assessment includes analysis of the proposed alignment options to establish the level of demand for each. The numbers of people using the service were forecast using the NTA's Eastern Regional Model, which showed that the rail line has the potential to facilitate up to 1.8 million passenger journeys per year. Demand modelling has also shown that both of the rail options considered have a similar impact on increasing public transport mode share and improving travel times to and from Meath, although Option A provides a marginally better improvement in travel times than Option B, reducing travel time between Navan and Dublin city by 5 minutes for existing journeys. This analysis has shown that while there is more demand attracted to the Navan stations in Option A, Option B attracts higher demand overall. This is due to the improved accessibility of Dunshaughlin station. It has also been shown that the bus-based alternative (Option C) performs significantly less well than the rail options in all regards.

1.7 Costs

Capital cost forecasts for all options have been developed based on the network designs provided in the 2011 draft RO for Option A and the 2009 Feasibility Study for Option B. The costs for Option C were provided by the NTA and were based on recent bus procurement exercises. The costs were calculated using rates from other relevant heavy rail-based projects including the DART+ Programme, Woodbrook DART station and some light rail costings. Cost forecasts also included a high-level cost/km assessment of other completed projects, the most relevant being the 7.5km heavy rail extension to M3 Parkway from the junction west of Clonsilla (Dunboyne line) completed in 2010.

40% risk and contingency has been included in accordance with NTA guidance, and when coupled with the accuracy range of the cost forecasts gives a P50 confidence interval. These forecasts give a cost range for the project of €777m to €1,122m for Option A and €990m to €1,431m for Option B (exclusive of VAT).

The cost forecasts also include a third-party valuation for land acquisition prepared by Avison Young, who were commissioned by the NTA. The AECOM forecasts also incorporate feedback from an independent cost validation exercise carried out by ChandlerKBS on behalf of the NTA.

1.8 Cost benefit analysis

A detailed cost benefit analysis of the project has been conducted to quantify (where possible) the benefits of the project over a 30 year appraisal period, plus a further 30 year residual value period. The appraisal is informed by the requirements of the Department of Public Expenditure and Reform's (DPER) Public Spending Code (PSC) and the Department of Transport's (DoT) Common Appraisal Framework (CAF) for Transport Projects and Programmes. Over the entire appraisal period, the user benefits for each of the options (discounted to 2011 values, and depending on whether NTA or MCC growth projections are applied) amounts to €402m-€450m for Option A, €381m-€409m for Option B and €132m-€147m for Option C. This results in Benefit to Cost Ratios (BCR) ranges of 0.71 - 0.79 for Option A, 0.53 - 0.58 for Option B and 0.92 - 1.04 for Option C.

1.9 Overall economic assessment

The overall assessment of options has been captured via a Multi-Criteria Analysis (MCA) to demonstrate the performance of each option with regard to the main assessment criteria defined in the DoT's CAF. The outcome of this assessment is illustrated in Figure 1-2 below.

	Do-Nothing (Option 0)	Option A (Rail)	Option B (Rail)	Option C (Bus)
Economy	Minor Negative	Minor Positive	Minor Positive	Neutral / No Impact
Safety	Minor Negative	Neutral / No Impact	Minor Positive	Neutral / No Impact
Environment	Minor Negative	Minor Negative	Minor Negative	Neutral / No Impact
Accessibility & Social Inclusion	Neutral / No Impact	Moderate Positive	Moderate Positive	Neutral / No Impact
Integration	Neutral / No Impact	Major Positive	Major Positive	Moderate Positive

Figure 1-2 Summary of MCA

The assessment has shown that there is a need for intervention as the status quo bus service is not serving the transportation needs of people travelling the corridor between Meath and Dublin, with the situation likely to degrade further in the future as population and congestion along the route increase.

While the cost-benefit analysis conducted has shown that the projected benefits of the project are less than the costs associated with the designs assessed, with the BCRs being less than 1.0 for both of the rail options considered, it should still be acknowledged that the scale of benefits incurred by users along the Dublin-Navan corridor is significant – at ~€400m. Given this early stage of the assessment, further development and refinement of the scheme's design would present opportunities to improve these BCRs.

The wider appraisal, which examined the qualitative and quantitative benefits of the reinstatement of the Navan Rail Line, has shown that the scheme has the potential to deliver significant economic, environmental, and social benefits along the Dublin-Navan corridor.

2. Introduction

2.1 Overview

This assessment report has been developed by AECOM on behalf of the National Transport Authority (NTA) and in collaboration with Meath County Council to assess the potential for the Navan Rail Line in light of current projections for population and employment growth along the proposed route options and across Meath. The assessment considered the likely future usage of the rail connection to Navan and how this will change as a result of current and future development. The report demonstrates the impact the provision of a high-quality rail service can have on the people of Meath by documenting the social, economic, and environmental benefits the project will generate.

2.2 Purpose

The assessment was commissioned by the NTA to support their ongoing review of the Transport Strategy for the Greater Dublin Area (2016 – 2035) and inform the content of the updated strategy covering the period from 2022 to 2041.

The assessment has considered the Navan Rail Line from the perspective of cost, demand and the impacts the project would have in terms of the economic, environmental and social benefits which the scheme would generate.

- Section 2 (this section) provides an overview of the project including the purpose, scope and background.
- Section 3 outlines the rationale for investment.
- Section 4 identifies the objectives of the Navan Rail Line.
- Section 5 outlines the route options considered within this assessment.
- Section 6 provides a summary of how the project would support national and local policy objectives and how the scheme is aligned with the wider environmental strategy.
- Section 7 details the impacts the Navan Rail Line can have on the people of Meath and other areas within the catchment of the scheme.

- Section 8 presents the demand analysis conducted and the outputs from the transport modelling exercise carried out.
- Section 9 highlights the outcome of the high-level route validation study carried out to identify any potential engineering and planning constraints which have arisen over the last decade.
- Section 10 outlines the population projections used to determine the level of demand for the scheme and illustrates how populations across Meath are likely to change over the next 50 years.
- Section 11 outlines the detailed cost estimates which have been developed for the Navan Rail Line.
- Sections 12 and 13 outline the financial and economic appraisals respectively for the project, including the quantification of user benefits and resulting cost benefit ratios for the project options.
- Section 14 contains a multi-criteria analysis of the project.

2.3 Scope

The scope of this assessment was to validate that the preferred route identified in the draft Environmental Impact Statement (prepared by Iarnród Éireann Irish Rail (IÉ) in 2011) remains available for construction, that it has not been compromised during the intervening period and that the route remains a reasonable representation of the best route for a rail link to Navan when compared to an alternative route as specified previously in the 2009 Feasibility Study[4] and a bus-based alternative option.

The assessment also included the development of a cost estimate for the project, inclusive of all direct and indirect costs, plus an appropriate allowance for contingency and inflation.

[4] Navan Railway Line Feasibility Study 2008/09, Roughan & O'Donovan Faber Maunsell

The assessment involved a comprehensive review of the benefits of the project, encapsulating economic, environmental, and societal benefits for the three options prescribed by the NTA. These options included two rail alignments as well as a bus-based alternative as summarised below (with further details provided in section 5 of this report).

- Rail Route Option A: The rail line follows the existing historical alignment and runs adjacent to the M3 at Dunshaughlin (where a station is located west of the M3) before continuing on to Navan.
- Rail Route Option B: The rail line follows the existing historical alignment, deviating near Dunshaughlin, where the line will cross over the M3 twice in order to place the station at Dunshaughlin to the east of Dunshaughlin town centre (making it more accessible for residents of Dunshaughlin). North of Dunshaughlin, the line resumes following the historical alignment to continue on to Navan.
- Bus-Based Option C: The bus option will be a high-capacity coach-type bus with a 15-minute frequency. The bus will mostly follow the M3 corridor, stopping at Navan North, Navan, Kilmessan, Dunshaughlin, Dunboyne, Clonee, Blacnhardstown, and multiple stops in Dublin city.

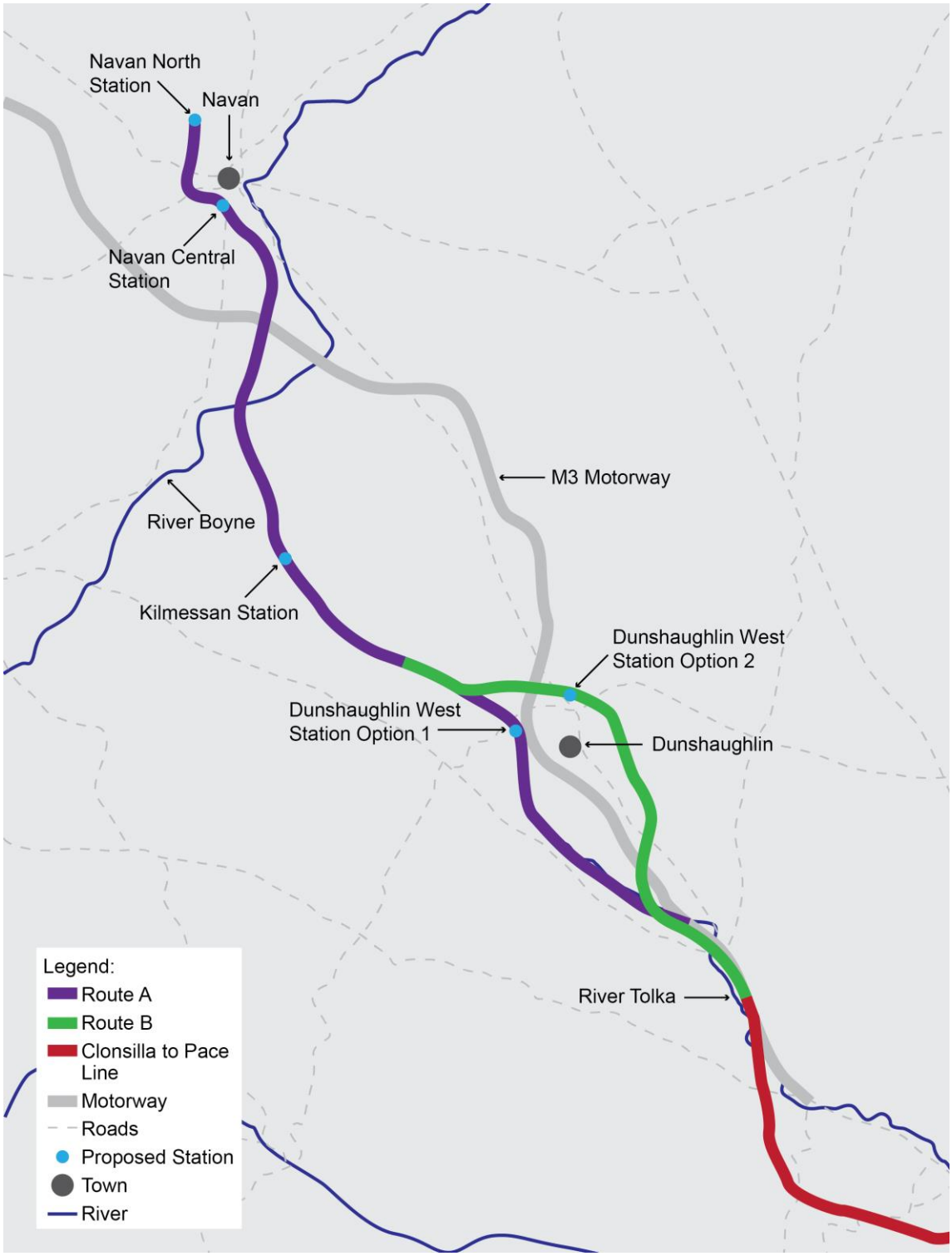


Figure 2-1 Rail route options map

2.4 Background

The Navan Rail Line project involves the extension of the rail line from M3 Parkway at Pace in Co. Meath to a proposed station to the north of Navan and includes intermediate stations at Dunshaughlin, Kilmessan, and Navan Central.

The proposed alignments will consist of approximately 34 kilometres of double-tracked railway and which will generally follow the abandoned rail right-of-way of the historical Dublin and Meath Railway, which closed to passenger service in 1963.

The development of a rail connection to Navan has been discussed and considered for many years and has been subject to considerable previous assessment, particularly over the last 20 years.

In 1998 a 'Preliminary Assessment of the Feasibility of Restoring Passenger Services in all, or part of the railway from Clonsilla to Navan' was conducted by IÉ. This review established that at that point in time much of the basic infrastructure remained in place, while a number of encroachments along the alignment were also identified.

Following this 1998 assessment, a 'Preliminary Economic and Financial Evaluation' carried out the same year determined that the re-opening of the line was not financially or economically viable.

While this view was echoed in the 2003 Strategic Rail Review[5] , a subsequent Farrell Grant Sparks pre-feasibility study found that further assessment of the alignment between Clonsilla and M3 Parkway at Pace should be undertaken.

Subsequently the phased reopening of the line was included in the Government's Transport 21 investment programme in 2005.

[55] Booz-Allen Hamilton, Strategic Rail Review Report, 2003

Phase 1 of the alignment from Clonsilla to Dunboyne/Pace was subject to a detailed feasibility study by IÉ in 2005 which indicated a positive rate of return for the project. It was implemented and opened to services in September 2010.

Phase 2 of the project, from Pace to Navan, has not yet been delivered and is the focus of this assessment. It was the subject of a Scoping Study[6] in 2007, which identified options for the alignment of the railway between Pace and Navan, two of which were taken forward for a more detailed assessment within the 2009 Feasibility Study[7] carried out for IÉ. These two route options, Option A and Option B, are the same two rail options assessed in this report.

Following this 2009 feasibility study, Option A was selected as the preferred route alignment based on the lower level of investment required in comparison to Option B and a greater adherence to the historical rail alignment.

The design and alignment for Option A was then advanced further in 2011 with the development of a full Environmental Impact Assessment[8] and a draft Rail Order. Since 2011 this alignment has been protected from development.

[6] Dunboyne (M3) Navan Railway Line: Scoping Study Report, Roughan & O'Donovan – AECOM alliance, 2007
[7] Navan Railway Line Feasibility Study 2008/09, Roughan & O'Donovan Faber Maunsell
[8] Environmental Impact Statement, Roughan & O'Donovan – AECOM Alliance, 2011

3. Rationale for investment

The rationale for the Navan Rail Line is driven by the need to provide an effective means of public transport between Meath and Dublin city centre which will cater for increases in demand and population and economic growth across Meath. This responds to the need to decarbonise transport as part of wider climate change targets and encourage a modal shift to public transport.

While the demand for rail travel is currently significantly reduced due to the COVID-19 pandemic and in the short-term capacity will be significantly reduced due to the need to maintain social distancing on trains, the current assumption is that demand will recover and that the long term need for investment in the heavy rail network remains.

Some of the main issues the project will help to address are outlined below.

3.1 Health and wellbeing

Over eight thousand people commute from within the catchment of the proposed Navan Rail Line to Dublin city on a daily basis. Approximately 60% of these commutes are by car and 23% by bus or coach[9]. The long commute between where people live in Meath and where they work in Dublin contributes to increased levels of stress for the residents of Meath and the surrounding areas. With many people now having to leave Meath earlier and earlier to avoid the increasing levels of traffic along the M3 and other routes into the city, it is extremely difficult to achieve any sense of work life balance with so much time required for commuting. 25% of surveyed[10] respondents have identified reduced levels of stress and increased convenience as the main impact the provision of a rail line between Navan and Dublin would have on their lives. The lower stress associated with rail compared with driving or taking the bus to and from work will serve to increase wellbeing for commuters.

[9] CSO POWSCAR data 2016

[10] *Behaviour & Attitudes Residential Survey for Meath County Council, 2021*

"Rail travel allows commuters more energy and time to participate in activities outside of work/commuting, contributing to their own health and wellbeing as well as the health and wellbeing of the communities in which they live. It is also widely accepted that the greater reliability associated with commuting to work by rail reduces stress, which in turn promotes well-being and overall health, leading to lower rates of absenteeism and greater productivity"[11].

3.2 Encouraging modal shift

In general, the public transport system in the eastern region provides a reasonably high level of service for point-to-point journeys on many routes. However, connections between Navan and Dublin city are inadequate and, in many cases, result in a continued reliance on the private car for commuting.

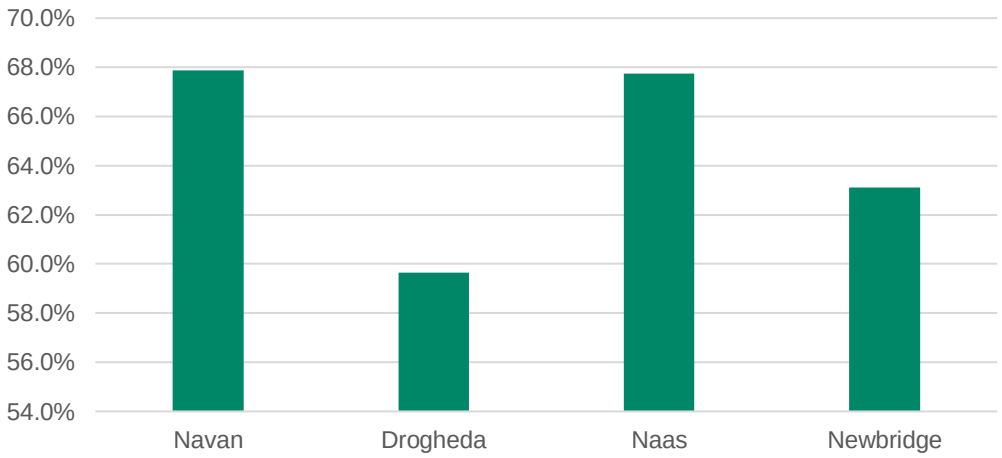


Figure 3-1 Private vehicle mode share for other towns

In Navan it is evident that 68% of commuters rely on private vehicles for accessing work, school and college, this comparing unfavourably to other rail connected towns of similar size and proximity to Dublin.

[11] Truncated Report on Non-Monetised Impacts of the Navan Railway Line Project, Meath County Council, 2021

The overall number of people crossing the canal cordon is higher than ever. There has been a steady increase in public transport, walking and cycling over the last decade. Further investment in our transport system is needed to sustain this growth.

Surveys[12] have shown that 88% of respondents in Meath would be likely to switch from commuting by car to using the new train service if the right facilities were put in place. There is an evident need to support and enable this shift to public transport by providing a significant increase in the level and quality of public transport between Meath and Dublin and develop a transport network across the eastern region which provides a greater level of integration of services and benefits for transport users throughout the eastern region.

3.3 Supporting economic and population growth

Project Ireland 2040: National Planning Framework forecasts that by 2040 the Eastern and Midland Regional Assembly (EMRA) will have an additional population of between 475,000 and 500,000 people, from a current population of 2.3 million people and 330,000 additional jobs from an existing quantum of 1.1 million jobs.

Project Ireland 2040 identifies the need for a high-quality public transport system as being integral to the region's attractiveness. The future of the eastern and midlands region, and Dublin in particular, is reliant on its ability to attract and maintain these residents, workers, businesses and tourists. This can only be achieved if the transport infrastructure in the eastern region continues to improve, as it remains below the European Union average level of efficiency for rail networks compared to well-developed economies with whom Ireland competes for investment.

Based on a survey by the World Economic Forum evaluating frequency, punctuality, speed and price of train services, Ireland ranked 19th out of 26 EU countries.

The heavy rail network is one of the central arteries of the overall public transport network, providing a means of transporting large volumes of people to work, education and

[12] *Behaviour & Attitudes Residential and Business Surveys for Meath County Council (March 2021)*

amenities throughout the day, especially during the peak AM and PM commuter periods. The Iarnród Éireann Irish Rail (IÉ) network is segregated from the road network (except at level crossings) and, therefore, the services and travel times are not influenced by road congestion, unlike bus and light rail (Luas) services. This congestion can lead to damaging impacts on the broader economy by increasing the cost of doing business; due to time lost, increased operating costs and the impacts on health. In 2012 this was estimated to cost €358 million per year, with this forecast to rise to €2.08 billion per year in 2033 should no mitigation be put in place.

The Navan Rail Line aligns with government land use and spatial policies and in particular has the potential to significantly impact land use and spatial planning in the catchment area of the line. Planning authorities will find the commercial and planning proposition to deliver high-density housing developments, or otherwise manage impacts of land development, in the areas adjacent to the rail network increased because of the high capacity, high frequency services it enables. By providing higher quality public transport links to the Dublin city centre rail network, it will be easier to mitigate any adverse impacts associated with new developments such as car dependency and associated increases in congestion and greenhouse gas emissions. This will remove potential barriers to planning authorities where the adverse impacts of development may not fully align with wider environmental policy objectives, including sustainable growth. New residential developments in railway catchments are no longer required to provide car parking for each dwelling, in accordance with policies to reduce car dependency. This initiative will only succeed where a high standard of public transport services exists. Rail investment is a vital component to support both future growth and economic competitiveness alongside the creation of sustainable communities.

The unique advantage that the Navan Rail Line has over other modes is that it can carry by far the largest volumes of passengers via a fully segregated corridor, avoiding delays from congestion.

3.4 The environmental challenge

One of the greatest global challenges for this, and future generations is how we address and mitigate the effects of climate change. Ireland has committed to cutting its emissions

by 51% between 2018 and 2030 and to net zero no later than 2050. Ireland must reduce its greenhouse gas emissions by 80% by 2050. The European Union's non-ETS targets require a 20% reduction in non-ETS sector emissions by 2020 and 30% by 2030 (relative to 2005 levels). However, as estimated by the Sustainable Energy Authority of Ireland, Ireland's non-ETS emissions are likely to be just 1% less than 2005 in 2020.

In 2018 travel by private car was responsible for 40% of all transport emissions, for the same period public transport accounted for less than 4% of all transport emissions.

Investment in public transport is a key tool in reducing the dependency by encouraging modal shift and helping bring about a reduction in carbon emissions.

Expanding rail services to Navan will reduce the reliance on private cars and contribute to a decrease in the transport system's total greenhouse gas emissions within the eastern region. Expanded services will attract people away from the private car, reducing road traffic emissions. Further investment will allow IÉ to continue to improve in this area having already achieved a 46% reduction in carbon emissions since 2005.

3.5 Enabling compact growth

Ireland and the eastern region have suffered from a legacy of low-density urban sprawl and an over-reliance on the private car that this sprawl encourages. Project Ireland 2040 outlines the need to prioritise compact urban growth and sets a target of delivering 50% of new city housing within the existing Dublin city and suburban footprint.

The guiding principles for growth within the Greater Dublin Area are outlined in the EMRA's Regional Spatial and Economic Strategy (RSES), where identifying Compact and Sustainable Growth is specified as one of the five guiding principles for growth in the region.

This requires a focussed approach to compact, sequential and sustainable development of urban areas. To achieve the vision, it will be necessary to consolidate population and employment growth with a focus on improving housing supply and amenity provision to create sustainable communities and improve public transport and sustainable travel options.

Compact growth will allow for greater efficiency in the delivery of public services for citizens into the future. The Navan Rail Line will enable the movement of high volumes of passengers directly between Meath and Dublin city centre, offering scope for new areas to develop along the corridor which can support growth into the future.

4. Objectives

The primary objective of the Navan Rail Line project is to support the generation of economic, social and environmental benefits for the people of Meath and the midlands and eastern region. This is to be done by enhancing the heavy rail network between Dublin city centre and Meath to provide a sustainable, safe, efficient, integrated and accessible public transport service along the corridor which supplements existing bus services.

The sub-objectives of the project have been developed to align with the Department of Transport's (DoT) Common Appraisal Framework (CAF) main criteria of Economy, Environment, Accessibility and Social Inclusion, Safety and Security, Integration and Physical Activity. The sub-objectives are aligned to the primary objective. The achievement of each of these sub-objectives will contribute to the delivery of the primary project objective. The sub-objectives form the backdrop for the appraisal of project options and act as a benchmark to evaluate the performance of the project at a later date.

The sub objectives for the project are to:

- ***Enable Growth:*** Support sustainable economic development and population growth in the Navan – Dublin corridor through the provision of a high frequency, high capacity, public transport services.
- ***Reduce Travel Times:*** Reduce travel time between Dublin and Navan for the increasing number of people living in Meath and commuting to Dublin on a daily basis.
- ***Improve the customer experience:*** Provide a higher standard of customer experience including provision of clean, safe, modern vehicles and a reliable and punctual service with regulated and integrated fares.
- ***Reduce Environmental Impacts:*** Deliver an efficient, sustainable, low carbon and climate resilient heavy rail network, which contributes to a reduction in congestion on the road network in the eastern region and which supports the

advancement of Ireland's transition to a low emissions transport system and delivery of Ireland's emission reduction targets

- ***Improve Accessibility:*** Improve access to jobs, education, and other social and economic opportunities through the provision of improved inter-rail and inter-modal connectivity and integration with other public transport services
- ***Enable Compact Growth:*** Enable transport-oriented urban compact growth along the corridor to unlock regeneration opportunities and more effective use of land in the eastern region, for present and future generations.

5. Options

Three options were specified by the NTA for assessment, two rail options (Option A and Option B) and one bus-based option (Option C) as summarised in Table 5-1 below.

Table 5-1. Rail and Bus options comparison

Criteria	Rail Route Option A	Rail Route Option B	Bus-Based Option C
Length (km)	33.4 km	33.6 km	36.6 km
Service Headway (mins)	30 minutes at peak times, with services operating from Connolly and Docklands stations to M3 Parkway and then on to Navan.	30 minutes at peak times, with services operating from Connolly and Docklands stations to M3 Parkway and then on to Navan.	15 minutes
Peak Capacity (passengers per hour per direction)	2,536	2,536	368
Vehicles	DMU based service transitioning to BEMU in 2045	DMU based service transitioning to BEMU in 2045	High-capacity double decker coaches
Linear Infrastructure	Double-track rail between M3 Parkway Station and Navan North Station.	Double-track rail between M3 Parkway Station and Navan North Station. Two crossings of the M3.	No new infrastructure provided, although service will utilise future BusConnects infrastructure from Blanchardstown into Dublin city centre.
Stations/Stops	4 new stations	4 new stations	11 stops
Major Infrastructure Works	3,815 m^2 overbridge deck area, 3,194 m^2 underbridge deck area	5,326 m^2 overbridge deck area, 4,394 m^2 underbridge deck area	None

5.1 Rail options

The rail service will utilise existing Iarnród Éireann Irish Rail (IÉ) DMU rolling stock to provide a half-hourly service between Dublin and Navan. Four new stations will be developed along the new alignment. These new stations will include high-capacity park-and-ride facilities at Navan North, Kilmessan and Dunshaughlin, with no public parking provided at Navan Central station. Proposed station locations are the same in both rail options with the exception of Dunshaughlin station, which is located further east in Option B.

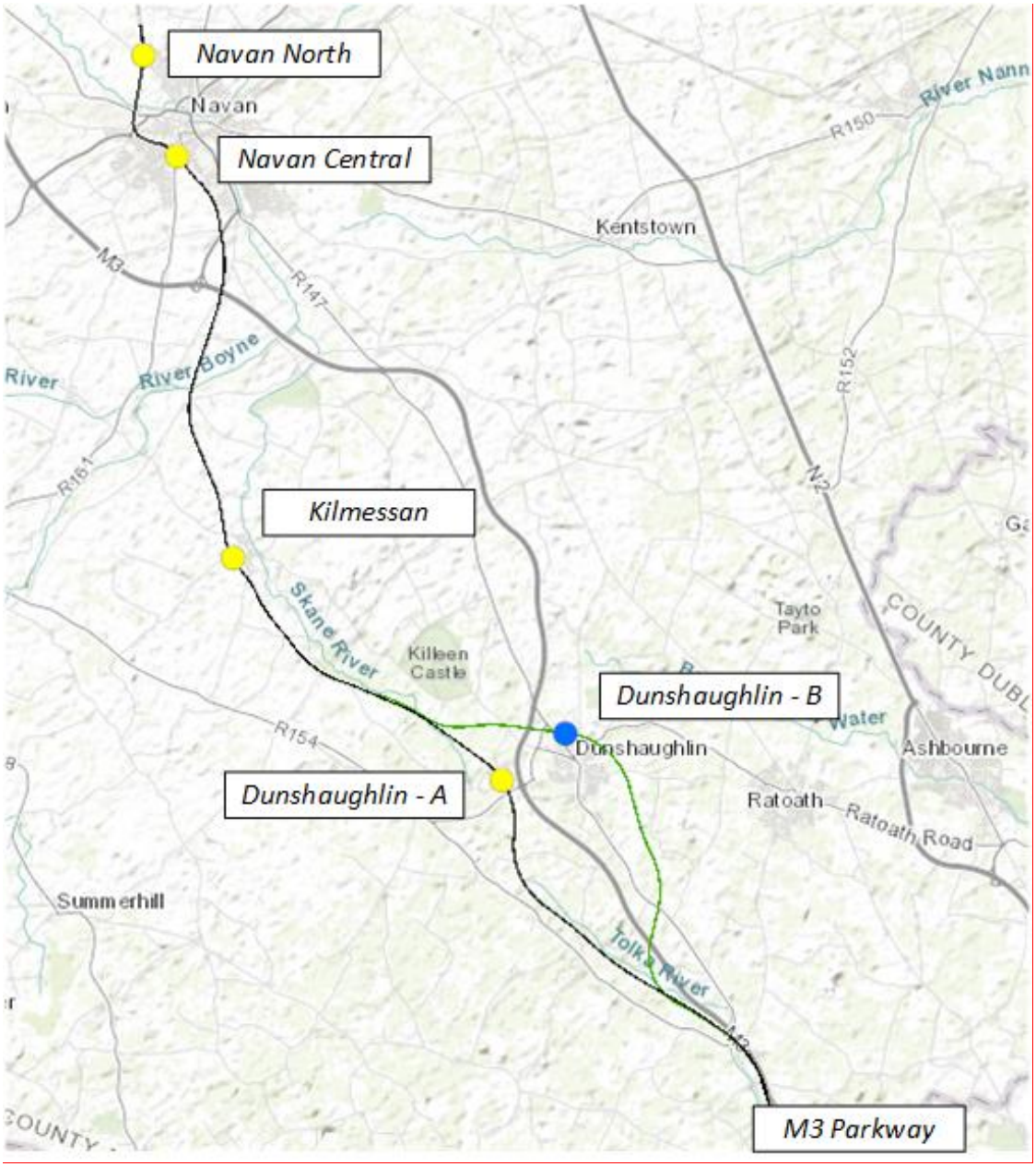


Figure 5-1 Proposed Navan Rail alignment and station options

5.1.1 Rail Route Option A

The Option A alignment follows the historical Dublin and Meath Railway route from M3 Parkway station to the proposed Navan Central station, with local diversions where the line is blocked by the M3 north of Blackbull. The alignment diverts east to locate a station as close as possible to the M3 interchange with Dunshaughlin and avoid the costs

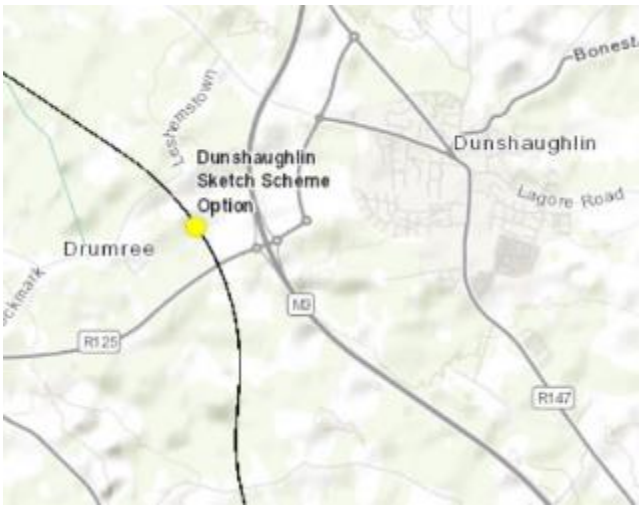


Figure 5-2 Dunshaughlin Station - Option A

associated with crossing the M3. The location of the Dunshaughlin station in Option A is shown in Figure 5-2.

North of Navan Central, the line will utilise the existing Kingscourt line. Relaying and re-signalling a section of the line and upgrading two level crossings in Navan will be required. While the existing alignment will be followed for the majority of the route, the right of way will be widened to allow double-tracking for the entire route between M3 Parkway and Navan North stations.

5.1.2 Rail Route Option B

This option generally follows the route of Option A except where the alignment diverges east over the M3 at Dunshaughlin to provide a station on the north side of Dunshaughlin as shown in Figure 5-3. The line will cross over the M3 from west to east near Batterstown before crossing over the M3 again from east to west to re-join the historical route just north of Leshamstown.

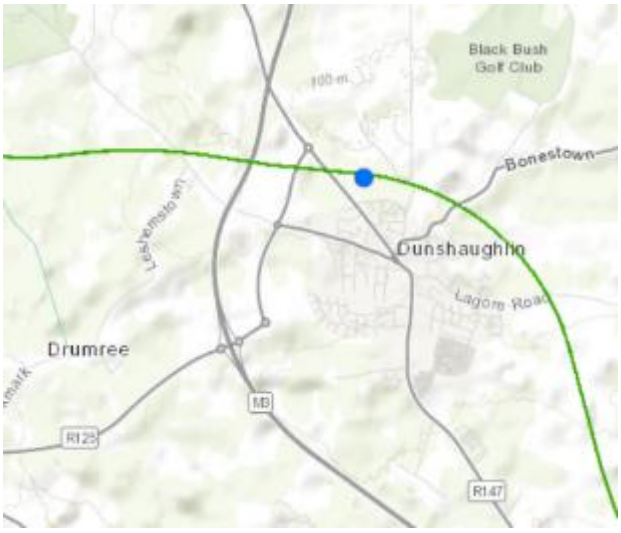


Figure 5-3 Dunshaughlin Station - Option B

5.2 Bus-Based Option

The bus-based option (Option C) will be a high-capacity coach-type bus with a 15-minute frequency throughout the day. The typical capacity of these buses is 92 passengers. Following the completion of the BusConnects Blanchardstown Core Bus Corridor (CBC) between Blanchardstown and Stoneybatter, the bus will be able to take advantage of continuous dedicated bus lanes and signal priority to provide faster and more-consistent

journey times. The CBC will cover approximately 17% of the bus route length, and the most congested portion of the route. The indicative stop locations for this service are:

- Dublin (Busáras)
- Phibsboro (Mater Hospital)
- Navan Road Parkway
- Navan Road/N3 adjacent Connolly Hospital
- Blanchardstown
- Clonee
- Dunboyne
- Dunshaughlin
- Kilmessan
- Navan
- Navan North

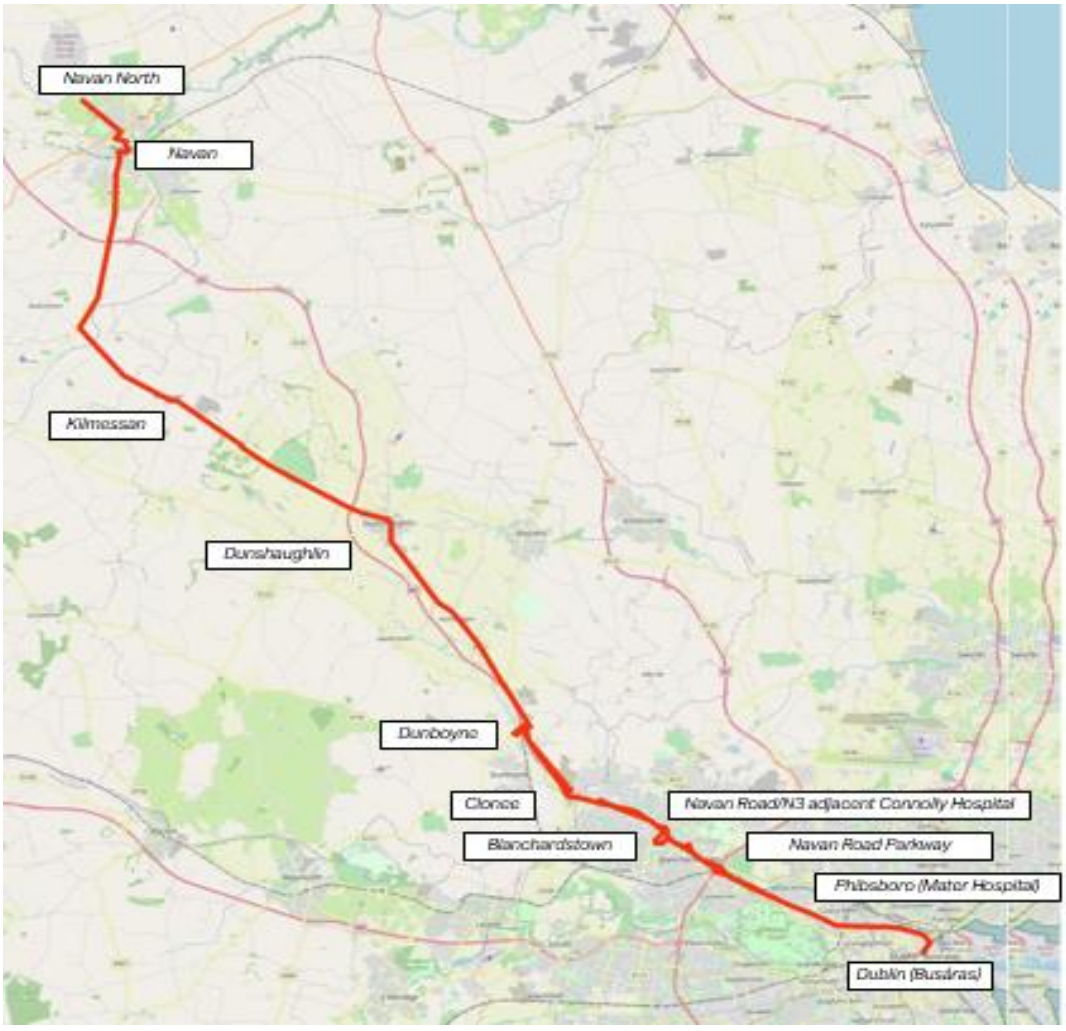


Figure 5-4 Option C Bus-based route

6. Policy context

The Navan Rail Line project aligns with multiple national and local government policies and strategies. The project will support the objectives of these policies and help realise an ambition to decarbonise the transport network and drive sustainable development across Meath, as described below.

Figure 6-1 Relevant policy documents

6.1 Project Ireland 2040: National Planning Framework (NPF)

The National Planning Framework (NPF) is the Government's high-level strategic plan for shaping the future growth and development of Ireland to 2040. It was released in tandem with the National Development Plan (NDP), which sets out the national infrastructure investment budget for the next 10 years. The document lists 10 National Strategic Outcomes (NSOs), and those of relevance to the Navan Rail Line project are highlighted below.

NSO 1 – Compact Growth

'Carefully managing the sustainable growth of compact cities, towns and villages will add value and create more attractive places in which people can live and work. All our urban settlements contain many potential development areas, centrally located and frequently publicly owned, that are suitable and capable of re-use to provide housing, jobs, amenities and services, but which need a streamlined and co-ordinated approach to their development, with investment in enabling infrastructure and supporting amenities, to realise their potential. Activating these strategic areas and achieving effective density and consolidation, rather than more sprawl of urban development, is a top priority.'

NSO 2 – Enhanced Regional Accessibility

'A co-priority is to enhance accessibility between key urban centres of population and their regions. This means ensuring that all regions and urban areas in the country have a high degree of accessibility to Dublin, as well as to each other'.

NSO 4 – Sustainable Mobility

'In line with Ireland's Climate Change mitigation plan, we need to progressively electrify our mobility systems moving away from polluting and carbon intensive propulsion systems to new technologies such as electric vehicles and introduction of electric and hybrid traction systems for public transport fleets, such that by 2040 our cities and towns will enjoy a cleaner, quieter environment free of combustion engine driven transport systems.'

NSO 5 – A Strong Economy, supported by Enterprise, Innovation and Skills

'This will depend on creating places that can foster enterprise and innovation and attract investment and talent. It can be achieved by building regional economic drivers and by supporting opportunities to diversify and strengthen the rural economy, to leverage the potential of places. Delivering this outcome will require the coordination of growth and place making with investment in world class infrastructure, including digital connectivity, and in skills and talent to support economic competitiveness and enterprise growth.'

NSO 8 – Transition to a Low Carbon and Climate Resilient Society

'The National Climate Policy Position establishes the national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050. This objective will shape investment choices over the coming decades in line with the National Mitigation Plan and the National Adaptation Framework.'

6.2 National Development Plan (NDP) 2018 – 2027

The National Development Plan (NDP) 2018 – 2027 came into effect in February 2018, paired with the National Planning Framework (NPF). The NDP will drive Ireland's economic, environmental, and social progress over the next decade. It sets out the configuration for public capital investment over the next 10 years in order to achieve the National Strategic Outcomes. While it is currently being updated through the Government's "Review to Renew" process, the document specifically mentions the Navan Rail Line, saying:

"In 2016 as part of the preparation of the GDA Transport Strategy, a cost benefit analysis of an extension of the Dunboyne/M3 Parkway line to Dunshaughlin and Navan was conducted by the National Transport Authority (NTA). The NTA is required to review its Greater Dublin Area Transport Strategy before the end of 2021. This review will include a reappraisal of the project taking into account the scale of new and planned development along the route and will allow for its consideration during the Mid Term Review."

6.3 Strategic Investment Framework for Land Transport 2015 (SIFLT)

The Department of Transport, Tourism and Sport's (DTTaS) Strategic Investment Framework for Land Transport (2015) lays out the role of transport in Ireland's future economic development and provides a strategic framework for estimating appropriate investment in Ireland's land transport system over the coming decades. The framework priorities largely echo the Project Ireland 2040 National Strategic Outcomes to guide investment decisions for transport schemes by:

- Addressing Urban Congestion: Improve the efficiency and sustainability of urban transport systems in Ireland. This will be achieved by improving and expanding

public transport capacity, implementing a wider use of technology within transport systems and the improvement and expansion of walking and cycling infrastructure.

- Maximising the contribution of Land Transport to National Development: Enhance the efficiency of the existing network, improve connections to key ports and airports and support national and regional spatial planning priorities.

6.4 Department of Transport's Forthcoming Land Transport Investment Framework

The Department of Transport's forthcoming Land Transport Investment Framework is currently under public consultation and will align land transport investment with Project Ireland 2040, replacing SIFLT. This will establish four investment priorities:

- Decarbonisation;
- Protection and Renewal;
- Mobility of People and Goods in Urban Areas, and;
- Enhanced Regional and Rural Connectivity.

It establishes a modal hierarchy, with active travel getting highest priority, public transport getting second highest, and private vehicles being prioritised last. It sets out an intervention hierarchy which prioritises the maintenance, optimisation and improvement of existing infrastructure with new construction seen as a last resort solution. An updated Common Appraisal Framework (CAF) will be published within 3 months of the investment framework's publication to ensure that both the investment framework and the NPF are embedded in the appraisal process. The Navan Rail Line aligns with this updated investment framework's priorities, assisting with decarbonisation, improving mobility of people and goods in urban areas, and enhancing regional connectivity.

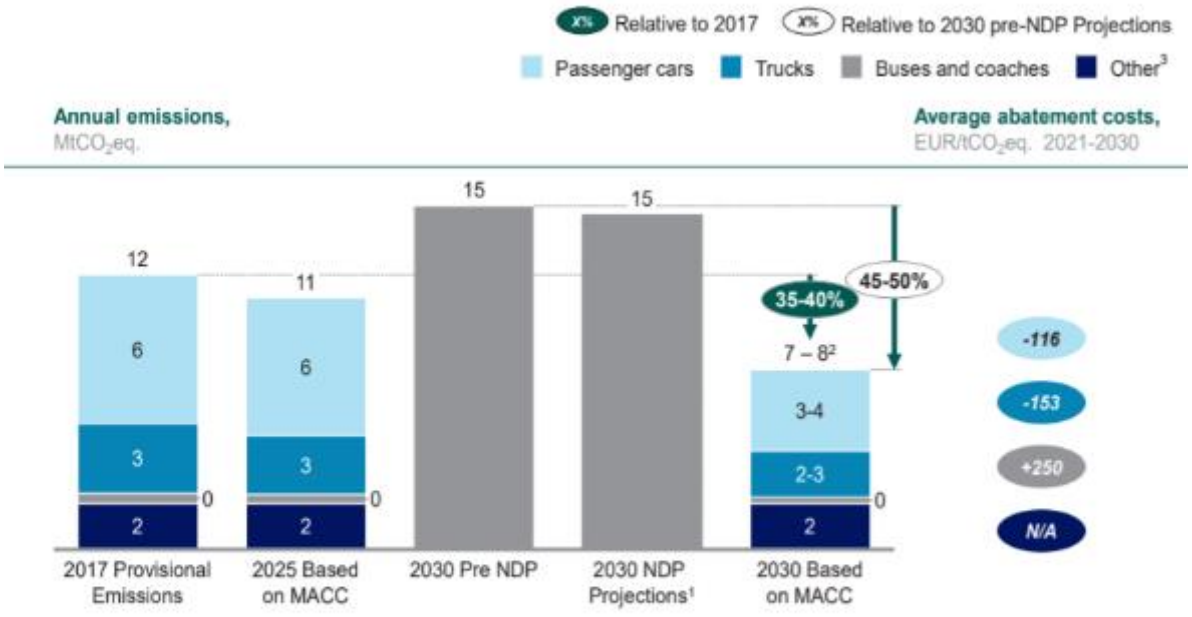
6.5 Land Transport Investment Framework

The forthcoming Land Transport Investment Framework stresses the need for alignment of land use and transport planning across all government agencies and departments, including:

- Better linkage between the zoning of land and the availability of transport infrastructure.
- Providing public transport infrastructure and services to meet the needs of smaller towns, villages, and rural areas.
- Strengthening public transport connectivity between cities and large-growth towns in Ireland and Northern Ireland with improved services and reliable journey times.
- Realising a low-carbon sustainable transport system.

6.6 Climate Action Plan 2019

The Climate Action Plan published by the Department of Environment, Climate and Communications in 2019 outlines a series of short- and medium-term measures to facilitate the transition to a low carbon, climate resilient and environmentally sustainable economy between 2020 and 2030. Transport accounts for over 20% of greenhouse gas



1 NDP projections assume implementation of all measures in the National Development Plan 2018-2027.
2 Note that the total numbers may not add up due to rounding
3 Other consists of fuel tourism and other emissions from transport (e.g. domestic aviation)
SOURCE: EPA; MACC Analysis

Figure 6-2 Annual Emissions and Average Abatement Costs in Transport

emissions in the state, and emissions within the sector have increased steadily in recent years. Road transport accounts for over 95% of all transport emissions. The plan identifies specific measures to develop and invest in public transport and encourage a modal shift away from private cars. Figure 6-2 details the costs of abatement required to reach 2030 carbon emission reduction requirements in the transport sector.

The Navan Rail Line would help support modal shift in Meath in order to help reach the 50% reduction in transport CO_2 eq. emissions by 2030 as outlined in the Climate Action Plan.

6.7 Climate Action and Low Carbon Development Bill 2021

The Climate Action and Low Carbon Development Bill, passed by the Dáil on 18th June 2021, provides for measures to achieve a 51% reduction in emissions by 2030, and to achieve a carbon-neutral economy by 2050. In order to do this, the transport sector must decarbonise even faster, achieving emissions reductions of greater than 51% in order to make up for industries that are not able to decarbonise as quickly, like agriculture. The Navan Rail Line supports emissions reductions in the transport sector by encouraging a modal shift away from combustion engine cars.

6.8 Eastern and Midland Regional Assembly's (EMRA) Regional Spatial and Economic Strategy (RSES) 2019-2031

The regional assemblies of Ireland have a main function to identify regional policies and coordinate initiatives that support the delivery of national planning policy. The 2019-2031 RSES provides regional level strategic planning and economic policy in support of the implementation of the National Planning Framework (NPF) and provides a greater level of focus around the National Policy Objectives (NPO) and National Strategic Outcomes (NSO) of the NPF. The RSES recognises Navan and the Navan Rail Line as key drivers of growth for the eastern and midlands region, specifically saying:

> ***"The Key Towns of Navan, Naas and Wicklow-Rathnew are located within the Core Region and are important within a regional and county context. These towns have capacity and future growth potential to accommodate above***

average growth coupled with the requisite investment in employment creation, services, amenities and sustainable transport" and,

"There is potential to improve public transport as part of the delivery of Phase 2 of Navan Rail project, subject to feasibility and for further investment in walking and cycling both in the town and regionally. The provision of additional road capacity around the town offers an opportunity for improved public transport, walking and cycling networks, through relocation of road space within the town."

6.9 Meath County Development Plan 2013 – 2019

The current Meath County Development Plan recognises Navan as a Primary Economic Growth Town and Dunshaughlin as a potential Moderate Sustainable Growth Town following the granting of permission for the Navan Rail Line. It states that Navan is the only Designated Town in the Hinterland that does not currently have a rail service to Dublin city centre, and that a new rail line would support regional planning objectives and facilitate Navan's sustainable development. The rail line is strongly supported by Meath County Council and features largely in the development plan.

"The provision of a heavy rail link to Dublin is considered to be critical for the sustainable development of the county, and for Navan to achieve its objective as a Large Growth Town I in the Regional Planning Guidelines for the Greater Dublin Area 2010 – 2022. Meath County Council is strongly committed to its delivery. Therefore, a strong policy stance is set out in this Development Plan to ensure that the detailed designed alignment is protected from further development, and that this protection also extends to potential stations and park and rides along the route."

This route is protected in the plan through the rail corridor zoning included in the Dunshaughlin and Navan Local Area plans, detailed below.

6.10 Draft Meath County Development Plan 2021 – 2027

The draft Meath County Development Plan is currently undergoing public consultation and is on-track to be approved by mid-2021. The draft plan refers to The Transport Strategy for the GDA 2016-2035, the NTA's policy position in relation to the delivery of the Navan Rail Line, and states that *"the corridor previously identified for a rail link to Navan should be protected from development intrusion".*

The policies included in the plan are very similar to the current Meath County Development Plan and focus strongly on the rail line, including researching the line to Navan and the feasibility of an additional rail spur to Ratoath and Ashbourne. The following policies are included in the plan:

- Navan: The delivery of a rail line to Navan is a cross-cutting theme of this plan. It is therefore integral to have a development strategy that demonstrates the town has the capacity to support the population increase associated with a rail-based settlement.
- Dunshaughlin: To demonstrate the town has the capacity to accommodate a critical mass of population associated with a rail link delivered as part of Phase II of the Navan Rail Project. To work closely with government departments and agencies to assist in the delivery of critical infrastructure that would facilitate the economic growth of the county with particular reference to the development of the rail to Navan.
- To develop Navan and the Southern Environs of Drogheda as the primary development centres in Meath and to continue to promote Dunboyne as a key settlement in the Metropolitan Area of Dublin. The long-term growth of these settlements shall be based on principles of balanced and sustainable development that support a compact urban form and the integration of land use and transport.
- To actively pursue, in conjunction with Iarnród Éireann Irish Rail (IÉ), the implementation of the extension of the Dunboyne/M3 Parkway line to Navan

during the Mid Term Review of the GDA Transport Strategy in accordance with the precepts of the RSES.

- To promote, facilitate and advance the delivery of the Navan railway line project and associated rail services in cooperation with other relevant agencies.
- To protect and safeguard the detailed designed alignment the Navan rail route and surrounding lands (including identified station locations), as illustrated on Map Series No. 5.1 in Volume 4, free from development and any encroachment by inappropriate uses which could compromise its future development as a rail facility.
- To explore with IÉ and other stakeholders the feasibility of a future rail spur off the Navan-Dublin Rail line from Dunshaughlin to serve Ashbourne and Rathoath.

The railway line has also been cited in other contexts within the draft plan, notably.

- It is an objective of the Plan to explore the feasibility of providing a rail link to Ashbourne as part of the Navan Rail Project for the future growth strategy for Ashbourne and to improve connectivity with Dublin City Centre.
- Delivery of the rail project is an important element in supporting the sustainable growth of Dunshauglin and it is cited that the population growth of the town would support the delivery of the rail project in providing a critical mass of population along the rail line.
- The Importance of the Navan Rail Line's connectivity to Dublin to significantly strengthen the attractiveness of Navan as an investment and employment centre contributing to the population growth of the town which is expected to increase to 50,000 in the longer term.

During the public consultation (Stage 3) of the draft plan, there were no submissions or objections specifically in relation to the Rail Reservation Corridor (as shown on Map 5.1 Reservation Corridor Pace to Navan). However, the draft plan is still subject to change. Council members agreed changes to the draft County Development Plan at the start of

March 2021 and it is anticipated that the Material Alterations arising from the Member's changes will be placed on public display from 26th May to 28th June 2021.

Of note and relevance, Meath County Council, in exercise of its powers under section 49 of the Planning Development Act 2000, prescribed a supplementary development contribution scheme for re-opening of the Navan to Dublin Railway line – Clonsilla to Dunboyne (Pace) section in 2006. The scheme area covers 1,947 hectares and includes a catchment area approximately 1 kilometre on either side of the rail line. Should the rail line to Navan advance, a supplementary development contribution scheme may be prescribed for it also.

6.11 Navan Development Plan 2009 – 2015

The Navan Rail Line is described as *"critical to the sustainable development of Navan"* in the Navan Development Plan. The plan details that the rail line will have a town centre stop, as well as a terminating station to the north of Navan. It anticipates that the *"rail link will significantly strengthen the attractiveness of Navan as an investment and employment centre by allowing firms to benefit from the reduced costs of setting up in the town while still benefitting from the vast skills pool available in the Dublin City catchment. It will also provide a quality commuter service for those who choose to live in Navan and commute to Dublin. As Navan develops its own employment base and diversity of retailing and service facilities, the objective is for Navan to become more self-sufficient over time. The presence of a rail link to Dublin would see many commuters transfer from car to rail, as it will be faster and more reliable. Economic and retail leakage from the region will also be reduced."*

The plan also details the need to assess local bus, pedestrian and cycle network to restructure the local public transport and active modes to best integrate with the rail line.

6.12 Dunshaughlin Local Area Plan 2009 – 2015

The Dunshaughlin Local Area Plan is supportive of the railway and the potential to be designated as a Moderate Sustainable Growth Town once the railway is open. The public transport objectives promote, facilitate and advance the development of the Navan Rail

Line, as well as protect and safeguard the proposed alignment from development and encroachment by inappropriate uses.

6.13 Dunboyne, Clonee & Pace Local Area Plan 2009 – 2015

The Dunboyne, Clonee & Pace LAP is designed so as to be compatible with both the existing rail line to M3 Parkway station, and its proposed continuation towards a termination point north of Navan. It prioritises high-density employment and housing within 1 km of the rail stations to make efficient use of its proximity to the rail corridor and the M3. It also protects the proposed Option A alignment from inappropriate development in order to facilitate the extension to Navan. It also aims to provide for more pedestrian and cycle crossings of the rail route to improve station accessibility. As more high-density development occurs within the existing rail catchment in areas like Dunboyne/Clonee/Pace, the benefits of completing the rail line to Navan will continue to increase.

7. Social and economic impacts

The Navan Rail Line project will impact the lives of the people of Meath and those living along the route in a wide variety of ways. While some of these impacts can be expressed in terms of a quantified amount, many others can not. The impacts will be visible not only in the economic growth the project will enable but through improvements in the quality of life, reduced levels of stress and reduced impact on the environment. The impacts of the project on the people of Meath and the environment are discussed below.

7.1 Economic

7.1.1 Transport efficiency

Rail transport is more energy efficient than road-based transport, meaning that the Navan Rail Line would be more efficient than private vehicles or a potential bus-based alternative. Trains are the most efficient choice for passenger travel when measured by greenhouse gas emissions.[13] The average emissions by motorised mode of passenger transport in the EU27 in 2018 are shown in Table 7-1 below.

Table 7-1. Emissions by motorised mode of passenger transport, EU27 (EEA)

Transport Mode	GHG emissions (gCO_2e / passenger-km)
Passenger flights	160
Passenger cars	143
Buses and coaches	80
Maritime passenger	61
Passenger trains	33

The scheme would decrease petrol and diesel consumption by encouraging a mode shift from road-based transport to rail. Should electrified BEMU services be operated in future years, the transport efficiencies will increase further and emissions at the point of use will

[13] https://www.eea.europa.eu/publications/rail-and-waterborne-transport

be reduced to zero. Electrification of the service would improve efficiencies by reducing the maintenance requirements of vehicles as the operation and maintenance costs of electric traction units have been shown to be between 20% and 46% lower than DMUs on a per-car basis[14] and the efficiency of EMU and BEMU vehicles are comparable.

7.1.2 Freight

The 2020 Programme for Government highlights objectives to deliver a 50% reduction in emissions by 2030, while the Climate Action and Low-Carbon Development bill that is currently making its way through the Oireachtas calls for a net-zero emission economy by 2050. Heavy Goods Vehicles (HGVs) and Light Goods Vehicles (LGVs) account for 20% of transport emissions while rail (passenger and freight) is responsible for just 1%.[15] A single freight train has the potential to remove up to 25 articulated HGVs from our roads. As rail freight generates 76% less emissions than road haulage (average of LGVs and HGVs), the growth of rail freight will be an effective way at reducing transport emissions[16]. The Dublin-Meath county-to-county flow of goods is the second largest in the country by 2016 HGV traffic flows.[17] While this assessment is focused on passenger transport, it should be noted that this line has the ability to facilitate the movement of goods in more-sustainable ways to more areas of County Meath, especially considering its direct connection to Dublin Port.

7.1.3 Transport reliability

Rail transport is more reliable than road-based transport, as rail is less affected by traffic and weather conditions. Dublin is one of the most congested cities in Europe, and journey times can vary significantly due to traffic conditions. An analysis undertaken by the Department of Transport's Economic and Financial Evaluation Unit (EFEU) estimated the cost of time lost due to aggravated congestion was €358 million in the base year (2012).

[14] Irish Rail Operation and Maintenance Costs, 2016
[15] Energy in Ireland report, SEAI, 2019
[16] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2020
[17] CSO, 2016, County to County, Articulated HGV traffic flows

This is forecast to rise to €2.08 billion per year in 2033.[18] The analysis found that nearly half of this time lost will occur outside the M50 by 2033, as shown in Figure 7-1 below.

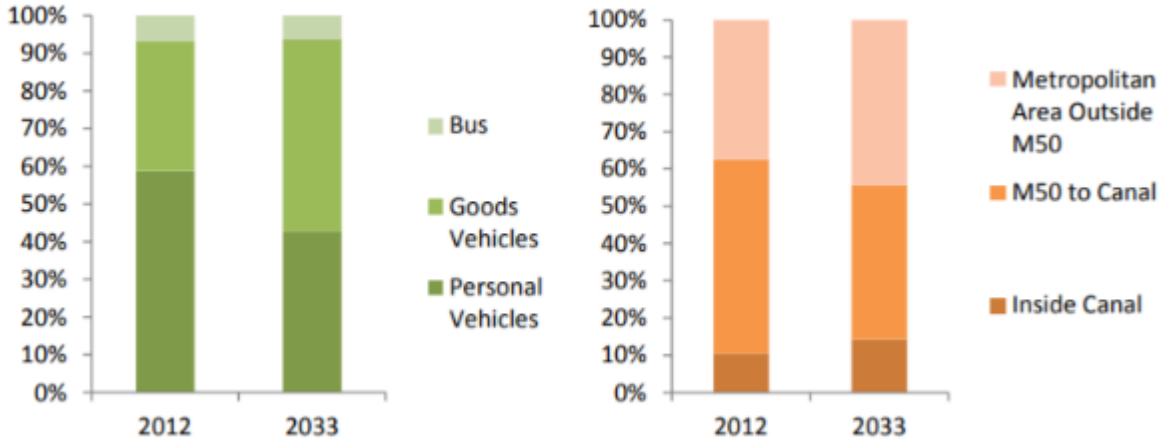


Figure 7-1 Breakdown of annual cost of time lost due to congestion (Department of Transport)

As shown in Table 7-2, the greatest increase in costs incurred by congestion will occur in goods vehicles, which do not often have the option of switching to another mode. The Navan Rail Line could help reduce time lost due to congestion by facilitating a modal shift away from personal vehicles, minimising time lost due to congestion for both rail and road users.

Table 7-2 Increase in total annual cost of time lost due to aggravated congestion, between 2012 and 2033 (€million) (Department of Transport)

Inside Canal	Personal Vehicles	€100.0
	Goods Vehicles	€139.9
	Bus	€19.9
M50 to Canal	Personal Vehicles	€293.5
	Goods Vehicles	€337.2
	Bus	€43.8
Metropolitan Area Outside M50	Personal Vehicles	€287.3
	Goods Vehicles	€460.5
	Bus	€41.3

[18] https://assets.gov.ie/13615/110debccab3346aa9a6f871f0ae660d9.pdf

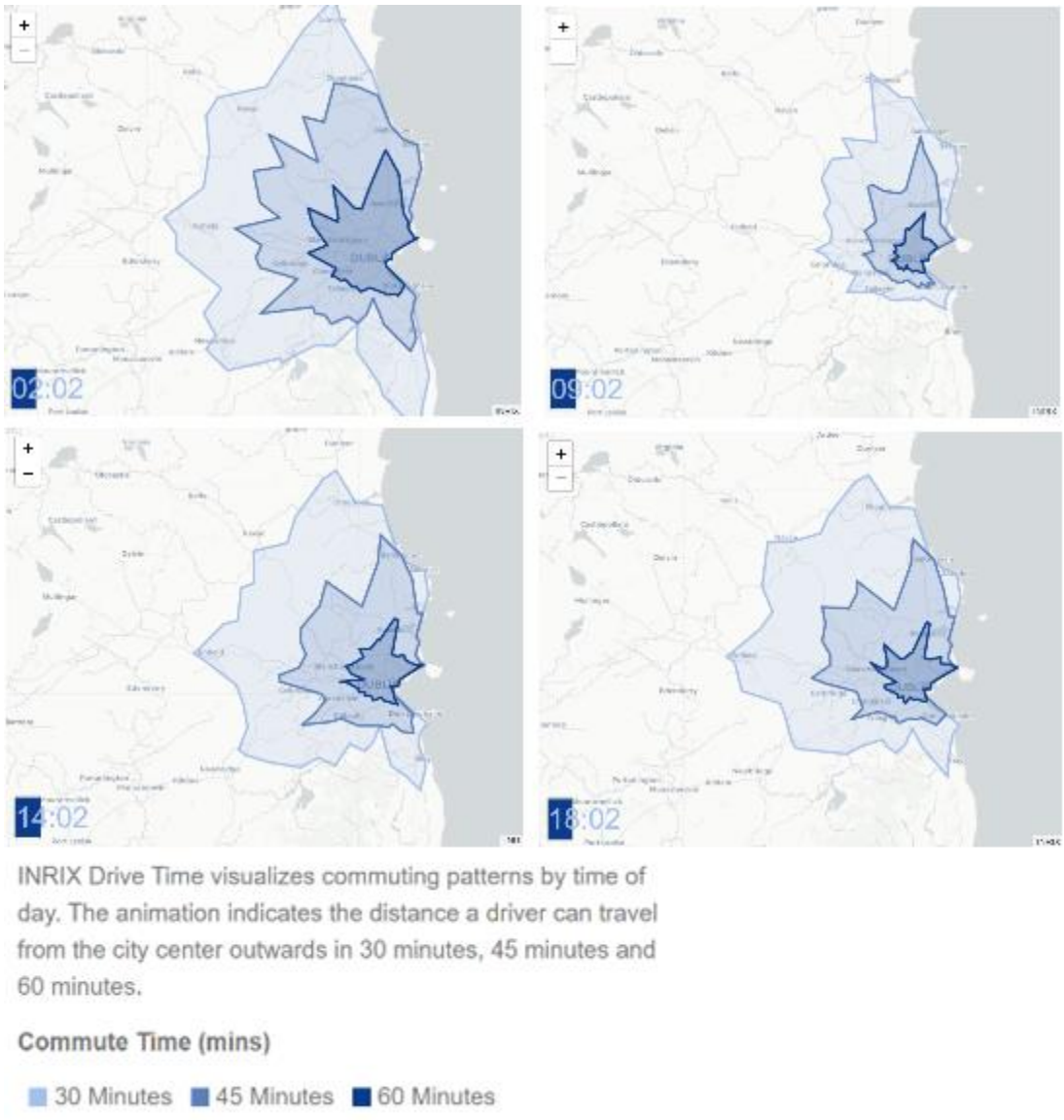


Figure 7-2 Areas reachable by a journey of 30, 45 and 60 minutes from the city centre (INRIX)

For those who transfer to it, the scheme will be able to provide consistent journey times between the four proposed stations and Dublin city centre. Currently, journey times by road transport vary widely by time of day, as shown in Figure 7-2.[19] In light traffic conditions (such as the 2:02 AM map shown in the top left portion of Figure 7-2), one can drive to Navan from Dublin city centre in less than one hour. In heavy traffic conditions

[19] https://inrix.com/scorecard-city/?city=Dublin&index=20

(such as the 9:02 AM map shown in the top right portion of Figure 7-2), one can only drive about halfway to Navan in one hour.

Another county with high proportions of Dublin commuters is Wicklow, where a 2018 survey found that "unreliable public transport" was the main reason that Wicklow commuters chose the car as their primary means of transport.[20]

The current M3 Parkway service from Pace to Dublin city centre has achieved a 95% on-time performance between 2018 and 2020, while Bus Éireann commuter bus services in the Dublin area recorded 57% on-time performance during the same period.[21,22] The permanent infrastructure provided by rail investment means that transport provision can be counted on with a higher degree of certainty than a bus service, which is affected by traffic congestion and more often subject to changes in scheduling or routing. This will increase confidence in the service and ensure that passengers arrive at work, their transport connection, or other obligations consistently and with reduced stress than via road-based transport.

7.1.4 Resilience

Resilience is an important part of any proposed transport project, as climate change will make severe weather events more frequent around the world. This scheme will improve resilience, as it provides another mode option of travel between Meath and Dublin to supplement road travel should the road network be affected by construction, police activity, weather, etc. Additionally, this initial investment has the option to be electrified in the future, increasing Ireland's ability to facilitate transportation without the use of imported diesel and petrol, increasing energy independence and energy resilience.

[20] https://www.wicklow.ie/Portals/0/Documents/Business/Business-Environment/Wicklow-Facts-Figures/Commuter%20Study%20Report.pdf
[21] https://www.irishrail.ie/en-ie/about-us/train-punctuality-reliability-performance/2018
[22] https://www.nationaltransport.ie/wp-content/uploads/2020/12/2018-to-2020-Bus-Eireann-Bus-Performance-Report-Punctuality.pdf

7.1.5 Transport quality

Over eight thousand people commute from within the catchment of the proposed Navan Rail Line to Dublin city on a daily basis[23]. The Navan Rail Line would provide an increase in quality over current public transport provision. Stations would be well-lit, designed for safety and accessibility, and easily accessible from surrounding towns via cycling/walking through the provision of pedestrian infrastructure, cycle lanes, and cycle parking, as well as by Navan local bus services and private vehicles. Rail is quieter and smoother than buses and cars, and typically allows for greater comfort and the ability to easily move throughout the vehicle. Train cars have Wi-Fi and tables to facilitate both working and relaxing. This high-quality environment reduces the anxiety that is often associated with long commutes while also providing passengers the opportunity to be more productive during their commutes. The ability of passengers to be productive during their commute would improve the economic output of the GDA, as less time would be wasted driving to and from the office.

An online survey conducted on behalf of Meath County Council by JHPA in February 2021 showed 96% of respondents "agree strongly" or "agree slightly" that the Navan Rail Line would "enhance the quality of commuting to and from Dublin". This is largely due to the increase in quality that rail provides over bus.

7.1.6 Agglomeration

Agglomeration effects occur because firms can derive productivity benefits from their proximity to each other, and from being located in large labour markets. If transport improvements effectively bring firms closer together and closer to their workforce, an increase in labour productivity above and beyond that which would be expected from transport efficiency savings alone can be expected.

[23] CSO POWSCAR data 2016

A high-quality labour market supply is important to the GDA economy, especially when looking to attract foreign investment. The Navan Rail Line would have the ability to widen the Dublin labour, supplier and consumer market, improving productivity as well as allowing firms to locate further away from Dublin city centre while still availing of the productivity benefits they enjoy from their proximity to other firms. Additionally, firms that are already located near the proposed stations will be able to increase their productivity due to the reduced time it will take to travel to other firms they may often collaborate with. Centres of employment like Mullaghboy Industrial Estate, Meath Enterprise and Dunshaughlin Business Park are all within the walking/cycling catchment (1.5km) of proposed stations. Navan Business Park, Eamon Duggan Industrial Estate and Scurlockstown Business Park are within the driving catchment of proposed stations. These locations are detailed in Figure 7-3. As outlined in section 13.4, the agglomeration benefits for the project range from €19-32 million for the rail-based options and over €400,000 for the bus option.

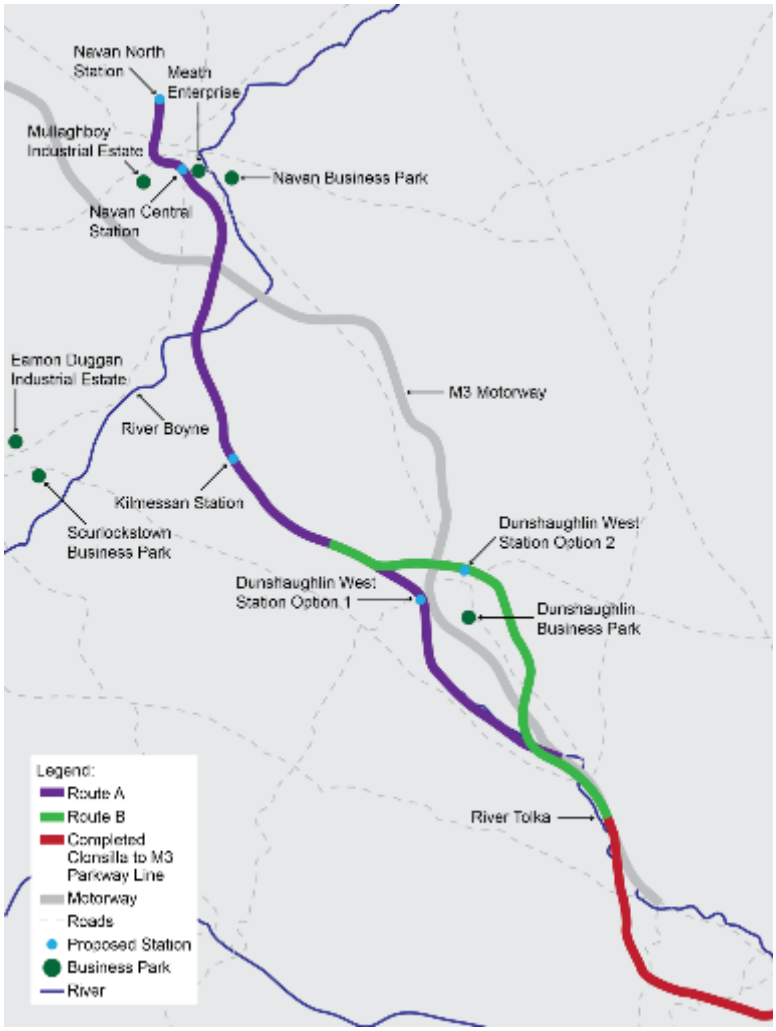


Figure 7-3 Business park and employment areas within rail catchment

7.1.7 Employment impacts and growth

The rail line would provide direct and indirect short-term employment benefits during the construction phase, and direct and indirect long-term employment associated with the operations and maintenance of the rail line. Early estimates of employment creation using the project spend from the 2011 Business Case[24] and Environmental Impact Statement (EIS) put direct employment numbers at about 300 direct full-time equivalent jobs and 550 indirect full-time equivalent jobs per year throughout the construction phase of the project.

The improved image of the area associated with the construction of a rail line, in addition to improved quality and quantum of work force within commuting distance of Meath, has the potential to attract new businesses to Meath that previously had not considered the county, encouraging further job growth.

7.1.8 Tourism

The provision of rail services is an important factor in attracting tourism to an area. Rail is more easily understood by tourists than bus services and more affordable than renting a car. 58% of tourists relied on public transport in 2017, but only 11% of domestic tourists and 5% of out-of-state tourists used the rail network in 2016.[25] The provision of a new rail line will allow tourists to more easily and visibly access cultural and historical sites in Meath that previously would not have been considered. The Boyne Valley Drive includes cultural sites such as the Hill of Tara, Slane Castle, Trim Castle, Brú na Búinne, and more. Accessibility improvements to these sites could encourage more domestic and out-of-state tourists to visit Meath.

Upon the completion of the MetroLink project, Meath will have a rail link with Dublin Airport via the proposed MetroLink interchange at Glasnevin station. This will allow tourists arriving from the airport simple access to Meath without having to go through Dublin city

[24] Navan Railway Corridor, Phase 3: Outline Design Business Case, IÉ
[25] https://www.nationaltransport.ie/wp-content/uploads/2016/11/151116_2016_Rail_Review_Report_Complete_Online.pdf

centre first or switch between bus and rail, encouraging Meath as an easily accessible place to stay and visit.

Greenways are a growing trend in tourism in Ireland, converting disused rail lines/canal towpaths/other linear infrastructure into long-distance cycling and walking paths. The proposed Boyne/Navigation Greenway is identified as one of the strategic destination opportunities within the Ireland's Ancient East promotional area. The route of this greenway is shown in Figure 7-4 below. The rail line will link Dublin to this greenway, in addition to the proposed Navan to Kingscourt Greenway, contributing to Ireland's growing Green Tourism industry and improving the ability of cyclists to explore Meath via sustainable modes.

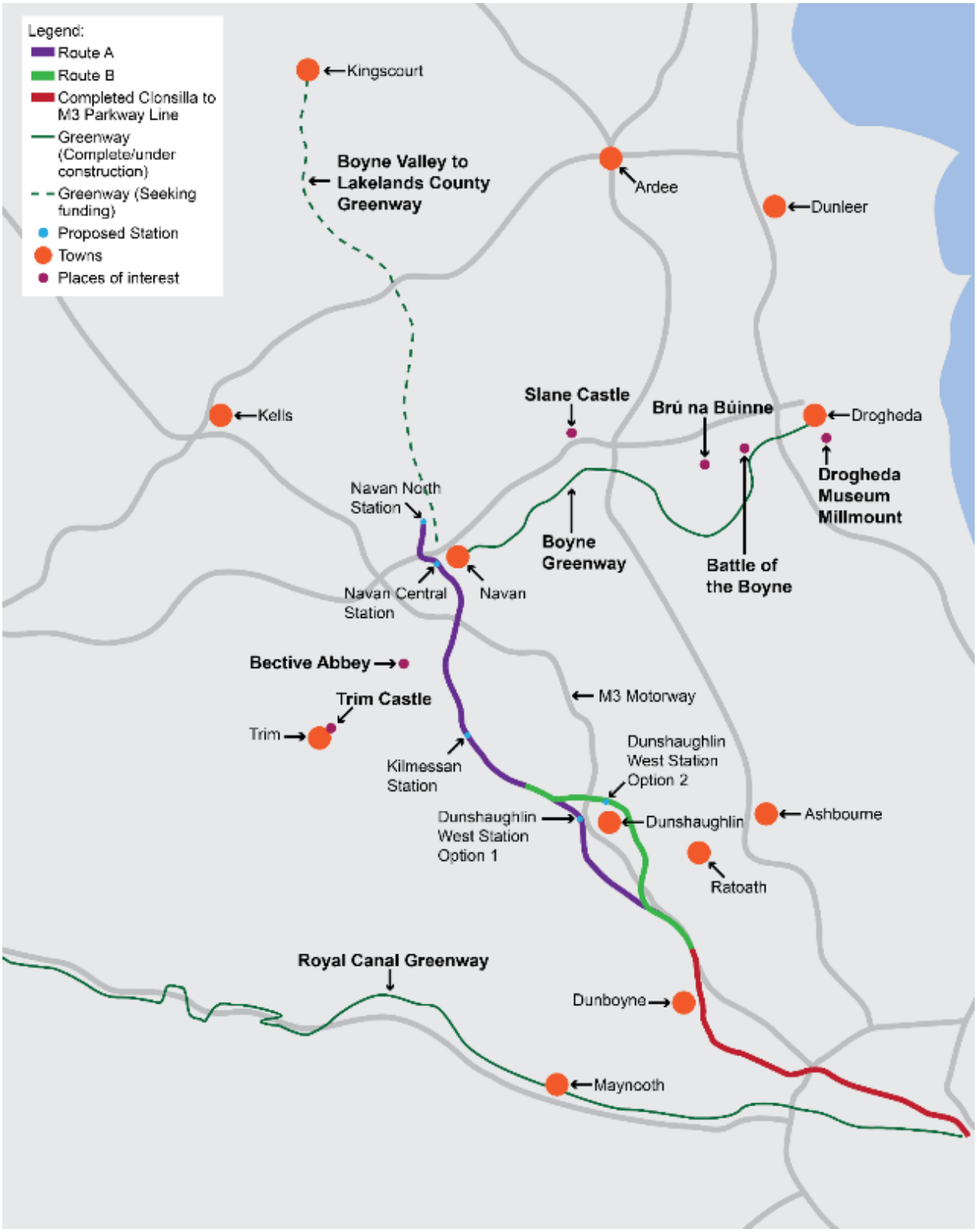


Figure 7-4 Proposed greenways and significant tourist sites in Meath (Fáilte Ireland)

7.1.9 Sport

The Navan Racecourse is located about 2.5km from the proposed Navan North station, on Proudstown Road. The racecourse hosts approximately 19 fixtures throughout the year, supporting the hospitality sector in Meath with an average annual attendance of about 35,000.[26] Other racecourses near rail stations like Naas Racecourse, the Curragh Racecourse and Fairyhouse Racecourse provide shuttle bus services from nearby rail stations, allowing those without cars to attend the races. Providing shuttle buses from the Navan North station could allow Navan Racecourse to increase attendance among those without access to a car.

Páirc Tailteann is located about 600m from the proposed Navan Central station, within the station's walking catchment. Planning approval was granted in 2018 for a redevelopment of the stadium, increasing capacity to 22,000. Improved accessibility from Dublin city centre via the rail line, in addition to an enhanced fan experience provided by the redevelopment, can encourage greater participation in Meath GAA and can support the development of sport across the county.

7.2 Safety

7.2.1 User safety

The Navan Rail Line would encourage mode shift from road-based transport to rail. Rail is the safest form of land transport in Ireland.

Table 7-3 2018 Average accident rates rail vs. road (IÉ, RSA)

Total accidents per billion seat-km (Irish Rail)	Total accidents per billion seat-km (Car)
4.4	330.0

[26] https://www.hri.ie/uploadedFiles/Factbook%202019%20FINAL.pdf

As seen in Table 7-3 above, rail travel in Ireland has about 75 times fewer accidents per billion seat-km than road travel does. Additionally, rail has the smallest number of fatalities when compared to other modes of land-based transport, as illustrated in Table 7-4[27].

Table 7-4 User safety comparison of different modes of passenger transport (International Railway Safety Council)

Transport Mode	Fatalities per Billion Passenger Kilometres
Airline Passenger	0.10
Railway Passenger	0.16
Bus/Coach Occupant	0.43
Car Occupant	4.45
Motorcycle	52.59

It can be expected that the reduction in vehicle miles traveled will result in a reduction in collisions and fatalities. Following transport modeling of the proposed options, it has been calculated that the Navan Rail Line will reduce private vehicle travel by an average of 37 million veh-km per year. Using standard vehicle collision rates and collision costs published by TII[28] it has been calculated that this will result in collision cost savings of €9.8 million over the appraisal period.[29]

The rail service will run on dedicated track, segregated from public highways. Road user safety has the potential to decrease slightly, as two new level crossings are proposed. These level crossings will be fully automated with barriers to minimise any risk of interaction between vehicles/pedestrians and trains.

[27] https://international-railway-safety-council.com/safety-statistics/
[28] https://www.tiipublications.ie/library/PE-PAG-02030-01.pdf
[29] Navan Rail Line Cost-Benefit Analysis, AECOM

7.3 Integration

7.3.1 Modal integration

The rail line will improve modal integration, as it makes use of existing infrastructure within Dublin city centre that has existing connections with Dublin Bus, Luas, DART, Commuter and InterCity rail, and Bus Éireann services. Additionally, integration with planned projects like MetroLink at Glasnevin and Luas Finglas at Broombridge will allow connection to destinations in the north like Finglas, Dublin Airport, and Swords without a city centre connection. DART+ West, which will operate frequent, electrified rail service between M3 Parkway and Dublin city centre will also integrate with the Navan Rail Line at multiple stations. A map of existing heavy rail and Luas services in the Dublin area is shown below in Figure 7-5. Note that the proposed scheme will join the network at M3 Parkway station.

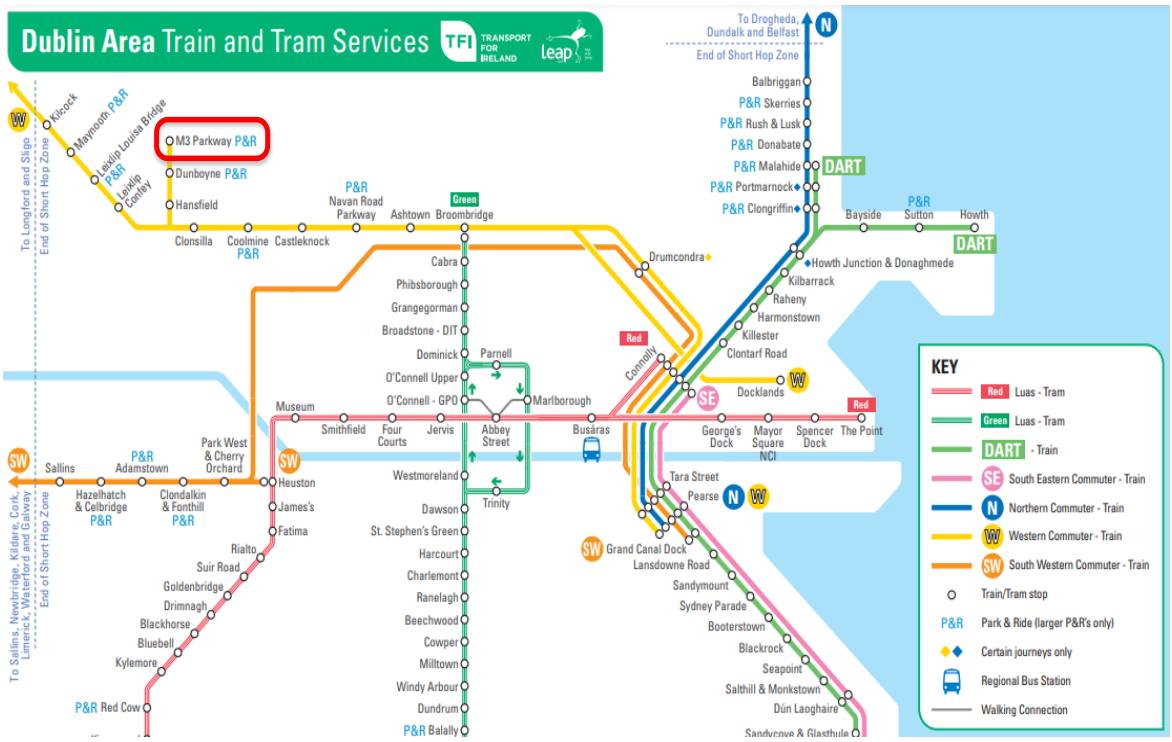


Figure 7-5 Dublin Rail Map showing M3 Parkway and Dunboyne Stations in Co. Meath (Dublin Public Transport)[1]

Bicycle parking will be provided at all stations, encouraging cycling integration without the need to bring bicycles on trains. The rail line will integrate with cycling more effectively than bus, as folding bicycles will be allowed on trains at all times, and standard bicycles

will be allowed on trains during non-peak hours. Proposed greenways (as shown in Figure 7-4 previously) around Navan and existing greenways in Dublin will further encourage modal integration with the bicycle.

The rail line will integrate with private vehicle as well. Navan North, Kilmessan, and Dunshaughlin stations are all designated as park-and-ride stations, which will increase the catchment of these stations and improve accessibility to residents that own a car but would prefer to take the train upon completion. The Navan Development Plan 2009-2015 includes multiple distributor road proposals that will improve accessibility to the Navan North station, allowing traffic from north of Navan (particularly Kells) road access to the station without the need to travel through the town centre.

7.4 Land use integration

The area surrounding the four proposed stations contains a variety of uses and opportunities for integration with the proposed rail line. The area surrounding the proposed Navan Central station is surrounded by mixed-use, community infrastructure, new/existing residential, commercial and open space zoning as shown in Figure 7-6 below.

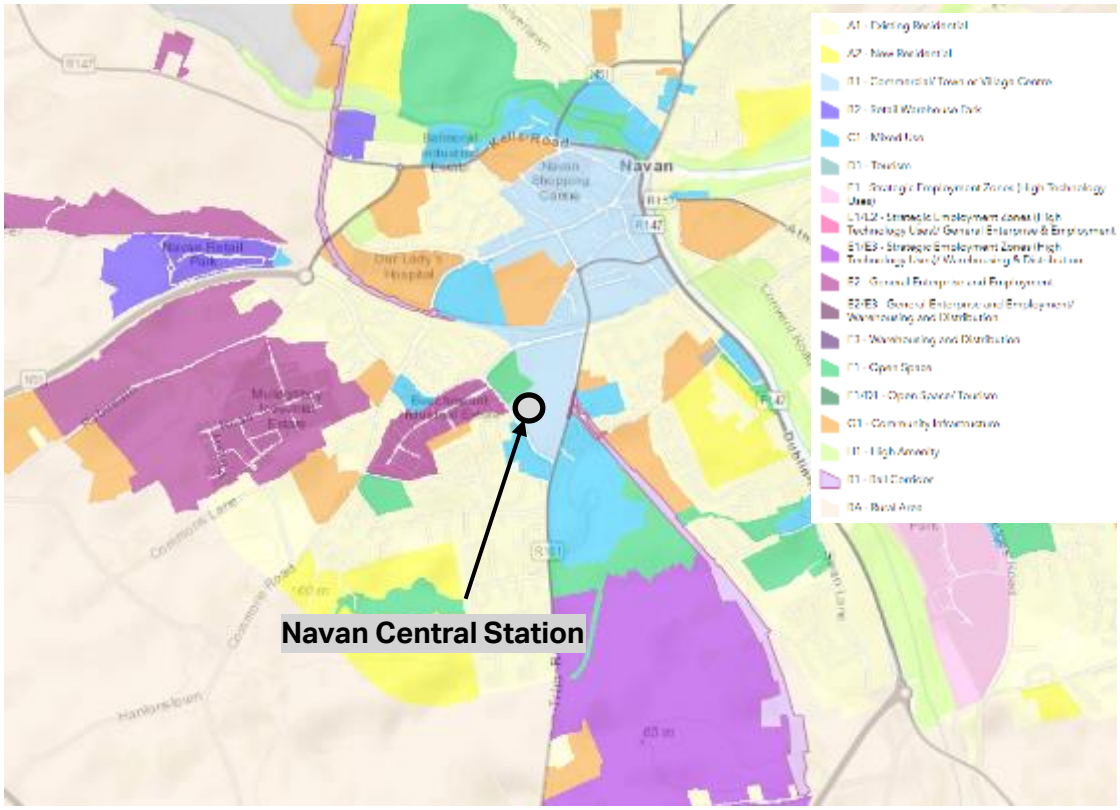


Figure 7-6 Zoning of area surrounding Navan Central station, 2021-2027 Draft Meath County Development Plan (MCC)[30]

The proposed Navan North station is surrounded by community infrastructure, new/existing residential and open space zoning as shown in Figure 7-7 below. The station will be approximately 1.3km from the previously designated Clonmagadden Strategic Development Zone (SDZ), approved by An Bord Pleanála in 2004. The Navan Rail Line could improve connectivity to these areas identified for population growth in the Meath County Development Plan.

[30] https://consult.meath.ie/en/consultation/meath-draft-county-development-plan

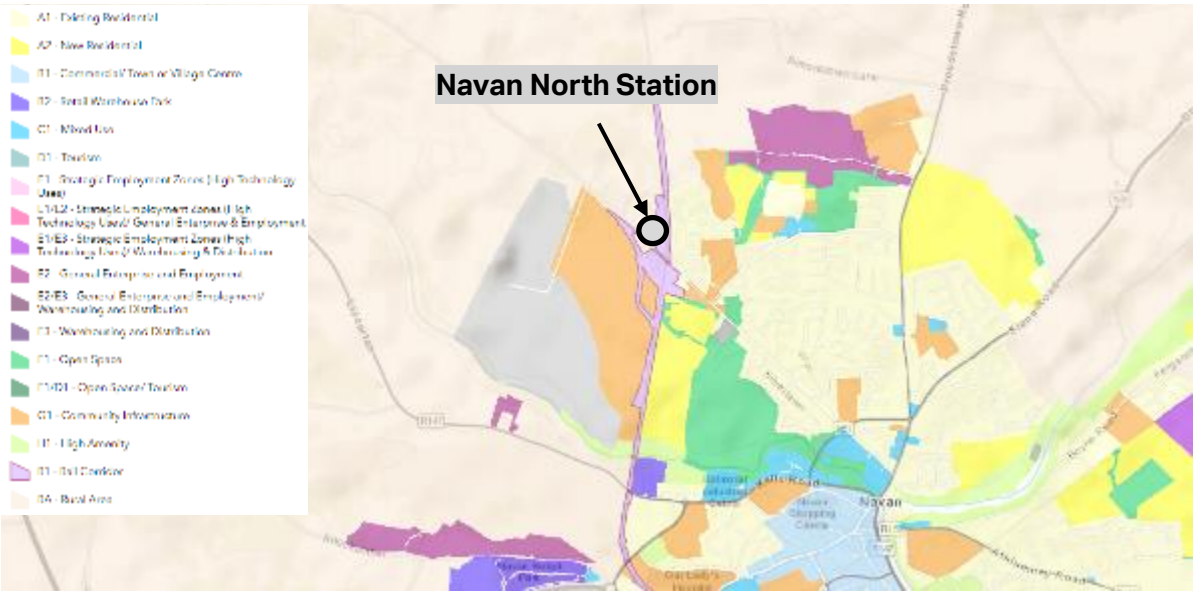


Figure 7-7 Zoning of area surrounding Navan North station 2021-2027 Draft Meath County Development Plan (MCC)[31]

The proposed Dunshaughlin Station for Option A is approximately 500m from lands zoned for new residential development and general enterprise, as shown in Figure 7-8 below. Upgraded cycle and pedestrian infrastructure across the M3 will allow sustainable access to the station from Dunshaughlin town centre.

[31] https://consult.meath.ie/en/consultation/meath-draft-county-development-plan

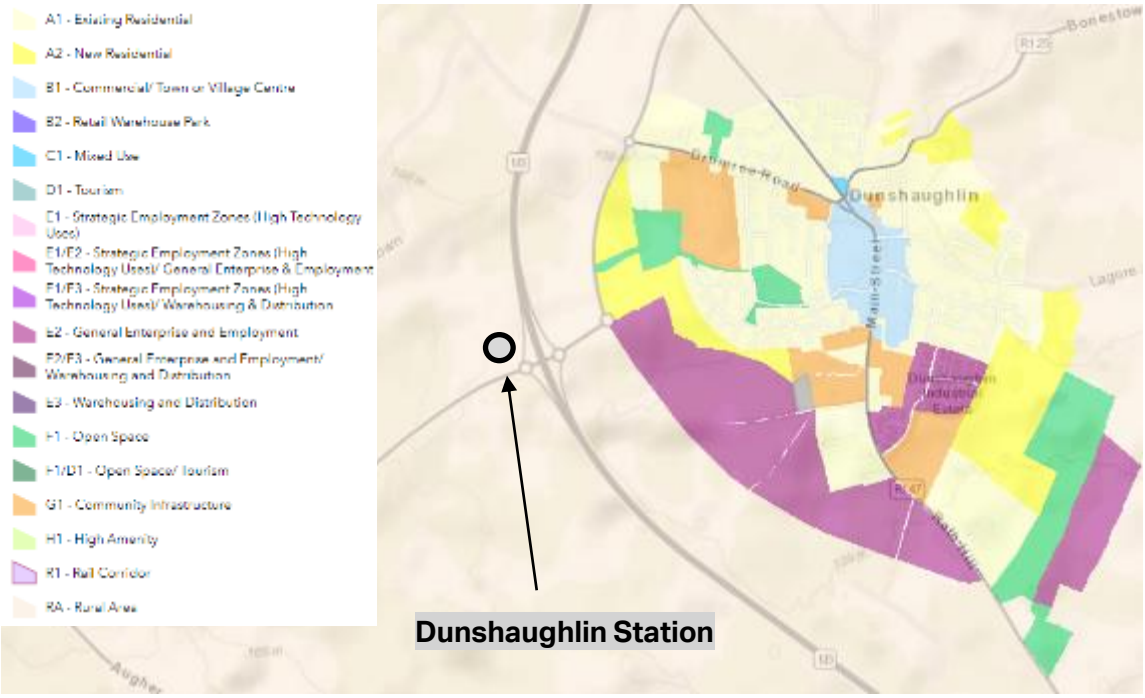


Figure 7-8 Zoning of area surrounding Dunshaughlin station 2021-2027 Draft Meath County Development Plan (MCC)

7.5 Environmental

In accordance with the scope of the assessment, the summary of potential environmental impacts in the following sections is informed by the 2011 EIS[32]. It is noted that since 2011 the legislation and specific environmental designation and context has evolved significantly. The legislation framework in relation to Environmental Impact Assessment (EIA) has become more stringent since 2011 with amendments to the Planning and Development Act 2000 in 2018 as required by the European Union Directive 2014/52/EU transposed into the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 S.I. No. 296/2018.

[32] Navan Rail Line, Environmental Impact Study, ROD, 2011

Key amendments as well as the title change from Environmental Impact Statement (EIS) to Environmental Impact Assessment Report (EIAR) mandated by the 2014 Directive include:

- The refinement of environmental factors and the guidance documents to be considered in the assessment process – resource efficiency, climate change, population and human health, biodiversity and Major Accidents and Disasters.
- The introduction of "scoping" of the EIAR in the 2018 Directive.
- Requirement that the EIAR be prepared by competent experts and for the competent authority to have, or have access to, sufficient expertise to examine the EIAR.
- Requirement for a 'baseline scenario' - an assessment of the current state of the environment and how this is likely to evolve without the proposed project but having regard to existing and approved projects and likely significant cumulative effects. The baseline assessment requires the collection and examination of relevant data on the environment and it must be conducted within a reasonable timeframe.
- Requirement for monitoring of significant adverse effects resulting from the construction and operation of a project.
- That EIARs are drafted on the basis of avoidance of significant effect on the environment instead of mitigation of impacts.

In accordance with these changes, should the Navan Rail Line project proceed, the environmental impacts of the project would need to be reassessed reflecting the new baseline conditions as the project progresses and an EIAR developed as per the 2018 amendments to the Planning and Development Act and any relevant updated guidance documents since 2011, in addition to an updated Appropriate Assessment (AA) Screening and potentially a Natura Impact Statement (NIS). As such, reference to the findings of the 2011 EIS should be interpreted in light of these considerations.

A summary of the main findings from each environmental assessment that were undertaken for the 2011 EIS is outlined in the following sections. These include the terminology and description of environmental aspects that were appropriate at time of writing.

7.5.1 Air quality and climate

As outlined in the air quality and climate assessment in the 2011 EIS, the greatest potential impact on air quality during the construction phase of the scheme would be from construction dust emissions and the potential for nuisance dust. However, with the implementation of mitigation measures; for example, ensuring vehicles exiting the site shall make use of a wheel wash facility prior to entering onto public roads, it was identified that the residual impacts of the scheme on air quality would be insignificant and pose no nuisance at nearby receptors.

In addition to this, due to the size and nature of the construction activities, CO_2 and N_2O emissions during construction would have a negligible impact on climate.

During the operational phase, the emissions to atmosphere associated with the scheme would include sulphur dioxide (SO_2) particulates (PM_{10} and $PM_{2.5}$), volatile organic compounds (VOCs) and nitrogen oxides (NO_2 and NO_X). The modelling results indicated that all parameters would be in compliance with the relevant limit values.

The predicted impact of the proposed railway line was identified as beneficial for regional air quality in 2011 and would decrease NO_x levels by up to 0.08% of the NO_x emissions ceiling, decrease SO_2 levels by up to 0.007% of the SO_2 emissions ceiling and decrease VOC levels by up to 0.009% of the VOC emissions at that time. In addition, it was stated in the 2011 EIS that the impact of the scheme on national greenhouse gas emissions would be beneficial in terms of Ireland's obligations under the Kyoto Protocol during its operation.

7.5.2 Noise and vibration

As described in the noise and vibration assessment undertaken for the 2011 EIS, the construction of the scheme could result in noise and vibration impacts for a number of properties along the length of the alignment which are at distances of 10 to 50 m from the

proposed works. Noise sources during the construction phase could occur from numerous construction activities, including site preparation works, excavation/fill works, structures (bridges, culverts, stations etc.), and track construction works.

Therefore, it was identified that mitigation measures would be required to reduce the impact on residents along the route. These measures included: the selection of quiet plant, control of noise sources, screening, adjusting work hours, liaison with the public and monitoring.

With regards to potential vibration impacts during the construction phase, it was concluded that vibration from construction activities would be limited to industry standard vibration limits as set out in the EIS, which provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage.

The 2011 noise and vibration assessment also identified a number of potential noise sources during the operational phase that could impact sensitive receptors in the study area. Potential noise sources identified from the scheme included passing railway noise, noise emissions associated with idling trains at station platforms and public address systems, in addition to departing and accelerating vehicles on approach and departure from the various stations proposed along the scheme. As a result, eighteen areas along the route were identified where noise mitigation would be required in order to reduce operational noise levels. This would entail the use of proprietary acoustic barriers between 1.5m and 3m tall as a means of reducing overall scheme related noise levels. Therefore, the results of the assessment determined that, through the proposed noise mitigation, the operation of the scheme could meet with the adopted noise criteria. In addition to this, it was determined that with the use of best practice control measures, noise emissions from public address systems would not cause a noise nuisance to the nearest noise sensitive locations and the predicted noise level associated with car parking activities during the operational phase would be below the existing ambient noise environment and would therefore not generate any significant noise impacts.

Vibration mitigation through the use of ballast mats and/or resilient rail clips was also identified to be required along parts of the scheme during the operational phase to ensure

vibration levels would be below the criteria as set out in BS 6427-1 (2008). The area identified for mitigation runs approximately from the scheme's crossing of Commons Road to the N51 in Navan.

The area around the M3 is currently subject to high levels of road noise. The Navan Rail Line's reduction of motor vehicle miles travelled has the potential to reduce road noise associated with the M3 corridor.[33] The 2011 Navan Rail Business Case identified the value of road noise reduction at €31 million over the 30-year evaluation period.

7.5.3 Landscape & visual

The landscape and visual assessment undertaken for the 2011 EIS identified that the scheme would have a number of impacts on the landscape and visual quality of the area. It was identified that the majority of impacts associated with the scheme would occur from the additional infrastructure such as roads, stations and bridges and also from the loss of hedgerows and trees along the corridor of the proposed railway.

The most significant impacts would likely arise from a loss of mature landscape elements such as trees, woodlands and hedgerows where double-tracking would be required widening the existing rail line or where new road embankments/alignments are proposed. These would all be replanted either in the same locations where possible or in appropriate locations nearby according to the 2011 EIS.

Some listed views would be impacted during construction (mainly by construction cranes); however, it was determined that no significant impacts would remain on any listed views or prospects. In addition to this, the local character in areas where new stations were proposed would be affected, as well areas where vegetation would be removed during realignment works and railway construction. For example, the loss of vegetation would give rise to local landscape impacts along the River Boyne and River Blackwater.

[33] https://www.tii.ie/tii-library/environment/noise-maps/2017den/Meath_Lden_Rev01.pdf

However, the assessment concluded that mitigation would over time address the identified potential landscape and visual impacts and significant residual impacts would be limited.

7.5.4 Biodiversity

The terrestrial ecological assessment undertaken for the 2011 EIS identified a number of potential impacts from the scheme on sensitive ecological receptors, including the loss of habitats for a number of sensitive ecological receptors such as bats, badgers, otter and birds. For example, there would be a major negative impact on the small wetland at Pelletstown, which supported important numbers of wintering snipe as well as breeding frogs, as there would be a loss of wetland habitat and the likely abandonment of the snipe. The assessment identified that the scheme would not have any adverse impacts on the qualifying terrestrial interests of the River Boyne and River Blackwater candidate Special Area of Conservation (cSAC) and Special Protection Area (cSPA) (now a SAC[34]) as a result of proposed river crossings. Results from the aquatic assessment undertaken for the 2011 EIS did identify that there could be a minor permanent reduction in the availability of spawning habitat for salmon and potentially lamprey outside of the cSAC (now a SAC) as a result of regrading of the Boyne tributary stream at one location.

The terrestrial ecological assessment concluded that given best practice design of the scheme, and with mitigation measures incorporated in full, the overall impact by the scheme on terrestrial ecological interests could be considered as minor negative at a local level, apart from the wetland at Pelletstown where the impact is rated as major at county level. Since the 2011 EIS, the Dunsany Estate has stopped agricultural practices to allow more natural land use, and joined the Rewilding Europe network, which may require further study on further impacts from the scheme to new potential wildlife in the area.

[34] Prime wildlife conservation areas considered to be important on a European as well as Irish level. The legal basis on which SACs are selected and designated is the EU Habitats Directive, transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011).

The 2011 aquatic ecology assessment identified a number of potential impacts during both the construction and operational phase of the scheme, including habitat loss, impacts on water quality arising from silt or pollutants entering the watercourses during the construction phase of the new rail line; risks of degeneration in water quality during operation arising from run-off and as a result of accidental spills, as well as impacts on species from pollution and proposed new culverts. However, it was identified that with the implementation of the specified mitigation measures, the residual impacts of the scheme on the aquatic environment would be localised and primarily temporary in nature.

7.5.5 Cultural, archaeological & architectural heritage

The archaeological and cultural heritage assessment undertaken for the 2011 EIS describes the principle source of impacts on the archaeological heritage as ground disturbance during the construction phase of the scheme, while the operational phase is unlikely to have any significant impacts on archaeological heritage.

The assessment concluded that the scheme would not have a direct impact on the Hill of Tara but there could be a number of indirect, negative impacts during the construction phase on a number of archaeological sites including church ruins, a tumulus, a deserted settlement, a ring fort, a rath and a holy well within sight distance of the scheme. However, it was identified that with the implementation of the archaeological mitigation measures outlined within the 2011 EIS, no significant residual impacts on archaeological heritage would remain. Construction phase mitigation measures identified included: centreline test excavation, underwater investigation, avoidance, landscaping/screening, and archaeological excavation of any discovered archaeological material.

As outlined in the architectural heritage assessment undertaken for the 2011 EIS, the principle source of impacts on architectural heritage would be associated with the construction phase of the scheme. It was concluded that the operational phase of the scheme is unlikely to have any significant impacts on architectural heritage known at the time of writing.

A number of structures included in the Record of Protected Structures, the National Inventory of Architectural Heritage and additional architectural features identified during

the field survey undertaken for the 2011 assessment were located within or close to the land take associated with the scheme. The assessment identified that impacts on these features would range from profound and negative, for example, where bridges would need to be demolished, to moderate and positive where historic bridges/viaducts would be restored and brought back into use.

For direct impacts that could be mitigated, it was identified that with the implementation of a number of mitigation measures, as outlined within the 2011 EIS, no significant residual impacts on architectural heritage would remain; for example, landscaping/screening would be provided if appropriate to minimise the visual impact on the Dunsany Castle Architectural Conservation Area (ACA).

7.5.6 Land use, soils & geology

The soils and geology assessment undertaken for 2011 EIS identified that during the construction phase, a number of activities could impact the existing soils and geology environment, including excavations, cuttings, and construction of embankments. For example, it was identified that should soils requiring remediation or removal be present, this would potentially have adverse effects on existing soils and groundwater unless appropriate measures and techniques are implemented. In addition, it was identified that the transport of soils away from site, for disposal to landfill, could contribute overall to a significant impact. However, mitigation measures were provided which would mitigate potential impacts.

It was also identified that as the scheme would mostly be located within the context of a previous railway line, the overall requirements and impacts from construction of embankments and cuttings on the existing environment would be not significant. The assessment concluded the renewal and development of the existing cut and fill slopes could have a minor to moderate beneficial impact with regard to slope stability.

The agricultural assessment undertaken for the 2011 EIS outlines that a total of 128.88ha of agricultural land would be lost as a result of the scheme. However, the assessment concluded that this loss, while significant to individual farmers, is not significant on a

county or national level. Mitigation measures identified in the 2011 EIS include overbridges and underpasses to reconnect severed agricultural land.

7.5.7 Water resources

The hydrogeological assessment undertaken for the 2011 EIS identified a number of potential impacts on groundwater resources associated with the scheme during the construction phase. For example, cut sections along the railway route have the potential to impact the level of the groundwater table in the surrounding area, as well as the potential to cause deterioration in aquifer water quality. In addition, potential impacts during the construction phase could occur as a result from spillages and leakages of hydrocarbon fuels during construction works. However, the assessment concluded that the impact of railway construction on aquifers and groundwater resources could be minimised by applying sound design principles and by following good work practices during the construction phase. Mitigation measures identified in the 2011 EIS included: restricting refueling and maintenance of vehicles to impermeable areas, dealing with hydrocarbon leakages or spills immediately, minimising dust, reducing traffic in areas with karst features, using sealed drains in areas of extreme vulnerability and backfilling and sealing areas that have water supply wells and springs beneath them.

The assessment also concluded that the scheme could introduce a new potential source of groundwater contamination during the operational phase through potential contaminated surface water drainage runoff from the railway and herbicides associated with track maintenance. However, a number of mitigation measures were identified in the 2011 EIS which could reduce potential impacts including sealed drainage and monitoring of herbicide use, etc. In addition, all station runoff would pass through a three-stage runoff quality improvement process. Overall, the assessment concluded that the scheme should not have any significant residual impacts associated with the hydrogeological environment.

The 2011 hydrology assessment concluded that during the construction phase, a number of mitigation measures would be put in place to prevent/contain any accidental discharges of potentially polluting substances to surface waters including the use of silt

traps and spill response kits, as well as the use of attenuative measures in nearby drainage as required, including straw bales, settlement tanks, etc. as required.

The hydrology assessment identified a number of potential impacts on surface waters during the operational phase as a result of the location of proposed river crossings, drainage outfalls, increased impermeable areas, culverting of rivers, and encroachment on floodplains. Potential impacts identified included flood risk, alterations to stream flow and contamination. However, it was identified that the proposed mitigation measures, including the use of filter drains and the implementation of SUDS, would reduce potential impacts. Therefore, it was determined that overall, the residual impact of the scheme on hydrology would be imperceptible to slight in respect to river and stream flow, flooding and flood risk, channel morphology and sedimentation processes and water quality.

7.6 Accessibility and social inclusion

7.6.1 Vulnerable groups

The improvements to reliability and safety as a result of the scheme, in addition to new stations provided in previously underserved areas, will improve access to employment, education, friends and family, healthcare, leisure and other services for vulnerable groups - namely young people, disabled people, and the elderly. The NTA Rail Review Report 2016 made reference to the National Disability Survey, which stated that respondents living in towns and rural areas were more likely to use inter-city trains than inter-city buses.[35] These vulnerable groups may not have had the ability to travel by private vehicle previously, and will have access to destinations that previously were unreachable or undesirable by existing modes.

7.6.2 Deprived geographical areas

Using the Pobal HP Deprivation Index, the small areas within 500m of the proposed Navan Central Station are generally considered deprived, with many areas being defined as

[35] https://www.nationaltransport.ie/wp-content/uploads/2016/11/151116_2016_Rail_Review_Report_Complete_Online.pdf

disadvantaged or very disadvantaged. These areas are shown in Figure 7-9 below. The average Pobal Index score of these areas is -6.44, indicating areas that are marginally below average. These small areas also have an average third-level education rate of 25%, and 19% of households have no access to a car.[36] Living within 500m of a direct link to third-level education and employment opportunities in the Dublin area will allow residents greater opportunity for upward social mobility.

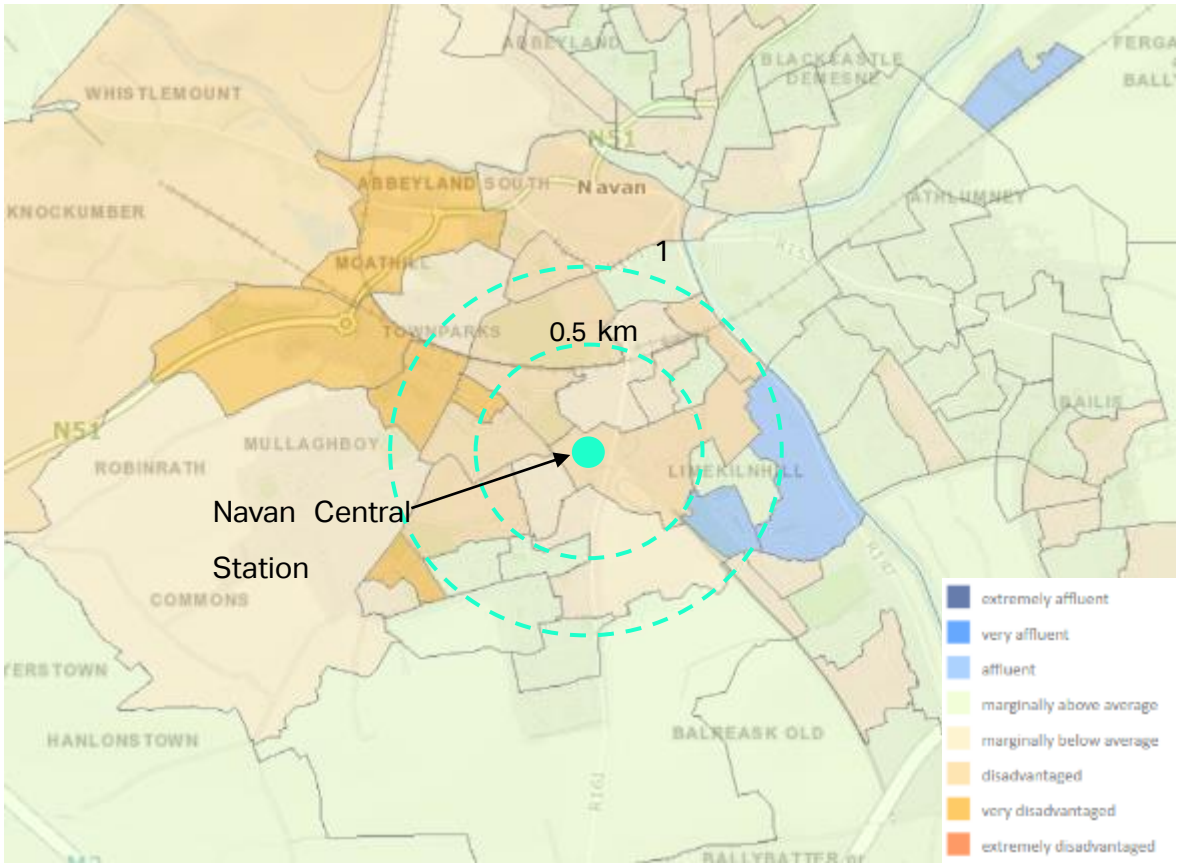


Figure 7-9 Pobal Index in Navan Central Station environs (Pobal)

It should be noted that there are further small areas designated as very disadvantaged within 1km of the proposed station that will benefit from this scheme, however specific

[36]The POBAL HP Deprivation Index measures relative affluence or disadvantage of geographical areas using data compiled from the previous three censuses. Source: https://maps.pobal.ie/WebApps/DeprivationIndices/index.html

analysis of the station catchment was limited to 500m as this area had greater consistency in land use and population density.

7.7 Community impacts

7.7.1 Remote work

The COVID-19 pandemic has accelerated trends towards more flexible working arrangements being offered to higher-salary workers with offices in the city centre, with many of these flexible working arrangements expected to remain after government restrictions ease. Research has shown that workers with the ability to work from home are more willing to locate further away from their office.[37] It can be expected that the rail line would encourage workers with flexible work arrangements to move to Navan, facilitating economic growth and industry diversification.

The implementation of the Digital Strategy for Meath – A Connected County and the government's National Remote Work Strategy (Making Remote Work, January 2021) both include provision for the development of additional remote working/digital hubs in smaller towns and rural areas. These hubs in Meath may cater for local workers or reverse-flow workers and firms looking to avail of more cost competitive offices/workspaces. A rail connection between these hubs and Dublin makes them more attractive, both for reverse-flow workers/firms as well as workers/firms based in Meath looking for easy access to meetings and business in Dublin.

7.7.2 Wellbeing

It can be expected that lower stress associated with taking rail over driving during one's daily commute will increase wellbeing for the eight thousand commuters[38] that work (76%) and study (23%) in Dublin city centre and live in Meath. A 2021 survey[39] found that the majority of residents and businesses in Meath were not satisfied with the public transport

[37] https://link.springer.com/article/10.1007/s00168-018-0873-6
[38] CSO POWSCAR, 2016
[39] Behaviour & Attitudes Residential and Business Surveys for Meath County Council (March 2021)

connections with Dublin or the commuting experience to work, school or college. In this survey, 72% of residents responded that a Navan rail link would make a ***"great deal of difference to their lives"***, and 69% of respondents indicated they would be very likely to switch from commuting by car to commuting by rail if there were good parking facilities close to the new stations. More detailed results of this survey are shown in Figure 7-10 and Figure 7-11 below.

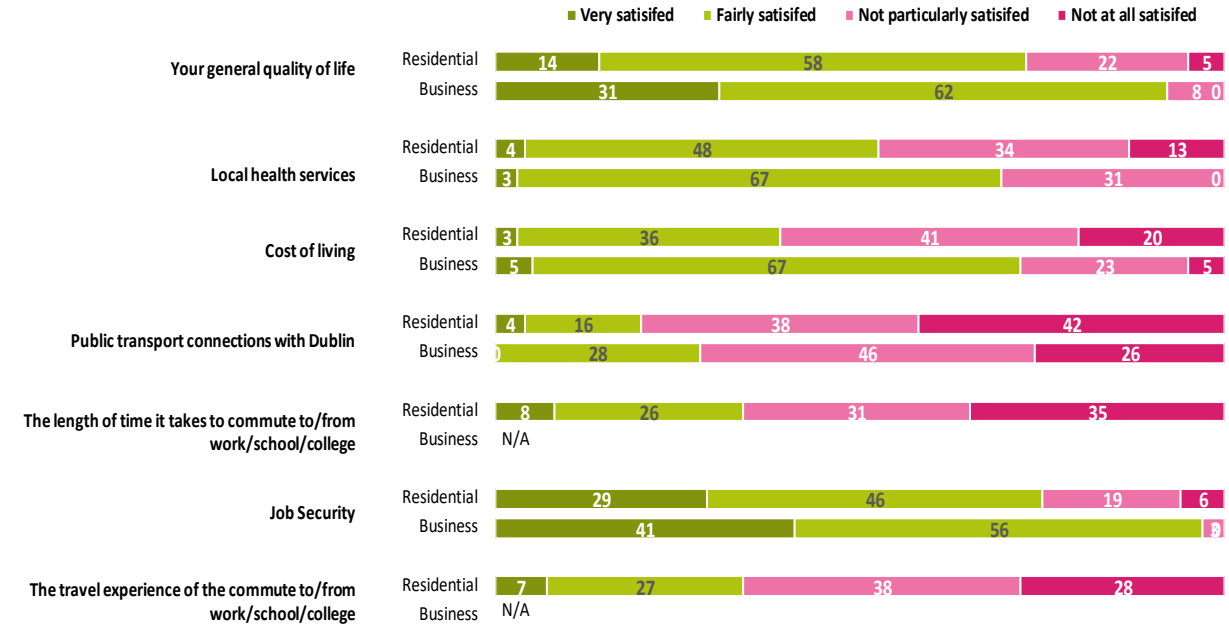


Figure 7-10 Level of satisfaction with key issues among residents and businesses in County Meath (Behaviour & Attitudes Residential and Business Surveys for Meath County Council – March 2021)

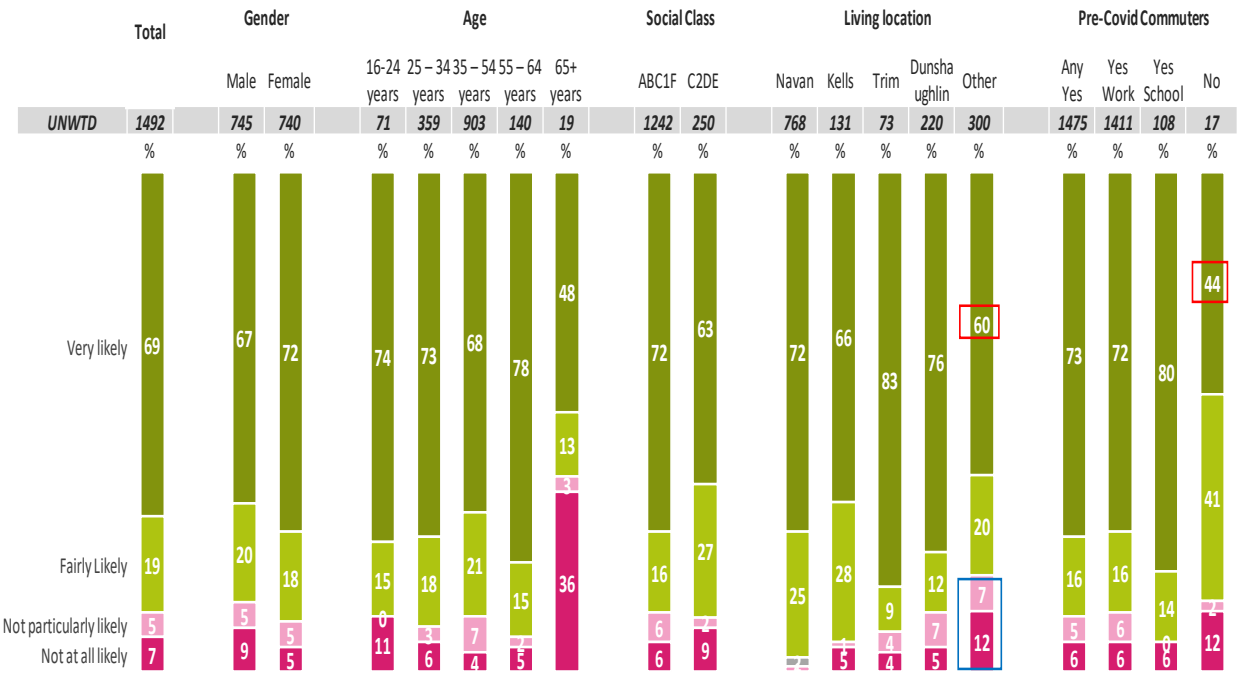


Figure 7-11 Likelihood of switching from commuting by car to the new rail line if there were good parking facilities close to the new stations (Behaviours & Attitudes Residential and Business Surveys for Meath County Council – March 2021)

A 2018 survey of commuters in Wicklow found that those that travelled by train or DART were happier with their commute than road users (car or bus) despite having longer average journey distances.[40] Taking the train can allow these commuters more energy and desire to participate in more activities outside of work/commuting, contributing to their own health and wellbeing as well as the health and wellbeing of the community.

Urbanisation is considered a primary instrument in the generation of economic growth and higher living standards, and improved accessibility of more rural areas to urban ones provides increased opportunities for social engagement. This allows rural residents to "borrow" positive effects of larger cities (access to cultural, economic and recreation activities) while being relatively insulated from the negative effects of living in large cities.[41] To this end, the connection this rail line would facilitate can be expected to improve the wellbeing of residents through their improved connection with Dublin.

[40] https://www.wicklow.ie/Portals/0/Documents/Business/Business-Environment/Wicklow-Facts-Figures/Commuter%20Study%20Report.pdf
41 https://worldhappiness.report/ed/2020/urban-rural-happiness-differentials-across-the-world/

Case Study: Borders Railway in Scotland

The Borders Railway is a rail line that opened in late 2015, connecting Edinburgh and the Midlothian and Borders regions of Scotland. The line mostly follows a pre-existing rail line that was closed in 1969 and is 56km long with 10 stations.

Figure 7-12 Borders Railway Extents (ScotRail)

This is comparable to the existing railway line from Dublin city centre to M3 Parkway (approximately 20km and 11 stations) and its proposed extension to Navan (an additional 34km and 4 new stations). Combined, the Dublin-Navan railway line will have a total length of approximately 54 km with 15 stations. The Borders line is mostly single-track, with half-hourly rail services Monday-Saturday. An evaluation was carried out on the railway in 2017, one year after opening. The evaluation found that the railway succeeded in facilitating a significant mode shift, as 57% of users who previously made their trip by another mode drove, and 29% of users who previously made their trip by another mode went by bus. The evaluation also found that the Midlothian and Borders regions saw an 8% increase in tourism employment and a 20% rise in visitor spend on food/drink, while the number of visitor days in hotels and bed and breakfasts increased between 12.3% and 27%. The railway also had an impact on employment and residential choices as over 50% of users who had moved to a new house and over 80% of users who had moved employment since the line opened stated the railway was a factor in their decision. A two year evaluation had similar findings.

8. Demand analysis

8.1 Introduction

The NTA's Eastern Regional Model (ERM) has been used to determine the level of transport demand for the three options considered. The ERM includes all modes of personal and goods vehicles, including private vehicles (taxis and cars), public transport (bus, rail, Luas, and Metro), walking and cycling, and heavy vehicles.

The NTA's ERM is a multi-modal model and consists of four input elements, including a Public Transport (PT) Model, a Walking and Cycling Model, a Highway Model and a Demand Model.

The ERM is used to assess the impact of interventions on people's travel choices in relation to time of travel, mode of travel and route of travel. In the context of the Navan Rail Line assessment, the ERM will provide information on the total *generalised cost*[42] of travel for all trips in the eastern region both with and without each of the options assessed.

The outputs from the ERM modelling are then fed into the economic appraisal and allow the impacts of the project to be quantified and monetised.

8.2 Modelling assumptions

A key input to the modelling of options is the assumptions regarding population projections. Planning sheets containing population and employment assumptions (as described in Section 10) for 2030, 2040 and 2070 were provided by the NTA and were used to derive 2030 NTA Growth and 2045 NTA Growth demand (by interpolating in a straight line between 2040 and 2070). Additional planning sheets containing adjusted population and employment growth within the Meath County Council (MCC) area for 2040 and 2070 were provided to reflect MCC's growth aspirations, from which 2045 MCC Growth demand was derived (by interpolating in a straight line between 2040 and 2070).

[42] Generalised cost is a concept that encompasses the total time and expense of a trip, including time travelling to and from the station, travel time, waiting times, fares, parking charges, tolls and fuel (for car trips). Time is converted to a monetary value using values of time which are defined by the Department of Transport and which vary for different types of trip.

Table 8-1 summarises the 2045 Meath population and employment projections used in the modelling.

Table 8-1 2045 projections used in modelling (based on 2040 and 2070 data)

	Pop 2045	Jobs 2045
NTA	251,236	52,391
MCC (ESRI)	261,449	52,919

8.3 Modelling outputs

A summary of the key modelling outputs is presented below with supporting details provided in Appendix B.

8.3.1 Boardings

The analysis shows a significant increase in scheme demand in 2045 relative to 2030. Analysis of future boardings for the line show that Option A and Option B perform similarly between 2030 and 2045 with total boarders increasing from circa 1 million in 2030 to between 1.6 and 1.9 million for Option A and Option B respectively by 2045.

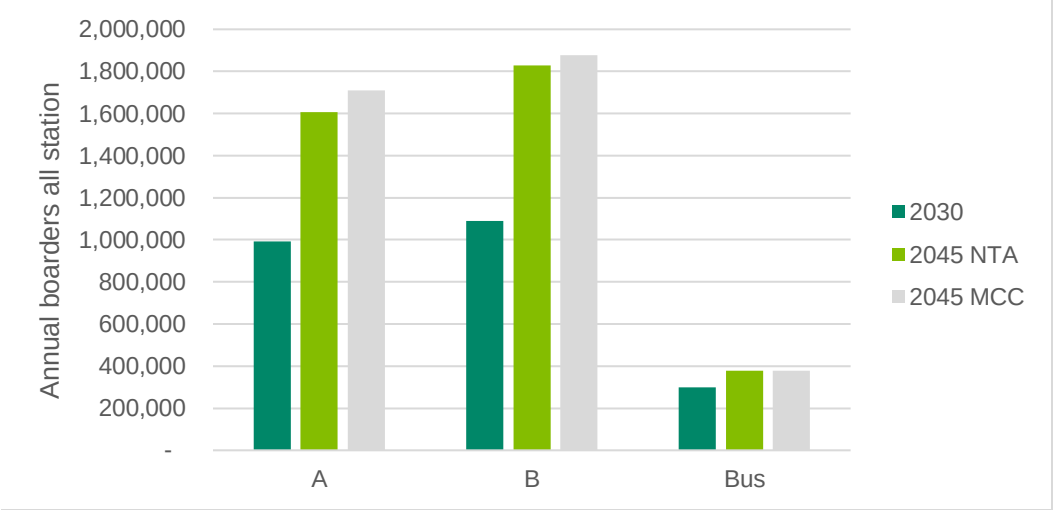


Figure 8-1 Annual weekday boarders, all stations, Navan Extension

Table 8-2 2045 NTA growth AM peak southbound demand, Navan extension

	Option A			Option B			Option C (Bus-Based Alternative)		
	Boarders	Alighters	Load	Boarders	Alighters	Load	Boarders	Alighters	Load
Navan North	945	0	945	933	0	933	91	0	91
Navan Central	624	27	1,542	590	27	1,496	96	41	145
Kilmessan	62	1	1,603	58	1	1,554	11	1	155
Dunshaughlin West	63	2	1,664	n/a	n/a	n/a	n/a	n/a	n/a
Dunshaughlin North	n/a	n/a	n/a	333	11	1,875	153	17	291

It is evident that in Option B there are a reduced number of boarders between Navan North and Kilmessan compared to Option A. This is due to the longer run time to M3 Parkway associated with Option B and due to the higher crowding along Option B which results from the higher demand on the extension as a whole (when taking into account demand boarding at Dunshaughlin).The higher boarders at Dunshaughlin in Option B compared to Option A result from the more accessible location of the station, closer to the town centre.

It can also be seen that the Bus-Based Alternative (Option C) has significantly lower levels of demand relative to rail options due to longer run times and different network coverage. These factors outweigh the effects of the higher frequency provided by the bus option.

8.3.2 Mode share

The project has a limited impact on mode share at this model-wide level of aggregation showing only a small increase in public transport mode share (circa 0.1%) in some cases.

However, when considered at a Meath County level, the rail options show significant increases (as illustrated inTable 8-2) in public transport mode share in the vicinity of the stations at Dunshaughlin, Kilmessan and Navan, with this impact reducing further away from the stations.

The bus alternative exhibits similar effects to the rail options although to a noticeably smaller extent; the increases in public transport mode share in the vicinity of the stops at Dunshaughlin, Kilmessan and Navan are lower than in the rail options.

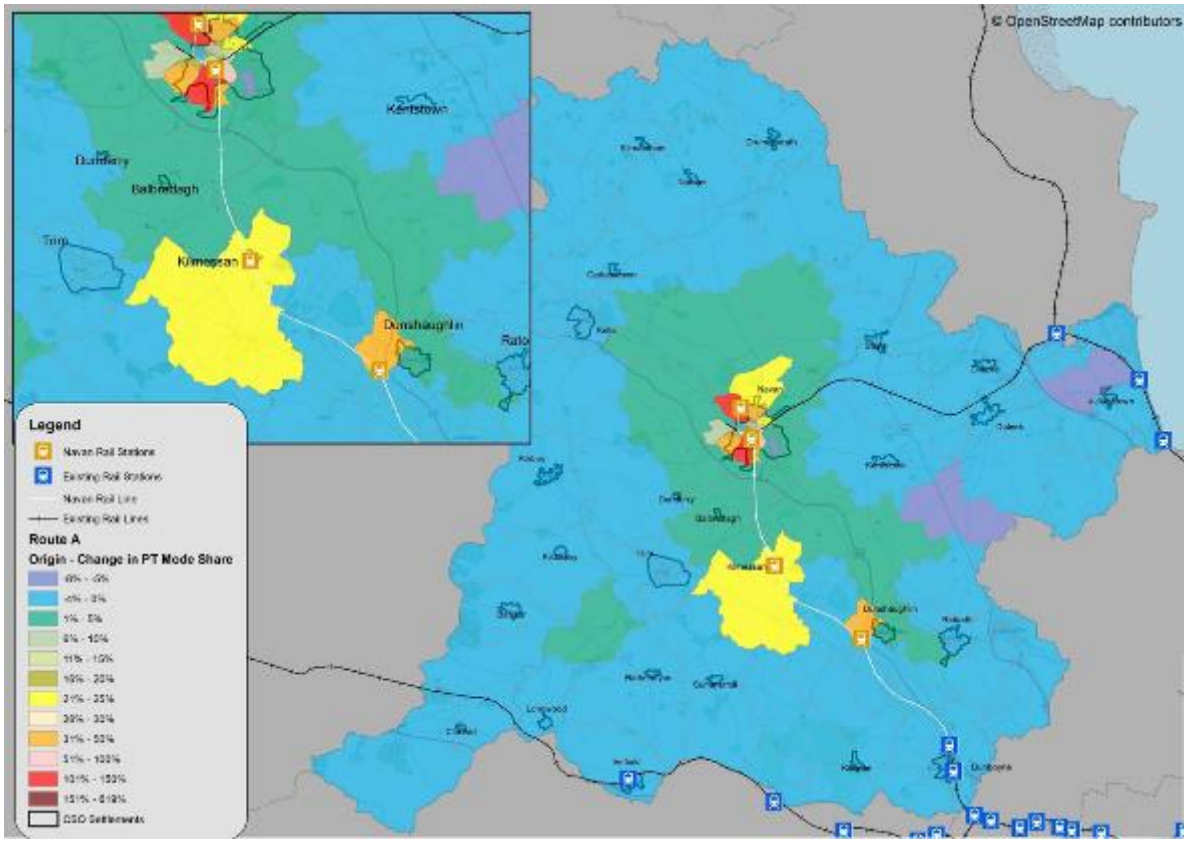


Figure 8-2 Change in 2030 public transport mode share by ERM zone, Option A vs Do-Minimum, origin trips

8.3.3 Time savings

For existing trips, i.e. trips whose origin and destination remain the same between the Do-Minimum and Do-Something scenarios, Option A has the highest impact in 2030, bringing about a reduction in travel time of 5 minutes in the AM Peak and 3.5 minutes on average throughout the day. Option B has a marginally smaller impact than Option A, whereas the Bus-Based Alternative (Option C) shows negligible change in travel times over the Do-Minimum.

By 2045 these time savings have increased marginally over the 2030 savings.

8.4 Conclusion

The demand analysis has shown that both rail options, Option A and Option B, perform similarly in terms of their impact on increasing public transport mode share and improving

travel times to and from the Meath area, although it should be noted that Option A provides a marginally better improvement in travel times.

Where the two rail options differ is in their impact on patronage attracted to the rail extension itself. Whereas more demand is attracted to Option A at the Navan stations due to shorter run times to M3 Parkway and lower crowding (due to less demand attracted at Dunshaughlin), Option B attracts significantly higher demand at Dunshaughlin due to the more accessible station location. Option B also attracts more demand to the extension as a whole compared to Option A.

It is also evident that the Bus-Based Alternative (Option C) performs significantly less well than the rail options in terms of change in public transport mode share, travel time improvement and scheme patronage.

9. Route validation

9.1 Introduction

A validation of the two rail alignment options (Option A and Option B) has been undertaken. Option A is described in the 2011 draft Railway Order (RO) documentation, the 2011 Environmental Impact Statement (EIS)[43] and the 2009 Feasibility Study[44] provided by the NTA, while Option B has been defined in only the 2009 Feasibility Study.

The scope of this validation exercise was to:

- Validate that the route identified in the draft RO prepared by Iarnród Éireann Irish Rail (IÉ) in 2011 remains available for construction and has not been compromised during the intervening period.
- Confirm, having regards to any developments or matters arising in the intervening period, that the alignment and station arrangements set out in the 2011 draft RO remains a reasonable representation of the optimum route/scheme for a rail link to Navan.
- Identify potential constraints which would need further consideration as the project develops.

This review has been carried out to consider the environmental, planning and build constraints which could impact the delivery of Option A and Option B. Potential planning and build constraints have been identified from a desktop review of mapping and publicly available planning history data from MyPlan.ie.

9.2 Route protection

The draft Meath Development Plan referenced in Section 6.10 includes ***"a strong policy stance to ensure that the detailed designed alignment is protected from further***

[43] Navan Rail Line, Environmental Impact Study, ROD, 2011
[44] Navan Railway Line Feasibility Study 2008/09, Roughan & O'Donovan Faber Maunsell

development and that this protection also extends to potential stations and park and ride sites along the route".

Consequently, a specific zoning objective R1 Rail Corridor ***"to provide for a strategic rail corridor and associated physical infrastructure"***, identified in Figure 9-1 below, will be reserved from development. Furthermore MOV OBJ 3 (a) aims ***"to protect and safeguard the detailed designed alignment of Phase II of the Navan Rail route and surrounding lands (including identified station locations), as illustrated on Map Series No. 5.1 in Volume 4, free from development and any encroachment by inappropriate uses which could compromise its future development as a rail facility."*** It is notable that the route shown in the development plan is that for Option A.

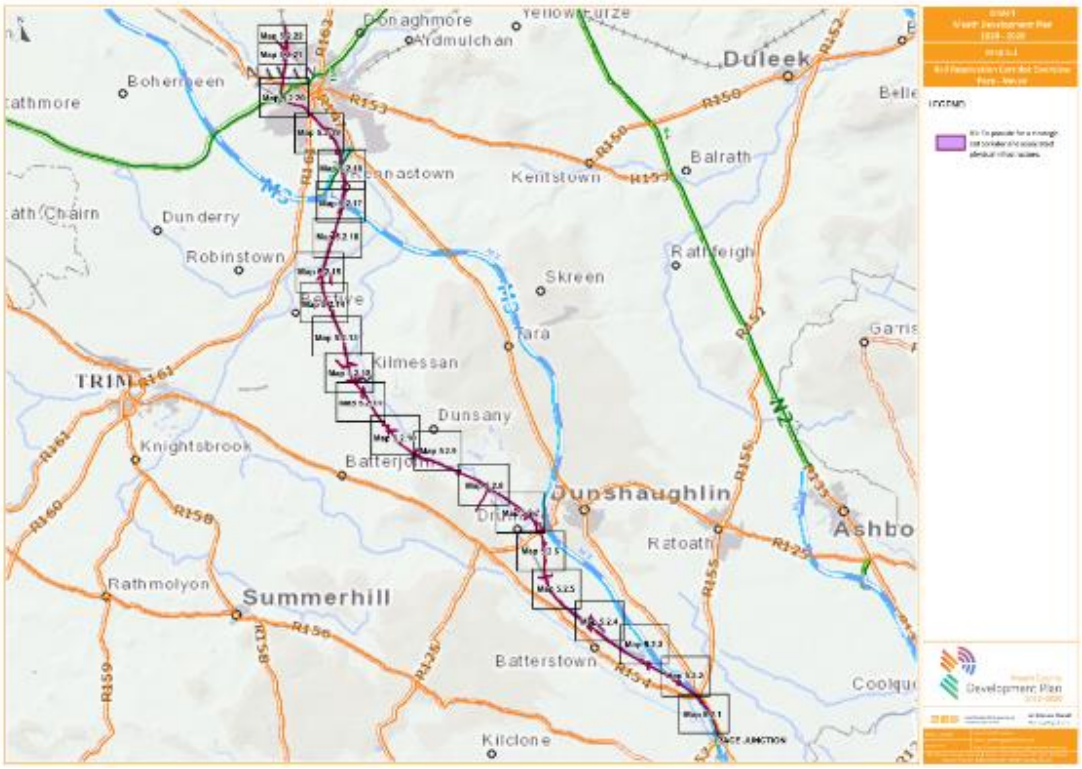


Figure 9-1 Meath County Council Draft County Development Plan Map 5.1 Reservation Corridor Pace to Navan

9.3 Additional environmental constraints

The environmental constraints highlighted in the 2011 EIS have changed over the last ten years with regards to biodiversity, flood risk and landscape and visual (for example), as summarised below. The legislative framework governing environmental assessment has

also evolved over time as described in Section 7.5. Therefore, to verify the railway line route fully, and if the project were to proceed, a new EIAR (Environmental Impact Assessment Report), AA (Appropriate Assessment) screening and NIS (Natura Impact Assessment) prepared in accordance with current legislation, policy and standards would need to be carried out.

9.3.1 Biodiversity

In 2011 it was noted that the proposed railway line traversed a candidate SAC and a candidate SPA, resulting in the completion of AA screening and NIS. The River Boyne and River Blackwater is now a full SAC and a number of other SPAs and SACs in the vicinity of the railway route have been noted in Table 9-1.

Table 9-1 Designated sites in proximity to the Navan railway line route

Site Location	Site Code	Proximity to Proposed Development
Special Protection Area (SPA)		
River Boyne and River Blackwater SPA	004232	Transverses Proposed Development
Lough Sheelin SPA	004065	
Boyne Estuary SPA	004080	
River Nanny Estuary and Shore SPA	004158	
Special Area of Conservation (SAC)		
River Boyne and River Blackwater SAC	002299	Transverses Proposed Development
Moneybeg and Clareisland Bogs SAC	002340	
Killyconny Bog (Cloghbally) SAC	000006	
Boyne Coast and Estuary SAC	001957	
Rye Water Valley/Carton SAC	001398	
Mount Hevey Bog SAC	002342	
Girley (Drewstown) Bog SAC	002203	
Lough Bane and Lough Glass SAC	002120	
White Lough, Ben Loughs and Lough Doo SAC	001810	

Source: National Parks & Wildlife Service – 18/02/2021

9.3.2 Flood risk

As detailed in the draft County Development Plan, in response to EU Flood Directive, Meath and Fingal County Councils and the Office of Public Works (OPW) completed the

Fingal East Meath Flood Risk Assessment and Management Study (FEMFRAMS) in 2012, a catchment-based flood risk assessment and management study of 19 rivers and streams in the Fingal and East Meath area. Subsequently, the OPW began a national programme of river catchment-based Flood Risk Assessment and Management. The Catchment Flood Risk Assessment and Management Studies (CFRAMS) has been completed on river catchments of all key watercourses and been included within a review of the FEMFRAMS.

This information is directly relevant to hydrology considerations in an EIAR.

Figure 9-2 displays SAC/SPA, Strategic Flood Risk assessment – flood Zone A and B and National Inventory of Architectural Heritage in proximity to the railway route.

9.3.3 Landscape and visual

The draft Meath County development Map 8.6 (Figure 9-3) identified views and prospects associated with Objective HER OBJ 55, which aims to preserve the views and prospects from development which would interfere unduly with the character and visual amenity of the landscape. The impact of the proposed railway line development on these views would need to be assessed.

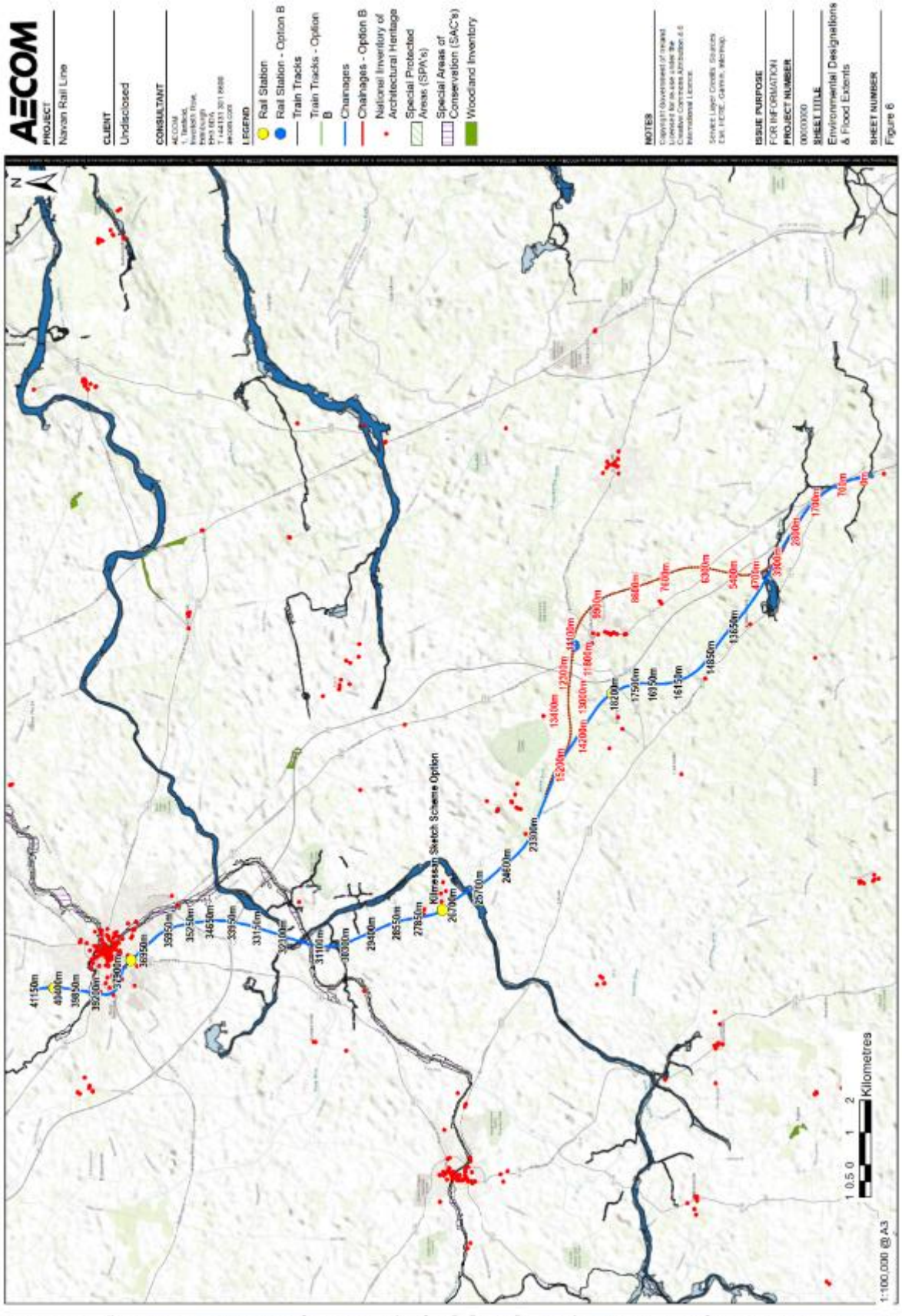


Figure 9-2 Railway line route and environmental designation and constraints identified

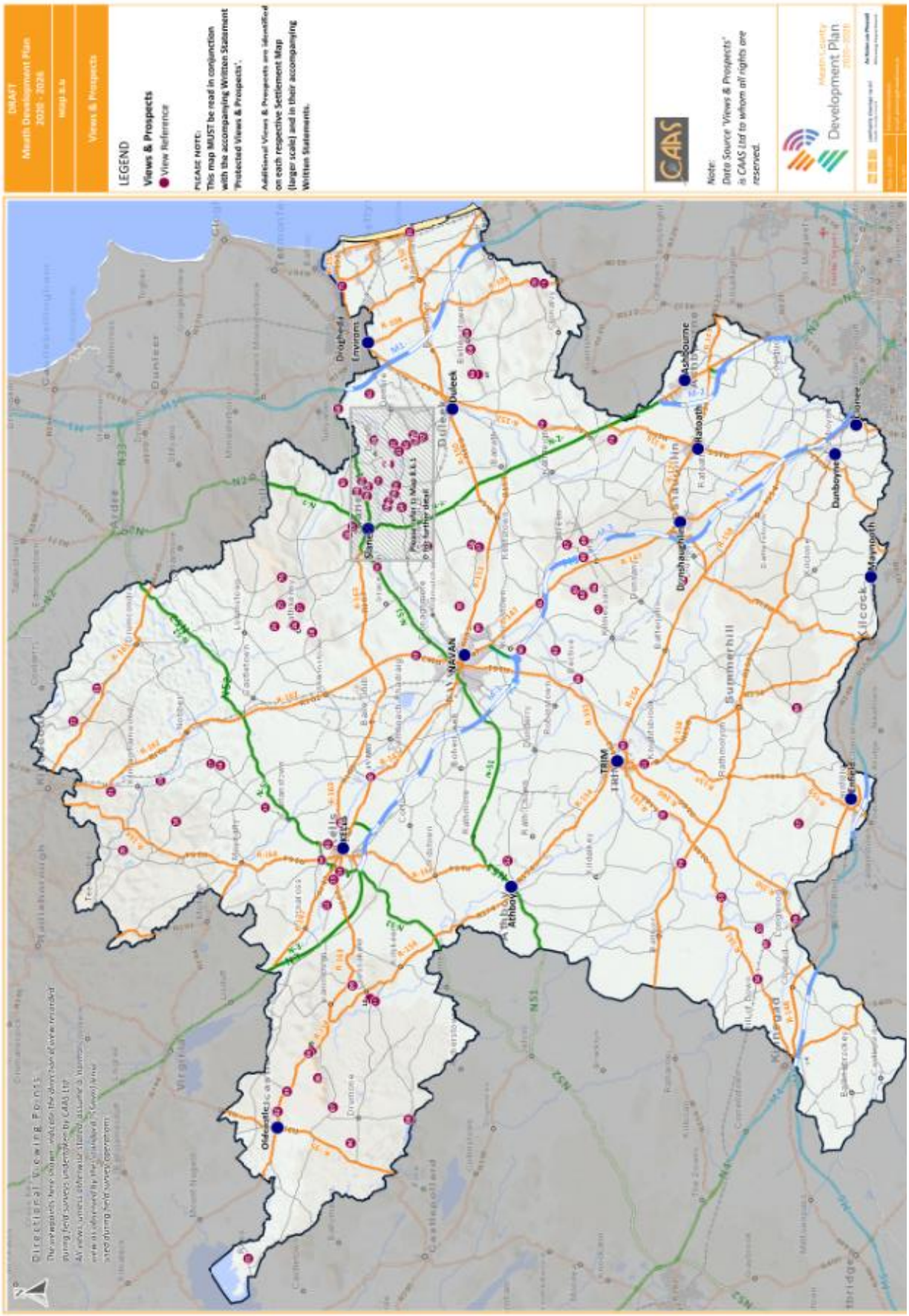


Figure 9-3 Meath County Council Draft County Development Plan Map 8.6 Views and Prospects

9.4 Development constraints

AECOM has carried out a desktop assessment and planning history search utilising publicly available data from MyPlan.ie and the Department of Housing, Local Government and Heritage's (DHLGH) Environmental Impact Assessment (EIA) Portal dating back to 2012. This search included a review of all valid planning (withdrawn and invalid applications were not included) applications within 250m of the proposed alignments and within 1km of potential new stations.

Additionally, a review of the permanent and temporary construction works required along each of the alignments has been carried out to highlight sections of the railway corridor where potential constraints exist. The aim of this validation exercise was to highlight aspects of the proposed design which could potentially need to be reconsidered in light of developments which have taken place or have been granted planning permission since 2011.

This assessment has identified constraints for both Option A and Option B.

9.4.1 Option A constraints

Considering that the proposed rail alignment for Option A has been protected from development, it is unlikely that any major development has occurred which would impact the proposed route. This validation exercise has confirmed this to be the case with the majority of sites required to undertake the construction of the scheme, as presented in the draft 2011 RO, being still available for construction.

However, this validation of permanent and temporary construction works has identified some issues which should be considered further as the project progresses and as detailed designs are advanced. These issues are additional to those identified in the draft 2011 EIS which had been mitigated in the draft 2011 RO designs. The most significant of these constraints are outlined below with further details of all site constraints for Option A being detailed in Appendix A.

Agricultural buildings

At chainage 12,450m, a 70m long farm shed extension on the former rail formation will need to be acquired along with the main shed directly impacted by the mainline works.

Additionally, between chainages 31,200m and 31,250m, agricultural buildings have partially encroached on the route corridor as shown in Figure 9-4 below.

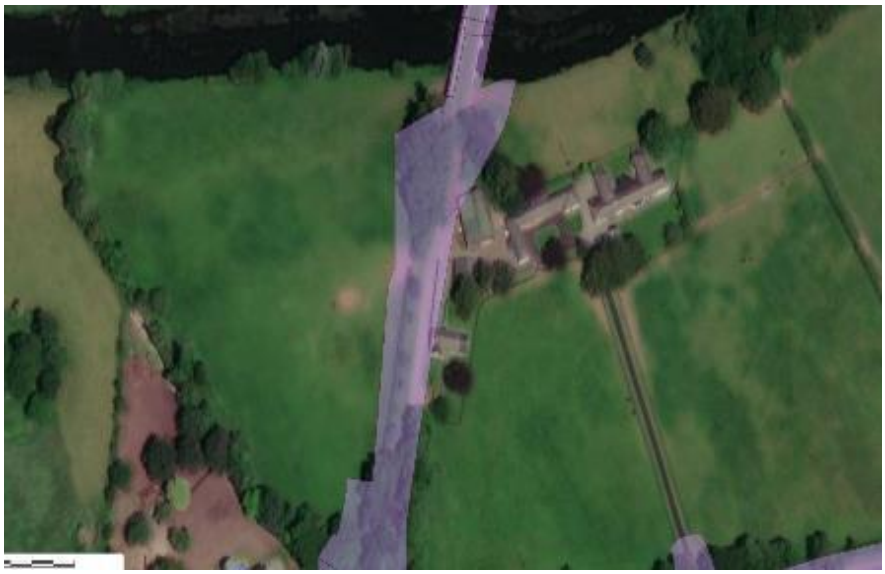


Figure 9-4 Agricultural buildings along Option A (chainage 31,200m)

New dwellings

At chainage 13,700m, planning permission has been granted for a new dwelling which will be impacted by the southern approach of the realigned L2209 overbridge, shown in Figure 9-5 below.

Figure 9-5 New dwelling planning permission along Option A (chainage 13,700m)

Between chainages 31,000m and 31,100m, a new dwelling was constructed adjacent to the route corridor, and an additional dwelling to the southeast is located directly under the route corridor, as shown in Figure 9-6.

Figure 9-6 New dwellings along Option A (chainage 31,000m)

Gas main

At chainage 19,420m, the route clashes with an existing 750mm diameter 85 bar gas main. At this location, the 2011 RO drawings will need to be updated to reflect a proposal to divert the gas main locally and provide sufficient clearance and protection under the proposed railway, which is in a slight cutting.

Sewer diversion

Beginning at chainage 22,350m, the Option 2 Skane Valley Sewer diversion proposal has been adopted to divert the existing 450/600mm diameter foul sewer to minimise impact on mature trees on the edge of Dunsany Wood. From chainage 22,350m, the sewer is diverted on a slight embankment alongside the north side of railway before crossing to the south side of the railway into a field to avoid Dunsany Wood at chainage 22,900m.

Telecommunications mast

North of chainage 26,400m, a telecommunications structure has been built adjacent to Option A, despite being refused permission by Meath County Council in 2017. This site has been referred to Meath County Council to confirm that permission was not granted for this structure.

Figure 9-7 Telecommunications structure built adjacent to Option A (chainage 26,400m)

Beaufort college

At chainage 37,000m, Meath VEC Beaufort College has been extended. There is potential impact on the new building and new all-weather pitch, which are located in close proximity to the mainline, which is in a slight cutting. This section is to be reviewed.

Figure 9-8 Meath VEC Beaufort College extents (chainage 37,000m)

Additionally, this assessment has identified a number of properties which will be impacted by the construction of the draft 2011 RO preferred rail alignment, but which are not included in the draft RO land take listings.

While these properties may be part of the arable lands along the route, the detailed information is not currently available. Considering the draft nature of the RO, this is not surprising.

In summary, while a small number of new constraints to construction have been identified, the review of the permanent and temporary construction works has shown that those identified in the draft 2011 RO and EIS as generally still available for construction.

9.4.2 Option B constraints

Option B has been reviewed via a desktop study based on the 2009 Navan Rail Line Feasibility Study, current aerial mapping, publicly available planning history data and planned infrastructure schemes. The available information and level of detail presented in the 2009 Feasibility Study is not as fully developed as the draft 2011 RO and EIS documentation.

Unlike Option A, which as been protected from development by Meath County Council, the Option B corridor has not been protected and as such it is evident that a number of sites along the alignment have been impacted by development over the last decade.

Sites of high significance are noted below, while a complete list of potential build constraints are included in Appendix A

Rathbeggan Lakes water leisure facility

At chainage 4,300m, the route crosses the corner of a former quarry on a 9-10m embankment which is now a public amenity – Rathbeggan Lakes water leisure facility.

Figure 9-9 Rathbeggan Lakes water leisure facility (chainage 4,300m)

New developments

At chainage 7,900m, existing horse training stables are significantly severed by the route crossing the site diagonally on a slight embankment. A new building constructed on the route now adds to the potential major impacts on this particular site.

Figure 9-10 Severance of existing horse stables (chainage 7,900m)

At chainage 12,900, there are a number of plots of land acquired for the proposed crossing of the L2208 overbridge. Since the 2009 Feasibility Study, three new residential dwellings have been constructed where the overbridge is proposed.

Figure 9-11 Extents of three new dwellings (chainage 12,900m)

Sewer diversion

Between approximate chainages 16,000m and 17,000m, Option B will run along more of the former railway formation, so a longer section of the existing Skane Valley Sewer running along the former rail formation will need to be diverted as described for Option A.

In summary, this assessment has identified a number of new additional developments which will be impacted by the construction of the alternative Option B as presented in the 2009 Feasibility Study's report. As for Option A, there will be large areas of arable lands and a number of associated properties affected or severed by the proposed railway.

While a small number of new constraints to construction have been identified, the review of the construction works has shown that those lands identified in the 2009 Feasibility Study are generally still available for construction.

9.5 Conclusion

The lands required for Option A have been protected by Meath County Council, however those for Option B have not. Consequently, constraints on the land within Option B are more likely to have occurred and/or will occur in the future.

Following a review of planning application history, the 2011 RO, the 2011 EIS, the 2011 NIS and the 2009 Feasibility Study, this has been confirmed to be the case. Option A and Option B both have new constraints to construction since the 2011 RO, however Option A continues to be the preferred option, as it has been protected by Meath County Council and therefore has been less affected by new development over the last decade.

The environmental constraints, issues and designation noted in the 2011 EIS have altered, as noted previously, in relation to biodiversity, flood risk and landscape and visual to select a few. There are also topics that have not been considered previously, including climate change, population and human health and major accidents and disasters. Changes in the baseline assessment, legislation framework and assessment criteria of other EIS technical chapters in the 2011 documentation can also be expected due to the passage of time. Numerous challenges have been taken in the courts on linear infrastructure projects based on the robustness of their alternatives process, thus assuming without revisiting these options that the current alignment is still "fit for purpose" would be grounds for a future challenge against the scheme.

Therefore, to verify the railway line route fully, and if the project were to proceed, a new EIAR, AA screening and a NIS prepared in accordance with current legislation, policy and

standards would need to be produced to adequately consider the environmental impact of the railway line's development.

10. Population and employment projections

Population projections for County Meath are required for transport modelling of the proposed railway alignment options. Population projections for the county were independently calculated by both the NTA (based on the National Planning Framework developed from RSES and NDP projections) and Meath County Council (based on work done by the Economic and Social Research Institute (ESRI)) up to the year 2040. The two projections differ slightly in year-on-year growth, which results in significant differences when projected out to 2070 for use in the appraisal period. These projections were disaggregated to 15 settlements across Meath, with the remainder of the population being attributed to the Meath Rural Area. This disaggregation process was carried out by Meath County Council and has been agreed by both Meath County Council and the NTA. Both projections are based on a verified background methodology, so both projections have been separately used in the transport modelling process of the project.

10.1 Projections up to 2040

Both the NTA and Meath County Council (MCC) obtained their 2016 population figure from the Census 2016 results. The NTA's figures up to 2040 are based on the National Planning Framework (NPF) Implementation Roadmap High Population Figure, while MCC's figures up to 2040 are based on independent internal methods. The growth rates of these figures result in a CAGR (compound average growth rate) of 1.26% from 2016 – 2026 and 1.15% between 2016 and 2031. The NTA population figure of 242,314 (in 2040) was calculated by assigning a proportion of the NPF 2040 population for EMRA (2,865,517) to Meath. The MCC population figure of 250,000 (in 2040) was calculated using independent methods and published in the 'Regional Demographics and Structural Housing Demand at County Level' report prepared in a partnership between the ESRI and the Department of Housing, Local Government and Heritage (DHLGH).

10.2 Between 2040 and 2070

The Straight-Line method was used to extrapolate the 2070 population and employment projections based on the 2016 and 2040 figures provided by MCC. The NTA figures were calculated by taking a percentage of the extrapolated population growth before

consolidating development in urban areas at a national level. As a result, the 2070 NTA projections are marginally lower than the MCC projections, as shown in Table 10-1 and in Figure 10-1 below. The NTA projection of 295,847 represents a 51.7% increase from 2016, while the MCC projection of 318,695 represents a 63.4% increase from 2016. In total, the difference between projected population growth (2016 – 2070) between the NTA (295,847) and the MCC (318,695) is 22,848 or 11.7%.

Table 10-1 Population growth in NTA and MCC scenarios

Growth Scenario	Pop. 2016	Pop. 2026	Pop. 2031	Pop. 2040	Ann. Growth 2016-2040	Pop. 2070	Pop. Increase 2016-2070	% Pop. Increase 2016-2070
NTA	195,044	221,000	231,500	242,314	1,970	295,847	100,803	51.7%
MCC	195,044	220,200	230,500	250,000	2,290	318,695	123,651	63.4%

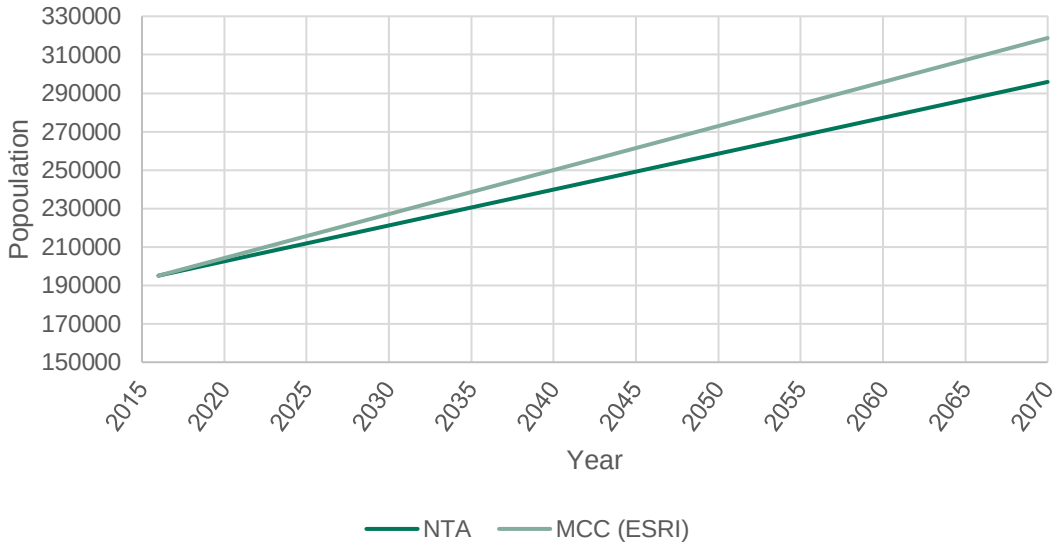


Figure 10-1 Meath Population Projections 2016 - 2070

10.3 Meath jobs projection

The NTA have provided a 2040 jobs projection of 49,992 for Meath (excluding people working from home). This figure is based on a proportion (48%) of a final NPF 2040 total employment figure for Meath of 105,189. In late 2020, following a request by the NTA, Meath County Council undertook an assessment of the employment growth rates for

each settlement within the county. This resulted in a projected 2040 jobs figure of 59,371 for the county. Although these two figures differ slightly, the 59,371 figure has been agreed with the NTA while for the purpose of employment projections, the more conservative 49,992 was employed in the analysis. To project this figure forward to 2070, the jobs-to-population ratio was applied. Assuming a steady jobs-to-population ratio, it can be assumed that the number of jobs will grow to 67,555 by 2070. This is shown in the table below.

Table 10-2 Employment growth using ESRI population growth

Statistic	2016	2040	2070	Change in Jobs (2016-2070)
Meath Pop.	195,044	250,000	318,695	
Meath Jobs	37,225	49,992	67,555	30,330
Jobs/Pop. Ratio	0.19	0.20	0.212	

It is important to note that the employment projections shown above are based on the 37,225 figure in 2016, which excludes people working from home. This is relevant to transport modelling but is not necessarily indicative of employment in the county as a whole.

11. Cost forecasts

11.1 Rail infrastructure capital costs

Capital cost forecasts for the project have been developed by AECOM[45] based on the designs provided and included within the 2011 draft Railway Order and the 2009 Feasibility Study[46]. These costs have been developed using a bottom-up approach utilising rates from other comparable rail infrastructure projects.

The capital cost ranges (excl. VAT) for the project have been estimated as between €777m and €1,122m for Option A and between €990 and €1,431m for Option B, as shown in Table 11-1 below.

Table 11-1 Summary of cost forecasts for Option A and Option B

Option A			
		COST (€ million)	**COST / km (€ million)**
Net, excl. VAT	**TOTAL**	863	25.2
30%	**High**	1,122	32.8
-10%	**Low**	777	22.7
Option B			
		COST (€ million)	**COST / km (€ million)**
Net, excl. VAT	**TOTAL**	1,100	31.7
30%	**High**	1,431	41.3
-10%	**Low**	990	28.6

The cost forecasts for Option A and Option B have been subjected to a review and third-party validation[47], and include land valuations provided separately by the NTA's advisers, Avison Young[48].

Based on the level of contingency and associated accuracy range, the cost forecasts are equivalent to a P50 confidence interval.

[45] OMC for Navan Rail Line, Route A and B, AECOM, 2021
[46] Navan Railway Line Feasibility Study 2008/09, Roughan & O'Donovan Faber Maunsell
[47] Order of Cost Estimate Peer Review, Navan Rail Project, ChandlerKBS, 2021
[48] Navan Rail Link, Report & Estimate, Avison Young, 2021

A summary of the costs for each alignment, split by discipline, contingency and escalation, is shown in Table 11-2. Full details of the cost forecasts prepared are contained in Appendix C.

Table 11-2 Capital costs (€m)

Year	Option A	Option B
Survey & Investigations	€3.07	€3.91
Planning, Design & EIS	€29.21	€37.25
Advance Works Contracts & Service Diversions	€14.31	€14.31
Building Works	€46.37	€44.72
Civil Engineering Works	€255.27	€369.15
Rail Electrification & Power Supply Works	€0.00	€0.00
Per- Way Works	€66.46	€66.66
Signalling, IE Electrical & Telecoms	€26.59	€26.59
Land & Property Costs	€69.00	€90.61
Legal Costs	€0.00	€0.00
Project/Construction Management & IE/CIE Costs	€38.44	€49.01
Infrastructure Protection Works	€0.00	€0.00
Other Costs	€0.00	€0.00
Works Cost Subtotal	**€548.72**	**€702.22**
Contingency	€191.89	€244.64
Escalation	€123.14	€153.94
Total (excluding VAT)	**€863.75**	**€1,100.80**
+30% upper limit	*€1,122.78*	*€1,431.04*
-10% lower limit	*€777.37*	*€990.71*

11.1.1 Phasing

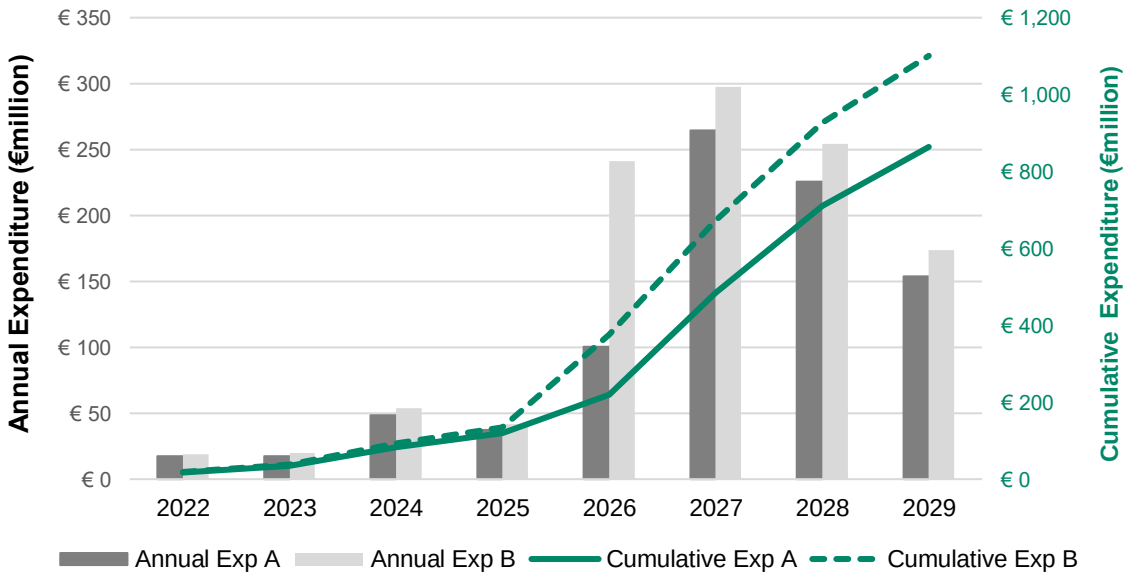
For the purpose of the financial and economic appraisals, it was necessary to develop a phasing profile. This indicative profile has been developed based on preliminary design and planning works commencing in 2022, followed by a four-year construction period beginning in 2026 and finishing in 2029. The distribution of costs over the planning, design

and delivery stages of the project are assumed as illustrated in Table 11-3 and Table 11-4 below.

Table 11-3 Capital costs annual distribution

Year	Option A - Phasing	Option B - Phasing
2022	2.0%	1.7%
2023	2.0%	1.8%
2024	5.6%	4.9%
2025	4.3%	3.8%
2026	11.6%	21.9%
2027	30.6%	27.0%
2028	26.1%	23.1%
2029	17.8%	15.8%
Total	100%	100%

Table 11-4 Capital cost phasing profile



11.1.2 Contingency

The estimate has been developed based on the information available at this early stage of the project. However, acknowledging that the alignment has undergone significant

design work previously, the level of contingency incorporated within the cost forecasts is lower than would have normally been the case. For both rail alignment options, a contingency of 40% has been included.

This allowance covers contingency, risk and optimism bias and is a top down assessment based on our historical knowledge and understanding of the required level of contingency on this project, taking into consideration the level of project definition, the anticipated procurement strategy and construction phasing/programme. It additionally includes our assessment of the construction cost, including direct and indirect contractor overheads and profit.

11.1.3 Escalation

The escalation allowance included within the cost forecast assumes a four-year construction period commencing in January 2026 and ending in December 2029. The compounded annual escalation forecast applied to the construction costs is 18.34%. The assumed annual escalation percentage uplifts are as given in Table 11-5.

Table 11-5 Assumed escalation profile

Year	% Annual Uplift
2022	4%
2023	3%
2024 to 2029	2.5%

11.2 Cost benchmarking and validation

As part of developing the capital cost forecasts, AECOM benchmarked and referenced unit costs from other relevant rail-based projects on which they are currently providing input, such as DART+, Woodbrook DART station and Luas. AECOM also undertook a high-level cost/km assessment of other completed projects, the most relevant being the 7.5km heavy rail extension to M3 Parkway from the junction west of Clonsilla (Dunboyne line) completed in 2010. After adjusting for inflation/cost escalation using Society of Chartered Surveyors Ireland (SCSI) tender price index, the cost per km for this reference project is €24.9 million in current year costs and €29.5 million including escalation of 18.34%.

The capital cost forecasts were also validated by ChandlerKBS, who were commissioned by the NTA to undertake an independent review. This review consisted of the following aspects of the cost plan.

- Structure and layout;
- Arithmetical accuracy;
- Allowances and quantities for direct costs;
- Adequacy of allowances for indirect costs;
- Validity of the rates and prices as tested through benchmarking, and;
- Suitability of contingency and inflation allowances.

ChandlerKBS found the cost estimates produced by AECOM to be comprehensive and sufficiently detailed to give confidence that allowance had been made for the key elements of work which they would expect to see. Their separate benchmarking exercise returned an order of magnitude cost that was within 4% of the AECOM cost forecast. This range was further reduced after holding a workshop to review and reconcile the ChandlerKBS comments/queries and they were satisfied that the cost forecast was within the anticipated range.

11.3 Rolling stock capital costs

From the assumed date of commencement of service in 2030 to approximately 2045 it is assumed that the services operating on the rail line to Navan will be diesel multiple units (DMUs). These vehicles will be cascaded from elsewhere within the Iarnród Éireann Irish Rail (IÉ) network and as such no investment in new rolling stock will be required at the outset.

However, the cascaded DMU vehicles will likely need to be removed from service and replaced from 2045 as they will be life-expired.

As part of the DART+ Programme, a number of battery electric multiple units (BEMUs) will be procured, with these being capable of operating on some of the route using battery power alone, without the requirement of constructing additional overhead electrification.

By 2045, following the implementation of the DART+ Programme, it is expected that the full extent of the DART network will have been electrified and that these BEMU rolling stock will be available for transfer to operate on the Navan Rail Line. However, as these BEMU vehicles will not have the capability to operate the return trip distance from M3 Parkway to Navan on battery power, additional charging infrastructure will need to be provided at Navan.

To capture this, the following assumptions have been made:

- From 2030 – 2045 the service would be operated using cascaded diesel fleet.
- From 2045 onwards the DART+ BEMU fleet would be cascaded to replace the DMU fleet. A cost of €12m has been included to provide the additional charging and battery capability on the rolling stock to cover the additional distance.

Post-2045 it is assumed that the service would be operated by cascaded BEMU fleet from the DART+ Programme's procurement. No initial costs have been assumed as this is also cascaded rolling stock, although an allowance for renewal costs have been included when this fleet reaches the end of its assumed asset life in 2060.

11.4 Rail service O&M costs

Train operating costs cover IÉ's Railway Undertaking's Chief Mechanical Engineer (CME) Department's costs and traction costs for both diesel and electric and drivers' hours. The cost forecasts are based upon information received from IÉ for the DART+ Preliminary Business Case as summarised in Table 11-6 and Table 11-7 below.

For Option A and Option B, the incremental cost has been based on the assumption that the DART+ Programme is a committed Do-Minimum scheme and the infrastructure and train service specification associated with the DART+ Programme will therefore be in place in the first year of operation of the Navan Rail Line when it begins operation in 2030. The DART+ Programme includes the electrification of the line to M3 Parkway and, as a result of this post implementation of the DART+ Programme, the services to and from M3 Parkway will be operated by electric multiple units (EMUs).

Prior to the cascade of the BEMU fleet in 2045, to enable through services from Docklands/Connolly to Navan, it will be necessary to use DMUs on the services which are extended to Navan. In line with the modelling assumptions, these costs are based on a 2 no. trains per hour (tph) service in both directions in the peak periods, reducing to 1 no. tph service in other periods.

Therefore pre-2045, the incremental costs capture the additional costs associated with the additional train kilometres between M3 Parkway and Navan and additional costs of operating DMUs on these selected services as opposed to EMUs between M3 Parkway and Connolly/Docklands.

Table 11-6 Option A: Incremental train operating costs (2019 Prices)

	Diesel Operation (€m per annum) Pre 2045	BEMU Operation (€m per annum) Post 2045
Traction	€ 1.54	€ 1.11
CME	€ 3.74	€ 1.52
Drivers Costs	€ 0.62	€ 0.62
Total	**€ 5.90**	**€ 3.26**

Table 11-7 Option B: Incremental train operating costs (2019 Prices)

	Diesel Operation (€m per annum) Pre 2045	BEMU Operation (€m per annum) Post 2045
Traction	€ 1.56	€ 1.13
CME	€ 3.78	€ 1.54
Drivers Costs	€ 0.63	€ 0.63
Total	**€ 5.96**	**€ 3.29**

For both route options, the DMU incremental annual cost is assumed to occur between 2030 and 2044, with the BEMU cost assumed to occur from 2045 onwards when the transition to electric trains is assumed. BEMU costs of operation have been assumed to be line with EMU costs. The higher annual cost for diesel operation is due to higher vehicle

maintenance associated with DMUs and higher fuel costs under diesel operation compared to electric operation.

11.5 Rail infrastructure maintenance costs

There will be an additional maintenance and lifecycle cost associated with the additional infrastructure between Navan and M3 Parkway. Cost forecasts have been estimated for the incremental maintenance costs for the following reasons:

- The Public Spending Code 2019 (PSC) requires all cash inflows and outflows to be considered. Maintenance costs are a key component of this.
- These costs will help inform a view on how the Infrastructure Manager Multi-Annual Contract (IMMAC) costs could be impacted.

The two main elements of the infrastructure works which would have additional maintenance costs associated with them are the additional track and the four new stations.

For the permanent way, high-level cost estimates based on the average rates per track km used for the DART+ Programme cost forecasts were used to ensure an allowance for infrastructure maintenance costs are included in the appraisal. For track maintenance, a cost commensurate with the current cost for the Maynooth Line of €40,000 per track km per annum was used.

For the new stations, cost estimates based on a high-level benchmark figure of €65k per annum per station have been used, equating to €260k per annum for the four new stations. This covers basic maintenance, renewal and repair of the station and is commensurate with a station with two platforms, a station building, and car park. This figure is shown below in Table 11-8.

Table 11-8 Incremental infrastructure maintenance operating costs (2019 Prices)

Route	Track Maintenance (€m per annum)	Station Maintenance (€m per annum)
Option A	€2.70	€0.26
Option B	€2.74	€0.26

11.6 Bus costs

The stopping pattern for the bus service takes in stops over a 60km route between Dublin (Busáras), Phibsboro (Mater Hospital), Navan Road Parkway, Navan Road/N3 adjacent Connolly Hospital, Blanchardstown, Clonee, Dunboyne, Dunshaughlin, Kilmessan, Navan and Navan North. The frequency is assumed to be a 15 minute service across all periods utilising high-capacity double decker buses.

Based upon NTA data, a cost of €3.43 per vehicle km was used for the bus operating costs. This cost does not include procurement, mobilisation, administration and some depot related costs. Additionally, this cost does not account for operator mobilisation costs, NTA mobilisation costs, NTA administrative costs, fare revenue, or future cost increases. An uplift of 10% has been included to cover these costs which increased the assumed rate to €3.77 per vehicle kilometre.

Based upon the assumed service frequency, this generates a cost of €10.8m per annum to operate the service.

The number of buses needed to operate the service is known as the Peak Vehicle Requirement. It is based on the end-to-end route journey time plus assumed layover. An end-to-end journey time of 1hour and 16 minutes has been assumed based upon current bus journey times and the route distance, with a layover of 7.5 minutes based upon half the service frequency. This results in an estimated bus fleet size of 13 vehicles, including spares. The assumed cost of a bus is €500k based upon a long distance double decker similar to those in use by Bus Éireann on their current Navan-Dublin service.

Therefore, a total capital cost of €6.5m for upfront purchase costs was assumed. This cost would re-occur every 10 years until the end of the appraisal period to cover renewal costs.

12. Financial appraisal

The financial analysis or appraisal is an important building block in the overall appraisal process and acts as a first step before carrying out the economic appraisal. A financial analysis only considers financial cash flows whereas an economic appraisal examines all costs and benefits for society and not just the direct financial flows arising from the project.

In line with the Public Spending Code (PSC) and the Department of Transport's (DoT) Common Appraisal Framework (CAF), the appraisal should clearly identify and examine a benchmark or counterfactual for comparative purposes. The counterfactual or Do-Minimum involves an assumption about the future state of the world in the absence of the project or programme. Assumptions on future projects or programmes assumed to be in place in the Do-Minimum are listed in Appendix B.

The financial appraisal is therefore based upon examining the incremental costs and revenues of the Do-Something over the Do-Minimum. The financial appraisal has been conducted in line with the PSC requirements. The core assumptions are outlined below.

12.1 Core assumptions

12.1.1 Price base

All values are based on 2019 prices discounted to 2019, using a real discount rate where Present Value figures are quoted. The rationale behind the 2019 price base is that this was the basis of the train service and infrastructure maintenance costs data used in the DART+ Programme's financial and economic model, which was also utilised for this study.

For the purposes of deflating costs, which are provided in nominal values or alternative price bases to 2019 prices, the Harmonised Index of Consumer Prices (HICP) has been used as the basis of deflating. This only accounts for general inflation and escalation above or below general inflation, and is not removed as they reflect relative changes in the value of particular items. Where prices require adjusting for inflation, actual outturn data up to 2020 has been used, with 2021 onwards being based on the medium to long-term HICP rate of 2%.

12.1.2 Discount factor

For Present Value calculations, a real discount rate of 4% was used for the first 30 years from the current year, and 3.5% thereafter.

12.1.3 Appraisal period

In the appraisal of capital projects, the CAF states that a 30-year appraisal period should only be used where the life of an asset is at least 30 years. With regard to the infrastructure works undertaken, there are a number of elements within the capital cost envelope which have an expected asset life of greater than 30 years. These include bridges and structures, earthworks, station buildings and platforms, and land purchase.

To address this, in terms of appraisal period, a residual value period of 30 years is applied based on the guidance outlined in Table 6.1.2 of TII PAG Unit 6.1: Guidance on Conducting CBA. For the purpose of this assessment, where a 60-year appraisal period is indicated, this is defined as comprising of a 30 year appraisal period plus a further 30 year residual value period.

To account for an extended appraisal period, the renewal, operations and maintenance costs for years 31 to 60 after opening are also quantified. They are included in the appraisal along with economic and revenue benefits. This approach has been adopted in both the financial and economic appraisal.

12.2 Rail infrastructure and rolling stock Present Value Costs

This covers the costs associated with the infrastructure options and rolling stock as described in Section 5. For the purposes of the appraisal period, an allowance for renewals has been included alongside a residual value. The following elements have had renewal and residual value costs included in the appraisal for both route options:

- Permanent Way has a typical asset life of 40 years and is assumed to be renewed in 2069 with a residual value for the remaining 20 years asset life being included in the final appraisal year of 2089.
- An allowance for the renewal of the signalling equipment has been included in 2059 as this has a typical asset life of 30 years.

- Although it is assumed that the BEMUs purchased in around 2025 as part of the DART+ Programme would be cascaded to this route in 2045, EMUs typically have an asset life of 35 years and would therefore require these vehicles to undergo renewal around 2060. An allowance for the renewal costs of the necessary vehicles has been included in 2060.

Table 12-1 shows the 60-year Present Value of the capital costs for the two rail-based options.

Table 12-1 Breakdown of capital cost Present Values (2019 Real Prices)

Capital Costs per element	Option A 60-Year PV (€m)	Option B 60-Year PV (€m)
Infrastructure Costs	€551.4	€707.7
BEMU Charging Infrastructure	€4.5	€4.5
Renewals/Residual Value	€25.9	€18.9
Total Capital Cost	**€581.8**	**€731.1**

12.3 Rail service O&M Present Value

This captures the financial impact of the incremental costs associated with operating the additional train services for the two rail-based options, as discussed in Section 5. Table 12-2 shows the annual incremental operation and maintenance (O&M) cost forecasts and the associated Present Value over the appraisal period.

Table 12-2 Train service O&M summary and Present Values (2019 Real Prices)

Route Option	Annual Cost 2030 (€m 2019 Prices)	Annual Cost 2045 (€m 2019 Prices)	60-Year PV (€m)
Option A	€5.9	€3.3	**€71.2**
Option B	€6.0	€3.3	**€71.9**

The change in costs between 2030 and 2045 from circa €6m to €3.3m is due to the rolling stock changing from DMUs to BEMUs at this point and the resulting reduction in maintenance and traction costs.

12.4 Rail infrastructure O&M Present Value

This captures the financial impact of the incremental costs associated with the maintenance of the additional infrastructure. Table 12-3 shows the annual incremental infrastructure maintenance cost forecasts and their associated Present Values over the appraisal period, relating to the additional infrastructure outlined in Section 5.

Table 12-3 Infrastructure O&M summary and Present Values (2019 Real Prices)

Route Option	Annual Cost 2030 (€m 2019 Prices)	60-Year PV (€m)
Option A	€2.96	€46.7
Option B	€3.0	€47.2

12.5 Bus costs Present Value

It is assumed that there are no infrastructure capital or maintenance costs for Option C, the bus-based alternative. However, capital expenditure will be required as a result of the need to purchase and renew buses to operate the fleet. Table 12-4 shows the 60-year Present Value of both the capital cost of the upfront purchase and subsequent renewals every 10 years.

Table 12-4 Bus procurement and renewal Present Values (2019 Real Prices)

Capital Costs	Option C 60-Year PV (€m)
Bus Capital and Renewal Costs	€12.5m

Table 12-5 shows the annual undiscounted cost and 60-year Present Value of service operations costs for Option C.

Table 12-5 Bus service O&M cost Present Values (2019 Real Prices)

Incremental Bus Operating Costs	Annual Cost (€m 2019 Prices Undiscounted)	60-Year PV (€m)
Bus Operating Cost	€10.8	€170.1

12.6 Revenue modelling

For heavy rail demand, the revenue forecasts have been based on demand and revenue data extracted from the Eastern Region Model (ERM) runs. TUBA outputs do not accurately enable the split between modes, which is essential in understanding revenue changes by mode, therefore an offline spreadsheet approach was adopted.

Furthermore, an allowance for ancillary revenue is also included in the rail revenue forecasts which is not captured in the yield data in the ERM. This covers revenue associated with car parking, advertising and retail which are assumed linked to footfall and demand. Table 12-6, Table 12-7 and Table 12-8 show the revenue outputs for each of the options split by heavy rail, bus, Luas, MetroLink and road tolls.

Table 12-6 Option A: Revenue forecasts (2019 Real Prices)

Option A	Annual Revenue 2030 (€millions)	Annual Revenue 2045 (€millions)	PV (€millions)
Heavy Rail Revenue	€4.6	€6.5	€98.1
Bus	-€2.6	-€4.3	-€63.4
Luas	€0.3	-€0.0	€1.1
MetroLink	€0.4	€0.4	€7.0
Road tolls	-€0.5	-€1.3	-€17.1
Net Revenue Impact	**€2.3**	**€1.2**	**€25.7**

Table 12-7 Option B: Revenue forecasts (2019 Real Prices)

Option B	Annual Revenue 2030 (€millions)	Annual Revenue 2045 (€millions)	PV (€millions)
Heavy Rail Revenue	€4.5	€6.6	€98.6
Bus	-€2.7	-€4.4	-€64.5
Luas	€0.2	-€0.0	€0.4
MetroLink	€0.5	€0.4	€7.5
Road tolls	-€0.5	-€1.4	-€17.5
Net Revenue Impact	**€2.0**	**€1.2**	**€24.4**

For Option A, net revenue is projected to be €2.3m in 2030, although this decreases in 2045 to €1.2m. Although heavy rail revenue increases from €4.6m to €6.5m between 2030 and 2045, this additional €6.5m revenue for heavy rail is offset by a €4.3m reduction in bus revenue and €1.3m reduction in road tolls.

A similar pattern is also observed for Option B with net revenue decreasing from €2.0m in 2030 to €1.2m in 2045. Although heavy rail revenue increases from €4.5m to €6.6m between 2030 and 2045, the overall increase is more than offset by an increase in the revenue abstracted from bus and the loss of highway toll revenue.

Table 12-8 Option C: Revenue forecasts (2019 Real Prices)

Option C	Annual Revenue 2030 (€millions)	Annual Revenue 2045 (€millions)	PV (€millions)
Heavy Rail Revenue	-€0.6	-€0.2	-€4.5
Bus	€1.5	€2.1	€31.9
Luas	€0.1	€0.4	€5.1
MetroLink	€0.2	-€0.1	-€0.8
Road tolls	-€0.1	-€0.3	-€4.1
Net Revenue Impact	€1.1	€1.9	€27.5

With Option C, the bus-based option, net revenue increases from €1.1m in 2030 to €1.9m in 2045. As expected, this is driven mainly by an increase in bus patronage of €1.5m in 2030 increasing to €2.1m in 2045.

12.7 Full Exchequer impact

Table 12-9 draws together the cost and revenue impacts and shows the full Exchequer impact of the project. This covers all elements which will impact on the Exchequer, in addition to costs and revenue solely associated with the construction and operation of the extension to Navan. Indirect taxation is also included as the loss of tax revenue through modal share to public transport, which is zero rated for tax and results in a loss of tax revenue to the Exchequer. This is therefore broadly proportionate to the revenue generated.

Table 12-9 Exchequer impact (2019 Real Prices)

Exchequer Impact	Option A (60-Year PV €m)	Option B (60-Year PV €m)	Option C (60-Year PV €m)
Capital Costs	€581.8	€731.1	€12.5
Train Service Operating Cost	€71.2	€71.9	€0.0
Rail Infrastructure Maintenance Cost	€42.6	€43.1	€0.0
Bus Operating Cost	€0.0	€0.0	€170.1
Indirect Taxation loss	€6.6	€6.1	€5.5
less Net Revenue generated	-€25.7	-€24.4	-€27.5
NPV Costs	€680.75	€838.9	€160.8

Option B has the highest PV cost which is primarily driven by the higher capital costs. The significantly lower PV cost for Option C is due to no requirement for infrastructure investment other than the provision of the bus fleet required.

12.8 Rail operating and maintenance subsidy

12.8.1 Public Service Obligation (PSO)

For the two rail-based options, it is envisaged that the incremental costs associated with the train operations, net of the revenue increase, would need to be captured through an increase in the Public Service Obligation (PSO) funding. There would also be an expected minor impact on PSO funding of Option C due to the change in heavy rail revenue, although there would be no incremental impact on train operations costs.

The PSO subsidy is Exchequer funded, paid through the DoT to the NTA, who negotiate and manage the contracts with Iarnród Éireann Irish Rail's (IÉ) Railway Undertaking (RU). IÉ's annual report for 2019 noted that the company's total PSO payment was €88.7m, which covered all rail services in Ireland.

Table 12-10 and Table 12-11 show the forecast change in the PSO funding (undiscounted) for both Option A and Option B for 2030, 2045 and the NPV over the appraisal period for each. This is based on the costs associated with the additional train service O&M plus the

access charges levied by the Infrastructure Manager (IM) on the RU less the incremental revenue generated by the scheme.

Table 12-10 Option A: PSO (2019 Real Prices)

Incremental PSO Payment Change	2030 Annual Cost and Revenues (€millions)	2045 Annual Cost and Revenues (€millions)	60-Year PV (€millions)
Train Service O&M	€5.9	€3.3	€71.2
Access Charges	€1.6	€1.5	€24.5
less Revenue (Farebox and Ancillary)	*-€4.6*	*-€6.5*	-€98.1
Total change in PSO	€2.9	-€1.7	-€2.4

For Option A, there is a forecast increase in PSO funding of €2.9m in 2030. This is driven by the costs associated with train service O&M and access charges exceeding the additional revenue. However in 2045, the increased revenue combined with a reduction in train service O&M through operating the BEMUs as opposed to diesel services results in a PSO saving of €1.7m per annum.

Table 12-11 Option B: PSO (2019 Real Prices)

Incremental PSO Payment Change	2030 Annual Cost and Revenues (€millions)	2045 Annual Cost and Revenues (€millions)	60-Year PV (€millions)
Train Service O&M	€6.0	€3.3	€71.9
Access Charges	€1.6	€1.5	€24.8
less Revenue (Farebox and Ancillary)	*-€4.5*	*-€6.6*	-€98.6
Total change in PSO	€3.1	-€1.8	-€1.9

A similar outcome is observed for Option B, with a forecast increase in PSO funding of €3.1m in 2030 and a saving of €1.8m (to the Exchequer) in 2045 due to a reduction in train service O&M.

Table 12-12 Option C: PSO (2019 Real Prices)

Incremental PSO Payment Change	2030 Annual Cost and Revenues (€millions)	2045 Annual Cost and Revenues (€millions)	60-Year PV (€millions)
Train Service O&M	€0.0	€0.0	€0.0
Access Charges	€0.0	€0.0	€0.0
less Revenue (Farebox and Ancillary)	€0.6	€0.2	€4.5
Total change in PSO	**€0.6**	**€0.2**	**€4.5**

For Option C, the slight increase in the PSO funding requirement is solely driven by the abstraction of revenue by bus from rail, equating to €0.6m in 2030 and €0.2m in 2045, as shown in Table 12-12.

12.8.2 Infrastructure Manager Multi-Annual Contract (IMMAC)

The PSO costs do not include the costs associated with the infrastructure maintenance.

IÉ's management of infrastructure is funded under EU regulation by a 5-year Infrastructure Manager Multi-Annual Contract (IMMAC) direct from the DoT, and infrastructure access charges from passenger and freight rail services. Total income through the IMMAC across the whole IÉ network was €142m in 2019 based upon the IÉ 2019 annual report. Costs associated with the additional Infrastructure O&M would therefore be required to be covered through an increase in the IMMAC less the access charges levied on IÉ's RU for use of the assets.

The access charges cover the IM's operating, maintenance and renewal costs that vary with traffic. In economic terms it represents the short run incremental costs. The variable usage charge is paid by all railway undertakings that use the IÉ network and there is a single common charge rate throughout the entire network. The variable usage track infrastructure charge applied to services operating on the network is a rate of €0.0077 per gross tonne kilometre. The variable usage traction power charge for use of traction power on the DART network is €0.001 per gross tonne kilometre.

Table 12-13 and Table 12-14 show the forecast change in the IMMAC for Option A and Option B respectively.

Table 12-13 Option A: IMMAC (2019 Real Prices)

Incremental IMMAC Change	2030 Annual Cost and Income (€millions)	2045 Annual Cost and Income (€millions)	60-Year PV (€millions)
Infrastructure Maintenance Costs	€3.0	€3.0	€46.7
Less Access Charges	-€1.6	-€1.5	-€24.5
Total change in IMMAC	€1.3	€1.5	€22.2

An increase of €1.3m in 2030 and €1.5m in 2045 is forecast for the IMMAC due to the difference between the additional costs and the revenue recouped from access charges.

Table 12-14 Option B: IMMAC (2019 Real Prices)

Incremental IMMAC Change	2030 Annual Cost and Income (€millions)	2045 Annual Cost and Income (€millions)	60-Year PV (€millions)
Infrastructure Maintenance Costs	€3.0	€3.0	€47.2
Less Access Charges	-€1.6	-€1.5	-€24.8
Total change in IMMAC	€1.4	€1.5	€22.4

Similar to Option A, an increase of €1.4m in 2030 and €1.5m in 2045 is forecast for the IMMAC due to the difference between the additional costs and the revenue recouped from access charges.

13. Economic appraisal

This section provides an overview of the transport user benefits, the Present Value of costs and the range of Benefit to Cost Ratios (BCR) arising from the Navan Rail Line assessment Cost-Benefit Analysis (CBA).

The appraisal is informed by the requirements of the Department of Public Expenditure and Reform's (DPER) Public Spending Code (PSC) and the Department of Transport's (DoT) Common Appraisal Framework (CAF) for Transport Projects and Programmes.

13.1 Appraisal framework and assumptions

The outputs from the transport modelling and cost forecasting have provided the core inputs to the CBA process. The transport model has provided outputs for 2030 and 2045 for this purpose.

The CBA assesses the impact of each scheme on users and operators under the following headings:

- Net transport user benefits;
- Journey time (in-vehicle time, transfer time, walk and wait time, etc.);
- Charges (fares/tolls, etc.);
- Vehicle operating costs;
- Net transport operator benefits;
- Impacts on greenhouse gas emissions for both modal shift from highway and impact of changes in vehicle kilometres for rail and bus;
- Investment costs;
- Operating and maintenance costs;
- Revenue, including both revenues generated by the DART+ Programme's services and abstraction from other modes;
- Indirect taxation impacts.

The CBA has been undertaken using TUBA software in line with the PSC. Individual economic parameters will be based on industry-standard variables extracted from the TII Project Appraisal Guidelines (PAGs). This includes Values of Time, Carbon and vehicle operating cost assumptions.

Core assumptions used in the appraisal are:

- A price base year and Present Value year of 2011, as defined in the DoT's CAF;
- A standard appraisal period of 30 years with a residual value period of a further 30 years;
- Discount rate of 4% for 30 years from current year and 3.5% for years 31 to 60;
- Shadow price of public funds of 130%;
- Shadow price of labour of 100%;
- Scheme opening year of 2030 in line with the capital cost profile.

The values used in the appraisal are incremental benefits, costs and revenue of the Do-Something scenario over the Do-Minimum. Section 8 of this report outlines the detail of the specific assumptions used for both the Do-Minimum and Do-Something scenarios.

The figures outlined in the summary below are based on the NTA growth assumptions, with the MCC result summarised at the end of the chapter.

13.2 User benefits

This section of the report presents the user benefits associated with improved services to existing users and the subsequent impact on other passengers through modal shift for the three options (Rail Option A, Rail Option B and the bus-based alternative, Option C).

Table 13-1 Option A: User benefits (€ Millions - 2011 Values and Prices)

User Benefits	Highway 60-Year PV (€millions)	PT 60-Year PV (€millions)
Travel Time	€175.5	€146.1
Vehicle Operating Costs	€27.8	€0.0
User Charges	€3.7	€48.9
Total	**€207.1**	**€195.0**

Table 13-2 Option B: User benefits (€ Millions - 2011 Values and Prices)

User Benefits	Highway 60-Year PV (€millions)	PT 60-Year PV (€millions)
Travel Time	€167.6	€141.9
Vehicle Operating Costs	€19.1	€0.0
User Charges	€3.3	€49.4
Total	**€190.0**	**€191.3**

Table 13-3 Option C: User benefits (€ Millions - 2011 Values and Prices)

User Benefits	Highway 60-Year PV (€millions)	PT 60-Year PV (€millions)
Travel Time	€36.2	€96.4
Vehicle Operating Costs	€2.7	€0.0
User Charges	€2.1	-€4.9
Total	**€41.0**	**€91.5**

13.3 Collision reduction benefits

As modes of transport, rail and bus tend to have much lower rates of collisions and casualties than private cars, meaning that a shift away from cars is likely to result in an economic benefit in terms of reduced collisions and casualties on the roads. Collision reduction benefits for the three options were estimated based on the reduction in vehicle kilometres driven from the demand modelling and comparative collision rates for cars, bus and rail. Average collision/casualty rates per vehicle kilometre for cars were sourced from the TII PAGs National Parameters Values Sheet, while average collision rates for bus and rail were based on figures from the International Railway Safety Council. Road collision rates in the PAGs' are based on different infrastructure types, meaning that it was necessary to develop an assumption as to what proportion of journeys would have otherwise taken place on each road type. As it was assumed that most journeys displaced by the Navan Rail Line would have been along the M3/N3 corridor, the road collision rates were apportioned 80% and 20% to 'Motorways' and 'Urban Two-lane' roads respectively. These rates were then applied to the vehicle kilometres driven in each of the three options and compared to that of the Do-Nothing scenario to estimate the total number of fatalities

and serious injuries prevented on average by each option. These were then monetised in line with the values outlined in the DoT's CAF, and updated for future years in the appraisal period based on projected real GNP growth, as shown in Table 13-4.

Table 13-4 Summary of collision reduction benefits (PV of Benefits in 2011 Prices)

Options	NTA Growth (PV in 2011 prices)	MCC Growth (PV in 2011 prices)
Rail Option A	€7,141,296	€9,843,562
Rail Option B	€4,525,472	€8,796,582
Bus Option C	€1,256,011	€4,455,395

13.4 Agglomeration

Agglomeration estimates have been developed using the Agglomeration Analysis Tool (AAT) developed by the Strategic and Transport Planning (STP) section of TII. The tool has been used to estimate annual and total appraisal period agglomeration benefits for each of the project options. The tool takes reductions in travel time and costs, jobs data and Gross Value Added (GVA) data as inputs to calculate productivity benefits to firms as a result of reduced travel times and costs.

The following agglomeration benefits for each option were then calculated using the AAT tool.

Table 13-5 Summary of agglomeration benefits

Option	PV of Benefits
Rail Option A	€32,049,463.15
Rail Option B	€19,252,577.63
Bus Option C	€424,611.71

13.5 Revenue

The impacts on revenue as a result of the proposed options are outlined in Table 13-6 below.

Table 13-6 Revenue (€ Millions - 2011 Values and Prices)

Revenue Source	Option A 60-Year PV (€millions)	Option B 60-Year PV (€millions)	Option C 60-Year PV (€millions)
Net PT Revenue	€39.1	€38.3	€28.9
Highway Tolls	-€13.5	-€14.1	-€3.4
Total	€25.6	€24.2	€25.5

Net additional public transport patronage is higher for Option A and Option B than Option C, reflecting the increased attractiveness of the rail option. However, the total net revenue impact for the two rail options is offset by a larger reduction in highway tolls than Option C, hence the net revenue impact is broadly similar across all three options.

13.6 Greenhouse gases

The implementation of the project will generate benefits associated with reduced levels of greenhouse gases (GHGs). These benefits are generated by two separate factors:

- Changes due to modal shift and changes in congestion on the road network.
- Changes in the rolling stock fleet ratio between diesel and BEMUs.

The highway impacts have been estimated using TUBA, whilst the rolling stock impact has been calculated based on changes in vehicle kilometres and associated fuel use. For rail, this considers the change from diesel to BEMU vehicles in 2045, whilst the bus option assumes initial hybrid buses gradually increasing to an all-electric fleet by 2050. Emissions factors for diesel and electric and associated monetised costs for traded and untraded carbon values have been based on assumptions and sources in the 'PSC Supplementary Guidance – Measuring & Valuing Changes in Greenhouse Gas Emissions in Economic Appraisal'.

Table 13-7 Greenhouse gases (€ Millions - 2011 Values and Prices)

	Option A 60-Year PV (€millions)	Option B 60-Year PV (€millions)	Option C 60-Year PV (€millions)
Modal Shift	€0.1	€0.1	€0.0
Train and Bus Emissions	-€7.2	-€7.3	-€1.7
Total	-€7.1	-€7.1	-€1.7

The key driver of the negative costs of the rail-based options is the working assumption to use diesel services prior to 2045. For all options, GHGs are zero post 2050.

13.7 Indirect taxation

For the economic appraisal, the impacts on indirect tax revenue are included as part of the Present Value of Benefits (PVB), rather than the Present Value of Costs in line with CAF. These impacts are driven by changes in tax payment to the Exchequer through changes in fuel duty and shift to public transport which is exempt from VAT.

Table 13-8 Indirect taxation (€ Millions - 2011 Values and Prices)

	Option A 60-Year PV (€millions)	Option B 60-Year PV (€millions)	Option C 60-Year PV (€millions)
Highway	-€0.5	-€0.9	-€0.2
Public Transport	-€5.5	-€5.4	-€4.3
Total	-€6.0	-€6.3	-€4.5

13.8 Costs

This section summarises the costs associated with the construction, operation and maintenance of all options based upon the assumptions outlined in Section 11.

Table 13-9 Costs (€ Millions - 2011 Values and Prices)

	Option A 60-Year PV (€millions)	Option B 60-Year PV (€millions)	Option C 60-Year PV (€millions)
Capital Costs	€531.6	€674.4	€11.4
Train Operating Costs	€65.1	€65.7	€0.0
Bus Operating Costs	€0.0	€0.0	€155.4
Infrastructure Maintenance Costs	€42.7	€43.1	€0.0
Total	**€639.3**	**€783.3**	**€166.8**

As discussed previously, the main driver of the differences are the higher capital costs for Option B when compared with Option A. There are no infrastructure costs required for Option C.

13.9 CBA results summary

A summary of the economic appraisal is shown in Table 13-10.

Table 13-10 CBA summary and core economic indicators (€ Millions - 2011 Values and Prices)

	Option A 60-Year PV (€millions)	Option B 60-Year PV (€millions)	Option C 60-Year PV (€millions)
User Benefits	€402.1	€381.3	€132.5
Greenhouse Gases	-€7.1	-€7.1	-€1.7
Revenue	€25.6	€24.2	€25.5
Indirect Tax	-€6.0	-€6.3	-€4.5
Agglomeration	€32.0	€19.3	€0.4
Safety	€7.1	€4.5	€1.3
Present Value of Benefits	€453.7	€415.9	€153.6
Present Value of Costs	€639.3	€783.3	€166.8
NPV	-€185.6	-€367.4	-€13.3
BCR	0.71	0.53	0.92

This shows BCRs of 0.71 for Option A and 0.53 for Option B. The higher BCR for Option A is driven by a combination of lower costs and higher benefits. Although the PVB for Option C is much lower, at €154m, the significantly lower PVC due to no infrastructure costs results in a BCR of 0.92.

13.10 MCC growth forecasts

Table 13-11 below shows the impact of using the MCC 2045 growth assumptions on the BCR.

Table 13-11 MCC growth forecast CBA summary and core economic indicators (€ Millions - 2011 Values and Prices)

	Option A 60-Year PV (€millions)	Option B 60-Year PV (€millions)	Option C 60-Year PV (€millions)
User Benefits	€450.7	€409.7	€147.1
Greenhouse Gases	-€7.1	-€7.1	-€1.6
Revenue	€29.5	€30.2	€27.8
Indirect Tax	-€6.9	-€7.0	-€4.9
Agglomeration	€32.0	€19.3	€0.4
Safety	€9.8	€8.8	€4.5
Present Value of Benefits	**€508.0**	**€453.9**	**€173.2**
Present Value of Costs	**€639.3**	**€783.3**	**€166.8**
NPV	**-€131.3**	**-€329.4**	**€6.4**
BCR	**0.79**	**0.58**	**1.04**

Comparing the BCRs derived for each option using the separate MCC planning assumptions with the NTA assumptions, all scenarios show a marginal increase in BCR, with the MCC growth scenarios driven by higher benefits.

13.11 Infrastructure capital cost sensitivities

As part of the capital cost for the infrastructure forecasts, High- and Low-cost estimates were also provided. These tested the impact of a 30% increase for the High scenario and a reduction of 10% for the Low scenario.

Sensitivity tests were conducted around these for Option A and Option B using the 2045 NTA growth assumptions for the benefits.

For Option A, the High cost estimate is €1,122.9m and the low cost estimate is €777.4m. Table 13-12 shows the impact of these assumptions of the BCR.

Table 13-12 Option A: Infrastructure capital cost sensitivity (€ Millions - 2011 Values and Prices)

(€ millions - 60 Year Present Value)	Central	High	Low
Present Value of Benefits	€ 453.70	€ 453.70	€ 453.70
Present Value of Costs	€ 639.30	€ 790.50	€ 589.00
NPV	-€ 185.60	-€ 336.80	-€ 135.30
BCR	0.71	0.57	0.77

For Option B, the High cost estimate is €1,431.1 and the low cost estimate is €990.7m. Table 13-13 shows the impact of these assumptions of the BCR.

Table 13-13 Option B: Infrastructure capital cost sensitivity (€ Millions - 2011 Values and Prices)

(€ millions - 60 Year Present Value)	Central	High	Low
Present Value of Benefits	€ 415.90	€ 415.90	€ 415.90
Present Value of Costs	€ 783.30	€ 977.30	€ 718.60
NPV	-€ 367.40	-€ 561.40	-€ 302.70
BCR	0.53	0.43	0.58

13.12 MCC growth forecasts with low cost sensitivity

Table 13-14 below shows the impact on the BCRs of the rail-based options where the MCC 2045 growth assumptions are assumed in combination with the lower cost forecasts.

Table 13-14: MCC growth with low infrastructure capital cost sensitivity (€ Millions - 2011 Values and Prices)

(€ millions - 60 Year Present Value)	Option A	Option B
Present Value of Benefits	€ 508.00	€ 453.90
Present Value of Costs	€ 589.00	€ 718.60
NPV	-€ 81.00	-€ 264.70
BCR	**0.86**	**0.63**

With the higher MCC growth forecasts combined with the low cost sensitivity, the BCRs are 0.86 and 0.63 for Options A and B respectively.

14. Multi-Criteria Analysis

Multi-Criteria Analysis (MCA) is a form of appraisal in which options are scored against a common set of economic costs and benefits to facilitate comparison and decision making. MCA has the advantage of allowing qualitative benefits and those that cannot be monetised to be fully incorporated in the appraisal process and can provide a broader view of the potential costs and benefits associated with a project.

This MCA largely draws from the different sections and analyses in this report, including the Demand Analysis, Economic Appraisal, Environmental Assessment and Impacts Assessment. While some of these analyses explore the general costs and benefits of rail compared to the status quo, the MCA will assess the comparative costs and benefits of the three options:

- **Option A -** Navan Rail Route A
- **Option B -** Navan Rail Route B
- **Option C –** Bus-based alternative.

A fourth option (referred to as Option 0) will also be included to account for the likely impacts of 'Doing Nothing' (i.e. providing no additional transport solutions between Dublin and Navan).

As with the economic appraisal, costs and benefits associated with each option are structured according to the Common Appraisal Framework (CAF) assessment criteria, which evaluates the impact of transport infrastructure and projects in terms of:

- Economy
- Safety
- Environment
- Accessibility & Social Inclusion
- Integration.

Within each of these main criteria, additional sub-criteria were developed to better assess different aspects of each option in greater detail. A full summary of the assessment criteria and sub-criteria are shown in the table below.

Table 14-1: MCA scoring scale

CAF Criterion	Sub-criterion	Description / Evaluation Indicator
Economy	Journey Times	Journey times between Dublin and Navan
	Transport Quality	Comfort and quality of journeys
	Transport Efficiency	Relative transport efficiency and capacity of each option
	Transport Reliability	Reliability and consistency of journey times
	Agglomeration	Agglomeration impacts
	Wider Economic Impacts	Other relevant impacts on economic development and growth along the Dublin-Navan Corridor
	Funding Impacts	Cost of each option, taking into account potential sources of funding.
Safety	User Safety	Collision rates and cost of collisions
	User Security	Users' sense of security and safety using transport option
Environment	Air Quality	Impact on pollutants harmful to human health
	Climate	Impact on greenhouse gas emissions and climate risk
	Noise & Vibration	Noise and vibration impacts
	Landscape & Visual	Impacts on the landscape, protected views and visual quality
	Biodiversity	Impacts on ecology and biodiversity
	Cultural, Archaeological & Architectural Heritage	Impacts on culturally-, architecturally- and archaeologically-significant buildings and features
	Land Use, Soils & Geology	Impacts on soils, geology and land use
	Water Resources	Impacts on hydrology and water quality
Accessibility & Social Inclusion	Accessibility for Vulnerable Groups	Accessibility improvements to employment, education and services for more vulnerable users
	Accessibility in Deprived Geographic Areas	Accessibility improvements to employment, education and services for those in socially disadvantaged areas
	Community Wellbeing	Impacts on wellbeing and community participation
Integration	National Land Use Policy	Integration with residential, employment and retail areas, in line with NSO principles of Compact Growth
	Local Land Use Policy	Integration with provision of Meath County Council Development Plan
	Active Travel	Integration of/with existing and future active travel infrastructure
	Public Transport	Integration of/with other existing and proposed public transport services and infrastructure

Options have been scored using a seven-point scoring scale adopted from Transport Infrastructure Ireland's (TII) Project Appraisal Guidelines (PAGs). This scale is set out in Table 14-2 below.

Table 14-2: MCA scoring scale

Major Negative	Moderate Negative	Minor Negative	**Neutral / No Impact**	Minor Positive	Moderate Positive	Major Positive

14.1 Economy

14.1.1 Journey times

Due to a growing population and increased congestion on the road network, journey times along the Dublin-Navan corridor have deteriorated over the preceding decade, with average journey times from Meath increasing between the 2011 and 2016 Censuses. As the population continues to grow, congestion and journey times will also grow in the absence of alternative transport solutions, meaning that the Do-Nothing option (Option 0) will be a **Minor Negative** in this criterion.

Journey time benefits were derived from the Economic Appraisal, and are based on the concept of total door-to-door journey time (i.e. from each person's residence to their final destination). Although both rail options are likely to reduce journey times between Dublin and Navan, the *average* journey time benefit (based on door-to-door trips) is relatively small at 3.5 minutes for Option A and 3.3 minutes for Option B. As such, these options were both given a **Minor Positive** rating.

Although the bus-based solution would have fewer stops than the existing bus service, the fact that it largely uses the current road network, which will not benefit from BusConnects improvements for a large portion of its route outside of Dublin, means that the overall journey time reductions are minimal. Option C was scored as **Negligible** as a result.

14.1.2 Transport quality

While cars will ultimately provide a similar journey quality in the future, if journey times and reliability continue to deteriorate in the absence of alternative transport solutions, this is

likely to have negative consequences for journey quality and increase the feelings of discomfort associated with long commutes. Option 0 therefore represents a **Minor Negative**.

As outlined previously, rail-based options are expected to result in major improvements in journey quality along the Dublin-Navan corridor, such as smoother ride quality, user facilities such as Wi-Fi and toilets, and the capability to support remote working; making Options A and B a **Major Positive** in the MCA. While the bus-based option would largely provide a pleasant journey quality, space constraints mean that buses are mostly unable to provide the same functionality, such as the ability to work remotely or toilets. As such, Option C was given a **Moderate Positive** score.

14.1.3 Transport efficiency

This criterion considers the relative efficiency of different modes of transport in moving passengers during peak periods, and the impact of each option in terms of increased journey capacity. An analysis of TII traffic flow data indicates that the M/N3 currently accommodates up to 2,200-2,800 vehicles per hour per direction at peak times[49], which would correspond to a current peak capacity of 2,600-3,400 per hour in each direction. However, the N3 is currently operating close to its maximum capacity, and significant congestion issues have been noted at peak times. This means that as the population of Navan and other towns along the N3 grows, alternative transport solutions will be required to accommodate the additional numbers wishing to travel.

In the context of high levels of demand during peak periods, rail has the ability to move much greater volumes of passengers using fewer vehicles compared to other modes of transport: comparing like-for-like transport efficiency, it would take nearly 15 high-capacity coaches to provide the same capacity as an 8-car commuter train. Based on proposed service frequencies, Options A and B are expected to provide for additional maximum capacity of around 2,500 passengers per hour, compared to under 400 for a

[49] Based on traffic flow data at Blanchardstown in February and November 2019.

bus-based alternative. Options A and B therefore represent a **Major Positive** in terms of Transport Efficiency, with Option C scored as a **Minor Positive**.

Table 14-3: Capacity of different transport modes

	Existing	Additional	
	Road	Bus	Rail
Peak Capacity (passengers per hour per direction)	*~3,000*	+368*	+2,536**

**Based on average capacity of 92 passengers for high-capacity coaches*

***Based on standing capacity of 1,268 for IE 29000 Class DMUs (8-cars)*

14.1.4 Transport reliability

In general, improvements in transport reliability (i.e. consistency of journey times) and reductions in congestion represent a significant benefit for transport users; allowing them to better plan and allocate their time throughout their day, and reducing feelings of stress or anxiety associated with unpredictable journey times. As outlined previously, the Greater Dublin Area and the M/N3 corridor currently suffers from high levels of congestion which, in the absence of measures to provide alternative transport solutions for travellers, is likely to deteriorate as the population of these areas grow. As such, doing nothing would be a **Major Negative** in terms of transport reliability.

As it runs along a separate track, rail tends to be a more reliable mode of transport than road-based modes. For example, as described previously, the current M3 Parkway service from Pace to Dublin city centre has achieved a 95% on-time performance between 2018 and 2020, while Bus Éireann commuter bus services in the Dublin area recorded just 57% on-time performance during the same period. This suggests that Options A and B would result in **Major Positive** improvements to transport reliability compared to existing infrastructure.

While a bus-based option is likely to experience poorer reliability than a rail-based option, the Express-type service proposed in Option C, along with planned investments in the Dublin bus network as part of BusConnects, means that it is likely to offer some

improvements on the current situation. However, when weighed up against general traffic and population growth, the overall impact is likely to be **Neutral.**

14.1.5 Agglomeration

As outlined in the Section 7.1.6, reductions in journey times can have spill-over impacts for productivity due to agglomeration, which is an economic phenomenon that arises from clustering of industries and employment centres. Agglomeration benefits (Present Values) for Options A and B were estimated at €32 million and €19 million respectively, and as such, both rail-based options were scored as a **Minor Positive**. All other options were assumed to be **Neutral** in this category.

14.1.6 Other wider economic impacts

Analysis by Meath County Council noted a number of other potential economic benefits of the reinstatement of a rail line to Navan, particularly in terms of tourism and the ability to provide a high-capacity transport solution for events in Páirc Tailteann and Navan Racecourse. The route will also feature stops near to some key tourist attractions, such as the proposed Boyne Greenway (at Navan Central) and the Hill of Tara (at Kilmessan), which may enhance the tourism appeal of the railway and of County Meath. Potential benefits were also noted in terms of freight, and the provision of an alternative freight route from Navan Mines to Dublin Port.

As a result, the two rail-based options represent a **Minor Positive** in this criterion, with all other options having **No Impact**.

14.1.7 Funding impacts

The Funding Impacts criterion considers the overall impact each option is likely to have on the Exchequer and is assessed based on the net present funding impacts over the appraisal period (i.e. the Present Value of costs, less the Present Value of net revenues). These requirements are summarised in Table 12-4 below.

Table 14-4: Funding impacts

	Option A	Option B	Option C
Net present funding impacts	€598-613 million	€724-749 million	€127-142 million

Option C would result in a net funding impact of between €127 and €142 million and was given a **Minor Negative** score. The two rail options would have considerably higher funding impacts at €598 to €613 million for Option A and €724 to €749 million Option B. Options A and B were scored as **Moderate Negative** and **Major Negative** respectively.

14.1.8 Summary of economic impacts

Table 14-5 displays a summary of the MCA for the economic criterion, providing an indication as to how each option compares under this heading. As it shows, Option 0 (Do-Nothing) is likely to have a negative impact on the economy of County Meath due to increased congestion, higher journey times and poorer reliability in the absence of alternative transport solutions. While Option C (the provision of enhanced bus services) would have some positive impacts, the overall impact is largely neutral given its relatively low capacity and its reliance on the existing road network.

Options A and B represent a Minor Positive overall in the economic criterion, primarily due to improvements in the efficient, quality and reliability of transport services between Meath and Dublin. The only difference between the two options in this category is related to Funding Impacts, as the capital cost of Option B is more expensive than Option A.

Table 14-5: Summary of economy scoring

	Do-Nothing (Option 0)	Option A (Rail)	Option B (Rail)	Option C (Bus)
Journey Times	Moderate Negative	Minor Positive	Minor Positive	Neutral / No Impact
Transport Quality	Minor Negative	Major Positive	Major Positive	Moderate Positive
Transport Efficiency	Major Negative	Major Positive	Major Positive	Minor Positive
Transport Reliability	Major Negative	Major Positive	Major Positive	Neutral / No Impact
Agglomeration	Neutral / No Impact	Minor Positive	Minor Positive	Neutral / No Impact
Wider Economic Impacts	Neutral / No Impact	Minor Positive	Minor Positive	Neutral / No Impact
Funding Impacts	Neutral / No Impact	Moderate Negative	Major Negative	Minor Negative
Total Score	*Minor Negative*	*Minor Positive*	*Minor Positive*	*Neutral / No Impact*

14.2 Safety

14.2.1 User safety and collisions

Given the collision risks associated with private car use, any option that attracts passengers away from cars and towards public transport will have a positive impact in terms of user safety. As described in the 'Social and Economic Impacts' section, rail travel in Ireland has about 75 times fewer accidents per million seat-km than cars, which suggests that a shift towards rail would result in less collisions, injuries and fatalities along the M/N3 corridor. This is confirmed by the CBA, which suggests collision reduction benefits of between €7 and €9.8 million for Option A due to the shift towards rail, and between €4.5 and €8.8 million for Option B. Both rail options are therefore a **Minor Positive.**

Collision reduction benefits for bus are much less at between €1.3 and €4.5 million; both due to a less significant shift from private cars and the slightly higher collision rates for buses compared to trains. Option C will have a largely **Negligible** impact on collisions overall. As traffic levels are expected to increase under the Do-Nothing scenario, which

will inevitably lead to more frequent collisions and incidents along the M/N3 corridor, Option 0 represents a **Minor Negative**.

14.2.2 User security

This criterion refers to a user's perception of safety and security while using transport infrastructure and services. It is important to consider User Security, as it can affect their willingness to use different modes of transport.

Overall, it has been assumed that transport authorities and Meath County Council will take action in all options to ensure basic security at stations/stops and onboard. For the two rail options, lighting, CCTV and other security measures will be provided at stations and along access routes, while Iarnród Éireann Irish Rail (IÉ) is also currently taking action to improve on-board security on its network, such as increases in patrols and the provision of methods to report anti-social behaviour.

However, the location of the Dunshaughlin Station in Option A may pose some minor issues in terms of user security. The proposed station is located 1.5 kilometres from the town, on other side of the M3 motorway, and in a relatively rural setting, meaning that users may feel less secure accessing the station (particularly at night) than they would for Option B, which is located nearer to the town and to built-up areas. Option A was given a **Minor Negative** score in this category, while all other options were scored as **Neutral.**

14.2.3 Summary of safety impacts

Overall, all options are likely to have relatively minor impacts in terms of user safety and security. Small collision reduction benefits are anticipated due to a shift away from private car use and towards public transport in all options, although these benefits are quite small over the appraisal period. All options are also assumed to include basic measures to ensure user security, although there are some minor differences in terms of station setting and location. A summary of safety impacts is shown in Table 14-6 below.

Table 14-6: Summary of safety impacts

	Do-Nothing (Option 0)	Option A (Rail)	Option B (Rail)	Option C (Bus)
User Safety (Collisions)	Minor Negative	Minor Positive	Minor Positive	Neutral / No Impact
User Security	Neutral / No Impact	Minor Negative	Neutral / No Impact	Neutral / No Impact
Total Score	*Minor Negative*	*Neutral / No Impact*	*Minor Positive*	*Neutral / No Impact*

14.3 Environment

14.3.1 Air quality

The 2011 Environmental Impact Statement (EIS) of the then Navan Rail Line extension noted that the greatest potential impact on air quality would be from construction dust emissions and the potential for nuisance dust. However, with the implementation of standard best practice mitigation measures, the residual impacts of the rail options on air quality would be insignificant. During the operational phase, local air quality is likely to improve as there would be a shift in transport mode from cars to rail. While electrification is not a part of the BCR calculated in this assessment, if the rail line is electrified in the future, the improvements in air quality will be even greater during the operational phase.

On the basis that the rail options will induce a larger model shift from cars, and as the rail options would carry more passengers than the bus alternative, the rail options are scored as **Minor Positive.** Option B is located closer to Dunshaughlin and therefore more receptors maybe negatively impacted during the construction phase and therefore Option A is considered preferable, although best practice mitigation should be capable of managing construction phase emissions.

The bus-based alternative option will enable a shift in transport mode from cars to public transport; however, according to the "Truncated Report on Non-Monetised Impacts of the Navan Railway Line Project" prepared by Meath County Council, it is anticipated that the bus-based alternative to the Navan Rail Line will see increased delays on the approach both to and inside the M50. The BusConnects project is likely to result in significant

increases in city bus services which will have frequent stops. This may delay express regional bus services using the same bus lanes. The increase in congestion will worsen air quality in these areas, although further investigation would be required to determine the extent of this congestion and proximity of sensitive receptors. Existing monitoring of nitrogen dioxide (NO_2) concentrations within Dublin indicates that at one monitoring station located on St John's Road West, there was an exceedance of the EU air quality limit value (40 µg/m^3), with an annual mean NO_2 concentration of 43 µg/m^3 recorded in 2019 (Environment Protection Agency, Air Quality in Ireland, 2019). The EPA report also indicates that indicative monitoring and detailed modelling indicates that the area of exceedance is far greater and includes certain areas of the city centre. Taking this into consideration, as the main route to and from Navan to Dublin city centre the bus option may worsen NO_2 concentration in an area already exceeding the limit value. Option C was therefore rated as a **Minor Negative.**

As Option 0 would ultimately result in growth in traffic levels over time and does not provide any alternative transport solutions for people along the M3 corridor, it was assessed as a **Moderate Negative** in terms of air quality.

14.3.2 Climate

The assessment for the 'Climate' criterion was split into three sub-sections:

- 'Embodied/Construction Emissions' are the greenhouse gas (GHG) emissions arising from the construction phase of the project
- 'Operational Emissions' are those arising from the operation phase, and any modal shifts that may occur as a result
- 'Climate Risk' refers to the potential threats to any of the options arising from Climate Change and its effects, such as from increased flooding.

Embodied/Construction emissions

Construction GHG emissions will be similar for Options A and B where their routes are coincident. When the routes differ, Option A will likely generate less construction GHG emissions compared to Option B as it is 1km shorter and, according to the 2011 assessment, requires approximately 417,000m^3 of imported material compared to

3,737,000m^3 for Option B. The smaller quantity of materials will result in less embodied carbon emissions, including emissions associated with the transportation of materials. In addition, the construction works for Option A are relatively minimal compared to Option B, hence the likelihood of less construction GHG emissions. Where mature landscape elements are lost to proposed infrastructure, this results in a loss of carbon sink, which negatively impacts GHG emissions. It is expected that this will be less of an impact for Option A as the route is closely aligned to the disused railway and vegetation clearance is assumed to be reduced.

As no new infrastructure would be required for the bus-based Option C, it can be assumed that there will be no GHG emissions from the construction phase.

Operational emissions

Operational GHG emissions are likely to be commensurate between Options A and B. Options A and B are likely to result in less operational GHG emissions from user emissions compared to alternative options as rail generates 47% fewer GHG emissions (gCO_2e) per passenger km compared to buses and coaches. Options A and B have the potential to transition to electrified services in the future, and are also able to support freight journeys (removing up to 25 articulated HGVs per single freight train).

Option C will not be able to support freight transport and so will not play a part in removing GHG emissions from road transport in the future. Whilst the improved bus service will reduce the reliance on private vehicle transport, the GHG emissions associated with bus travel will still exceed those associated with rail transportation. There is the potential for bus services to use an electric or hybrid fleet which may help reduce GHG emissions in the long-term.

Climate risk

As all options are in the same locality, the likelihood of a hazard occurring is largely equal for each option. The removal of vegetation for the required infrastructure is likely to make the scheme more vulnerable to climate change impacts, although it is assumed that vegetation clearance for Option A will be minimised compared to Option B. A flood risk assessment in 2011 of both the Boyne and Blackwater bridge sites showed that the

proposed scheme will not increase the risk of flooding and there will not be any further encroachment of the floodplain at the River Boyne crossing.

As Option C (bus-based alternative) is based on existing infrastructure, the climate risk of this option is not made any worse: for example, there will be no further encroachment onto floodplains possibly resulting in increased flood risk, and there will be no change to the existing land-use along the current route.

Overall, Option A was given a **Neutral** scoring, while Option B received a **Minor Negative** score. Option C was assessed as a **Minor Positive.** As Option 0 would ultimately result in growth in traffic levels over time and does not provide any alternative transport solutions for people along the M3 corridor, it represents a **Moderate Negative** in terms of climate.

14.3.3 Noise & vibration

As indicated in 2011 EIS, both railway alignments (Option A and the majority of Option B that is coincident with Option A) are likely to cause significant operational noise impacts in the vicinity (mainly within <50m to noise and/or vibration sensitive receptors) of their proposed corridors. These potential impacts are considered to be major negative at closest approach of the proposed track to the sensitive receptors for both Options A and B. However, with appropriate mitigation[50], these impacts can be reduced to **Minor Negative** overall.

It is important to note that the mitigation requirements would vary between Options A and B; with these differences for sections of the railway described as follows:

- Option A runs through a more rural area to the south of the M3 near Dunshaughlin, therefore the number of noise sensitive receptors within close proximity is much less in comparison to Option B. This is likely to result in lower mitigation requirements for Option A.

[50] At this stage, it is assumed that the noise and vibration mitigation measures recommended in EIS 2011 can be implemented with no limitations. It is understood that, in detailed design stage, feasibility of these mitigation measures would be evaluated considering any relevant physical (e.g. available space, buildability, potential impacts on landscape and/or air quality) and planning constraint.

- The nearest receptors to the proposed Dunshaughlin station are located beyond 300m for Option A, whereas for Option B the distance between the station and the nearest receptors is below 200m. Also, in Option A the number of receptors is much lower compared to Option B. This may require more careful planning and the introduction of best practices for Option B in order to minimise noise emissions from public address systems, car parks and access roads.
- Overall noise emissions from Option A are likely to be lower compared to Option B due to the track length and construction requirements. Option A is approx. 400m shorter in comparison to Option B.

Please note that the difference in overall noise emissions does not suggest a difference in noise exposure at receptors. This observation does not consider presence of receptors.

Option C, the bus-based alternative, is likely to cause negligible increases in road traffic noise levels along the major part of the proposed bus route where existing road traffic is assumed to be relatively high. However, at locations with relatively low existing traffic flows (e.g. the bus route section between the M3 and R161), the operation of the proposed bus service may increase road traffic noise levels by up to 5 dB which is likely to cause operational noise impacts not greater than moderate negative. With appropriate mitigation in the form of, for example, noise barriers, low noise surfacing along certain sections of the route, lowering traffic speeds and/or employing quieter buses (e.g. electric vehicles), the operational noise impacts from Option C can be reduced to **Negligible** impact.

14.3.4 Landscape & visual

Option A was subject to a comprehensive Landscape and Visual Impact Assessment (LVIA) in 2011. The 2011 LVIA noted that the proposed route would result in a number of effects on the landscape and visual quality of the area. It was identified that the majority of effects associated with the scheme would occur from the additional infrastructure such as roads, stations and bridges, and also from the loss of hedgerows and trees along the corridor of the proposed railway. The most significant effects would likely arise from a

loss of mature landscape elements such as trees, woodlands and hedgerows where double-tracking would require widening the existing rail line, or where new road embankments/alignments are proposed. Some listed views would be impacted during construction (mainly by construction cranes); however, it was determined that no significant effects would remain on any listed views or prospects following the completion of construction works. In addition to this, the local character in the areas where the new stations were proposed would be affected, as well as areas where vegetation would be removed during realignment works and railway line construction. For example, the loss of vegetation would give rise to local landscape character effects along the River Boyne and River Blackwater.

A mitigation plan was prepared showing vegetation to be replanted, either in the same locations as before, where possible, or in appropriate locations nearby (according to the 2011 EIS). The assessment concluded that landscape mitigation measures would over time reduce the identified potential landscape and visual effects and also reduce their residual significance to localised effects. Option A was therefore scored as a **Minor Negative.**

Option B largely follows the route of Option A, except where it deviates for 14.7km between approximately chainages 7300m - 22000m to run east and north of Dunshaughlin. A desk-based map review of landscape designations indicates that it comes quite close to a number of protected views, the most significant being the protected views from Skreen Church and designated panoramic views of the surrounding countryside located to the north west of Dunshaughlin, which will be in the aspect of this route option. The scheme also passes through green fields which appear to consist of good quality pasture. There is the potential that the landscape character will be altered in the areas where the deviated section of the route would be located. As Option B runs closer to these designations and the character areas north and east of Dunshaughlin in comparison to Option A, it was scored as a **Moderate Negative.**

Option C uses existing infrastructure, and as no groundworks would be required there would be **no additional impacts** to landscape and visual receptors.

14.3.5 Biodiversity

Option A crosses the River Boyne and the River Blackwater Special Area of Conservation (SAC) and Special Protection Area (SPA). The Option A EIS produced in 2011 concluded that it would not affect any of the qualifying habitats or species of these designated sites.

This option also crosses the Tolka River, which holds populations of wild brown trout and sea trout, and the Skane River east of Drumree. The same EIS concluded that with mitigation the residual impacts on the aquatic environment would be localised and primarily temporary in nature.

Option A passes over the eastern end of the Pelletstown wetland which is considered to be of County value as it supports significant numbers of wintering snipe and breeding frogs. As this option would result in the loss of between a quarter and a third of this wetland, as well as the likely abandonment by snipe, the 2011 EIS for Option A concluded it would have a major negative impact on this site.

Where this option crosses agricultural land, these are mostly large improved grassland fields which appear reseeded with common agricultural grasses and as such are of low ecological interest. This option largely follows the disused Dublin to Navan railway line. In the south of Option A this supports unimproved grassland, hedgerows and scrub, some of which is developing towards woodland. These habitats are largely limited to this part of the route and support species such as badger. Signs of the former railway are less distinct in the north of Option A due to reincorporation into farmland, though there is often still a line of trees and hedgerows. Hedgerows are therefore present along almost the entire route and despite some gaps, are considered to have local conservation interest as ecological corridors in the agricultural landscape. Although this option would result in the loss of much of the habitats associated with this former railway line, as well as dissect or result in the loss of hedgerows along much of the route, the 2011 EIS for Option A concluded that with mitigation in the form of replacement planting this option would have a minor negative impact on these habitats.

Overall, and recognising the early stage of this project, given best practice construction and operation mitigation measures, it is considered that the impact of Option A on

ecological interests can be considered to be **Minor Negative** as it goes though the wetland at Pelletstown.

Option B crosses mainly agricultural land, especially large improved grassland fields, most of which appear to have been reseeded with common agricultural grasses with a resulting low plant species diversity. As such, these fields are considered likely to be of low ecological interest.

A significant number of hedgerows are present along Route B and form important ecological corridors in the agricultural landscape, especially in the southern section of this option where the hedgerows are in good condition. In the north of Option B, the hedgerows tend to have more gaps and as a result have reduced value as an ecological corridor. With appropriate mitigation in the form of replacement planting, it is considered this option would likely have a minor negative impact on these habitats.

On two occasions Option B crosses the Tolka River, which holds populations of wild brown trout and sea trout. The route also crosses a section of the Broadmeadow east of Dunshaughlin. As with the other rail option, with mitigation the residual impacts of Option B on the aquatic environment are considered likely to be localised and primarily temporary in nature.

Overall, and recognising the early stage of this project, given best practice construction and operation mitigation measures, it is considered that the impact of Option B on ecological interests can be considered to be **Minor Negative**, albeit there is currently uncertainty over the ecological interest along some of Option B.

With regards to Option C, a bus-based alternative, as this route would make use of the existing road network which is already used by buses (e.g. Intercity Service 135 and Bus Service 109B), no new infrastructure will be provided by this option. Although the option would utilise some of the new BusConnects infrastructure at Blanchardstown, this is being considered and provided separately as part of a different business case. Overall, and recognising the early stage of this project, given best practice operation of this option, the impact of Option C on ecological interests was scored as **None / Negligible.**

14.3.6 Cultural, Archaeological & Architectural Heritage

Option A was subject to a comprehensive Cultural Heritage assessment in 2011. This noted that the proposed route follows the existing railway line for large sections but will have to deviate from the original railway line to cross greenfield. 36 recorded archaeological monuments were identified within a study area around the proposed route, while a further 38 Areas of Archaeological Potential were identified during the field survey of the route.

The Cultural Heritage assessment identified physical impact to one recorded archaeological monument which will require archaeological excavation to mitigate, while screening will be required along the railway line to mitigate impact to the settings of 8 assets. Wade survey and photographic recording were identified as requirements for 12 Areas of Archaeological potential, while archaeological investigation was proposed at six locations. As such, this option was given a **Minor Negative** score.

Option B mostly follows the route of Option A, except where it deviates for 14.7km between chainages 7300m and 22000m. It passes four recorded archaeological monuments and crosses one protected structure on this section. A review of the existing mapping shows that it crosses 15 townland boundaries which are considered areas of archaeological potential while one area of definite marginal ground was noted which would be considered an area of archaeological potential. The scheme passes through greenfield which appears to consist of good quality pasture. There is the potential that archaeological remains could be encountered anywhere along this. Combined with its common sections with Option A, Option B has 33 recorded archaeological monuments within a study area around the proposed route, with a possible 36 Areas of Archaeological Potential. This option was therefore assessed as **Moderate Negative** due to the potential to encounter previously unrecorded archaeological assets along the greenfield section.

Option C, which is the bus-based alternative, would use existing infrastructure along its route, and will require no additional groundworks. As such, this option was scored as **No Impact.**

14.3.7 Land use, soils & geology

With respect to geology, no significant impacts are foreseen for Option A. In terms of soils, potential negative impacts may arise from the removal of topsoil and shallow subsoils during excavations, while infill earthwork will mainly relate to the import and compaction of acceptable fill material. This excavation of soils and importation of fill would lead to the depletion of non-renewable natural resources, with a far greater quantity of fill material required for Option B than for Option A. Both options will also lead to a loss of agricultural land, although this amount is relatively small in comparison to overall land use in County Meath and nationally.

Due to these impacts on land and soil, both Options A and B were scored as a **Minor Negative.** As Option C would use existing roads, no additional significant impacts are anticipated for this option.

14.3.8 Water resources

A 2011 hydrology assessment indicated the impact of Option A on hydrology would be imperceptible to slight in respect to river and stream flow, flooding and flood risk, channel morphology and sedimentation processes and water quality. As Option B largely follows the same alignment as Option A, the hydrology impacts are likely to be largely similar. The excavation of soils and creation of embankments for both options may lead to changes to infiltration rates, potentially impacting groundwater levels locally. For Option A, these impacts were scored as **Negligible** given that it mostly follows the existing alignment. Option B, on the other hand, was scored as a **Minor Negative** as more cut-and-fill is required along its longer route than Option A, with larger potential impacts to groundwater and surface quality. This option is also within close proximity to a number of identified wells.

Option C, the bus-based option, is not likely to have an impact on groundwater levels, as the bus routes will use existing infrastructure. There may be impacts on groundwater and surface water quality in the event of any accidental losses of fuel or oils from buses while operating, however such effects are likely to be **Negligible** in the context of the existing road use.

14.3.9 Summary of environmental impacts

The potential environmental impacts of each option (summarised in Table 14-7 below) mainly stem from the construction phase, as well as the impacts of noise, air and greenhouse gas emissions during the operation phase. Construction impacts for the two rail routes have the potential to result in negative environmental impacts overall, particularly for Option B where it deviates from the existing alignment and would require the construction of a brand new alignment. Although both the Do-Nothing scenario and Option C would use existing infrastructure and would have no additional construction impacts, a continuation of the present car-dependent situation is also likely to lead to negative impacts in terms of climate, air quality and noise.

Operational impacts, particularly in terms of greenhouse gas emissions, are more difficult to determine. While a shift from private car use is generally positive, the ongoing environmental impact of this shift will ultimately depend on factors such as the operating fuel of each option, the extent and source of the modal shift, and the relative carbon intensity of alternative modes of transport in the future.

Table 14-7: Summary of environmental impacts

	Do-Nothing (Option 0)	Option A (Rail)	Option B (Rail)	Option C (Bus)
Air Quality	Moderate Negative	Minor Positive	Minor Positive	Minor Negative
Climate	Moderate Negative	Neutral / No Impact	Minor Negative	Minor Positive
Noise & Vibration	Neutral / No Impact	Minor Negative	Minor Negative	Neutral / No Impact
Landscape & Visual	Neutral / No Impact	Minor Negative	Moderate Negative	Neutral / No Impact
Biodiversity	Neutral / No Impact	Minor Negative	Minor Negative	Neutral / No Impact
Cultural, archaeological & architectural heritage	Neutral / No Impact	Minor Negative	Moderate Negative	Neutral / No Impact
Land Use, Soils & Geology	Neutral / No Impact	Minor Negative	Minor Negative	Neutral / No Impact
Water Resources	Neutral / No Impact	Neutral / No Impact	Minor Negative	Neutral / No Impact
Total Score	Minor Negative	Minor Negative	Minor Negative	Neutral / No Impact

14.4 Accessibility & social inclusion

14.4.1 Accessibility for vulnerable groups

As established in Section 7, Options A and B are likely to result in improvements in accessibility for more vulnerable users, particularly those without cars, such as young people, the elderly or those with physical or mobility impairments. Trains and stations will be fully accessible for all users, meaning that these options both received a **Major Positive** score.

While it has been assumed that any buses in Option C would be fully wheelchair-accessible, the train offers some advantages over the bus in terms of accessibility due to more spacious carriages, easier boarding/alighting, and features that increase the comfort of users' journeys, such as toilets and dedicated wheelchair spaces. The bus-based option would also have significantly less capacity than the train, meaning that any

accessibility improvements are provided to a much smaller population. As a result, Option C was given a **Minor Positive** score.

14.4.2 Accessibility in deprived geographic areas

As shown in Section 7, the proposed stations in Navan would be located in areas that have been identified as disadvantaged, meaning that any improvements in accessibility to employment, education and services are likely to disproportionately benefit those in disadvantaged areas. Option B would also improve accessibility in some less advantaged areas in Dunshaughlin compared to Option A, although the differences are considered too marginal to have an impact on the overall scoring. As a result, both Options A and B were given a **Moderate Positive** score.

Option C, the bus-based alternative, would not significantly improve accessibility in deprived geographic areas compared to existing services and was therefore given a **Neutral** score.

14.4.3 Community wellbeing

Analysis of survey results from Navan and County Meath residents revealed great support in the local community for the reinstatement of a rail link from Dublin to Navan. Many residents expressed great frustration with the length, quality and reliability of their current commutes, particularly to Dublin, which accordingly leaves them feeling tired, stressed and struggling to find the time to fully participate in family and community life. While the extent of this impact will ultimately depend on whether the scheme is successful in delivering a quicker and more reliable transport solution in County Meath, many expressed a strong belief that a rail line to Navan would enhance community wellbeing and social inclusion by improving journey times and reliability, and freeing up more time and energy to participate in social and community activities within County Meath. As a result, both rail options were given a **Minor Positive** score. Option 0 (Do-Nothing) was given a **Minor Negative** score, while Option C (the bus-based option) was considered to be **Neutral**.

14.4.4 Summary of Accessibility & Social Inclusion impacts

The Accessibility & Social Inclusion impacts of a scheme are generally difficult to measure, and often relate to how different groups of users experience and perceive a particular transport solution. Generally, the MCA showed both rail-based options to have a positive impact on this criterion, by providing a high-capacity transport solution that is designed to be accessible to all users. In addition, there is great support within the community for a rail link, and a perception that the railway would enhance residents' ability to fully participate in family, social and community life. In contrast, Option 0 (Do-Nothing) and Option C (the bus-based alternative) were considered to be more neutral in this category, and are not considered to fundamentally improve accessibility and social inclusion to the same extent as the rail option.

Table 14-8: Summary of Accessibility & Social Inclusion impacts

	Do-Nothing (Option 0)	Option A (Rail)	Option B (Rail)	Option C (Bus)
Accessibility for more vulnerable users	Neutral / No Impact	Moderate Positive	Moderate Positive	Minor Positive
Accessibility in Deprived Geographic Areas	Neutral / No Impact	Moderate Positive	Moderate Positive	Neutral / No Impact
Community wellbeing	Minor Negative	Minor Positive	Minor Positive	Neutral / No Impact
Total Score	*Neutral / No Impact*	*Moderate Positive*	*Moderate Positive*	*Neutral / No Impact*

14.5 Integration

14.5.1 National Land Use policy

This criterion considers how the options align with *Project Ireland 2040* and the *National Development Plan*; specifically the National Strategic Outcome of Compact Growth, which ***"aims to secure the sustainable growth of more compact urban and rural settlements supported by jobs, houses, services and amenities, rather than continued sprawl and unplanned, uneconomic growth."*** Within this criterion, options were assessed based on how well they connect to key population, employment and retail centres.

Broadly speaking, all options will have a positive impact in this category as they will improve integration between population and employment centres in Dublin and Navan. Option C, the bus-based alternative, was scored as a **Major Positive** as the proposed route will go through the centre of most towns along the route, including Navan, Dunshaughlin and Dunboyne. Between the two rail options, the main differences arises over the location of Dunshaughlin station. In Option A, the proposed station will be about 1.5 kilometres from the town in a largely rural setting, and is less well integrated with the main built-up areas in Dunshaughlin than Option B. As a result, Option A was given a **Moderate Positive** score, while Option B was given a **Major Positive** score.

14.5.2 Local Land Use policy

As outlined in the Impact Assessment, the provision of a rail line between M3 Parkway and Navan remains a key objective of Meath County Council, and it has made provisions in successive Development Plans to protect the proposed alignment (as identified in 2011) from development that would impede its future delivery. As Option A corresponds to this alignment, it was given a **Major Positive** score in terms of Local Land Use Policy.

While Option B would still fulfil the council's ultimate objective of providing a rail route between Dublin and Navan, it would require a new alignment around Dunshaughlin for which provision has not yet been made by Meath County Council. As such, Option B was given a **Moderate Positive** score.

As Option C would not result in a new rail connection or a significant improvement in accessibility within Meath, it was scored as **Neutral**.

14.5.3 Active travel

This sub-criterion considers how well each option integrates with existing and proposed active travel infrastructure, and how it facilitates active travel and multi-modal trips.

As outlined previously, the proposed Navan Rail Line would link to several proposed and existing greenways, such as the Royal Canal Greenway, Boyne Greenway, and Boyne Valley to Lakelands County Greenway. In addition to existing infrastructure, new dedicated pedestrian and cycling infrastructure will be provided to link the proposed rail stations with their town centres, residential areas, and other relevant points of interest. As a mode of

transport, rail is generally suitable for active travel and multi-modal trips, with most trains providing dedicated bicycle storage space that allows travellers to bring their bikes on the train. There is also more space at stations to provide secure bicycle parking, and these facilities will be provided at all stations on the route.

While both rail options are therefore expected to have a positive impact in this criterion, the main difference between options is again linked to the station locations in Dunshaughlin. As Option A is located further from the main population centres on the other side of the M3 Motorway, this severance is likely to discourage walking and cycling to the station compared to Option B, where the Dunshaughlin station is better integrated with the town and local population centres. As a result, Option A received a **Moderate Positive** score, while Option B received a **Major Positive** score.

While Option C would likely lead to some improvements in Active Travel integration by improving transport links to the Active Travel infrastructure described above, the inability to bring bikes on board and the lack of dedicated cycling facilities at most stops means that it is likely to be less successful in this category than the rail-based options. It therefore received a **Minor Positive** score.

14.5.4 Public transport

Options A, B and C would all connect to the public transport network in Meath and Dublin and would improve the integration of public transport services. Option C (the bus-based alternative) would feature numerous connections to the BusConnects network, including at Blanchardstown, along the Navan Road and in Dublin city centre. It would also connect directly to the DART network with the proposed future stop at Navan Road Parkway railway station, where travellers would be able to use the wider DART network to reach other parts of the city.

However, the creation of a high-capacity rail corridor between Dublin and Navan will deliver a central spine that has the ability to integrate more modes of transport than a bus-based alternative. Firstly, the two rail-based options will enable passengers to easily connect to other rail services at stations along the line. In particular, the service will feature a stop at the proposed Glasnevin station, where passengers will eventually be able to

transfer to other DART services to Heuston station, the Docklands and southwest Dublin. Glasnevin station will also be the location of a MetroLink station, which will allow passengers to easily travel to Dublin Airport, Swords or Dublin city centre. In addition to DART and MetroLink, existing connections are available to the Luas at Broombridge and Connolly stations, and to numerous bus services at different stations along the route.

As a result, Options A and B represent a **Major Positive** improvement in public transport integration, while Option C was scored as a **Moderate Positive**.

14.5.5 Summary of integration impacts

The integration criterion considered how well each option promoted the integration between people and places, such as different land uses, active travel infrastructure and other forms of public transport. The two rail-based options would have a major positive impact on integration, as it would create a new high-capacity public transport spine in Meath that could support complementary land uses and multi-modal trips. While Option C would be well integrated with key land uses and with other transport services, the capacity differences between bus and rail mean that it is unlikely to promote integration to the same extent as Options A and B. Rail as a mode is also more conducive to integration with active travel modes, meaning that it performed better in this criterion.

Table 14-9: Summary of integration impacts

	Do-Nothing (Option 0)	Option A (Rail)	Option B (Rail)	Option C (Bus)
National Land Use Policy	Neutral / No Impact	Moderate Positive	Major Positive	Major Positive
Local Land Use Policy	Neutral / No Impact	Major Positive	Moderate Positive	Neutral / No Impact
Active Travel	Neutral / No Impact	Moderate Positive	Major Positive	Minor Positive
Public Transport	Neutral / No Impact	Major Positive	Major Positive	Moderate Positive
Total Score	*Neutral / No Impact*	*Major Positive*	*Major Positive*	*Moderate Positive*

14.6 Conclusion

Multi-Criteria Analysis was used to compare the relative advantages and disadvantages of the four transport options considered for the Dublin-Navan corridor: one representing a continuation of the status quo, two representing the reinstatement of the Navan Rail Line between M3 Parkway and Navan along slightly different alignments, and one representing the provision of enhanced express bus services. As the population of Navan and the M3 corridor is likely to grow over the coming decades and given existing transport and traffic conditions in the area, it is likely that 'doing nothing' will lead to a deterioration in conditions for existing and future years. Trends over the past decade have shown increasing levels of traffic, higher journey times and progressively worse reliability along the M/N3 corridor, meaning that a lack of alternative transport solutions is likely to result in negative economic, social, and environmental outcomes for the region.

The comparison between options is summarised in the table below, and these results suggest that the reinstatement of the Navan Rail Line has the potential to deliver some significant benefits along the Dublin-Navan corridor. In terms of economy, slightly lower journey times, improved reliability, and increases in transport capacity would be expected. In terms of accessibility and social Inclusion, it would also provide a fully accessible service to more vulnerable users and deprived geographic areas. Finally, a high-capacity rail line would represent a strategic asset, greatly improving the integration of land uses, transport services and active travel infrastructure. While two potential rail options –

Option A and Option B – are largely similar overall, there are some subtle differences between the two that need to be considered. The main advantage of Option A is that it largely follows the existing alignment and land reservation, which is likely to reduce the cost and environmental impact of constructing the scheme. Option B however may be preferable in terms of the location of Dunshaughlin station, which – due to its closer proximity to the town – offers advantages in terms of station accessibility, active travel integration and user security.

Option C, which proposes an enhanced, express bus service offers clear benefits over the current situation, including greater frequencies, improved reliability and more accessible buses. However, it is limited in terms of capacity, which means the benefits of such an option are likely to be spread out over a much smaller population than the rail-based options, and is not likely to represent a transformational shift for the region in its proposed specification. It does, however, offer some advantages in terms of cost and environment, as it uses the existing road network and would not result in any construction impacts.

Table 14-10: MCA summary

	Do-Nothing (Option 0)	Option A (Rail)	Option B (Rail)	Option C (Bus)
Economy	Minor Negative	Minor Positive	Minor Positive	Neutral / No Impact
Safety	Minor Negative	Neutral / No Impact	Minor Positive	Neutral / No Impact
Environment	Minor Negative	Minor Negative	Minor Negative	Neutral / No Impact
Accessibility & Social Inclusion	Neutral / No Impact	Moderate Positive	Moderate Positive	Neutral / No Impact
Integration	Neutral / No Impact	Major Positive	Major Positive	Moderate Positive

15. Appendix A

15.1 Potential built constraints

Potential built constraints have been identified from a desktop review of mapping and publicly available planning history data from MyPlan.ie. A summary of these potential constraints is included in the following sections for Options A and B respectively. This section is intended to provide an overview of areas which will need to be reviewed in more detail to identify if existing / planned development will cause a physical constraint to the development of the Navan Rail Line within the respective route corridors.

15.2 Route A

Table 15-1. Route A – potential built constraints

Chainage / Maps Link	Image	Potential Constraint
East of chainages 37,150m – 36,700m Beaufort College, Navan.		Beaufort College is located adjacent to Option A. It should be confirmed if this encroaches on the proposed route.

Chainage / Maps Link	Image	Potential Constraint
West of chainages 37,000m – 37,150m		Extension of Duration (ref: NT140014) of parent permission NA803318 was granted in 2014 on lands adjacent to the route corridor. This extension of duration expired on 29/06/2019. No drawings are available online for the applications and this should be checked with Meath County Council. The applications appear to be in relation to the Lidl store, which is fully constructed; however, this should be confirmed.
Chainages 31,200m – 31,250m		Agricultural buildings partially encroaching on route corridor.

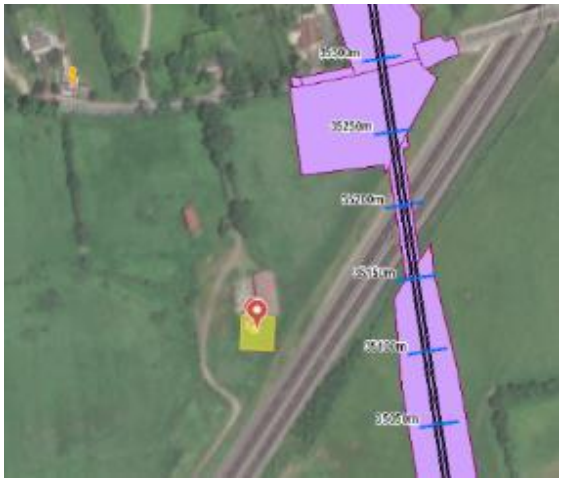
Chainage / Maps Link	Image	Potential Constraint
Chainages 31,000m – 31,100m		New dwelling constructed adjacent to route corridor. Garden of dwelling may encroach on route corridor (Planning refs: AA151435 / AA140925 / NA100318). Dwelling to south east is directly under the route corridor.
West of chainage 27,600m		Permission associated with new agricultural entrance. The site boundary partially encroaches on corridor (planning ref: DA120308).

Chainage / Maps Link	Image	Potential Constraint
North of chainage 26,400m. Telecommunications Structure built on foot of refused permission (RA170722).		Telecommunications Structure built adjacent to Option A on foot of refused permission (RA170722). This has been referred to Meath County Council to check if there are any existing permissions on this site.
South of chainage 26,350m.		Residential plot partially encroaches on route corridor (eastern portion of existing garden). DA140016 (extension of duration for new dwelling) refused to south of this on lands adjacent to route corridor.

Chainage / Maps Link	Image	Potential Constraint
Southwest of chainages 13,500m – 13,750m.		Permission granted for a new dwelling (ref: RA201291) which may partially encroach on the temporary land take.
Ch. 7km – 9km: Start of Route A north of M3 Parkway Station.		There is limited available construction space for temporary construction works between M3 Motorway and the rear of properties at Woodpark and Piercetown. A review of the required space should be undertaken particularly loss of existing mature trees and hedgeline, currently forming natural screening since the completion of the M3 motorway and alternative arrangements put in place where necessary. This site is required to facilitate the construction of the mainline railway.
Ch. 12km – 13km.		@ Ch. 12,450m, a 70m long farm shed extension on the former rail formation will also need to be acquired along with the main shed directly impacted by the mainline works.

Chainage / Maps Link	Image	Potential Constraint
Ch. 13km – 14km.		@ Ch. 13,700m, planning permission has been granted for a new dwelling which will be impacted by the southern approach of the realigned L2209 overbridge.
Ch. 18 – 20km.		@ Ch. 18,250m Location of Dunshaughlin Station. Lands available for station and P&R site. @ Ch. 19,420m as currently shown, the route clashes with an existing 750mm diameter 85bar gas main. At this location, the Railway Order (RO) drawings will need to be updated to reflect a proposal to divert gas main locally and provide sufficient clearance and protection under the proposed railway, which is in a slight cutting.
Ch. 22 – 23km.		The Option 2 Skane Valley Sewer diversion proposal has been adopted to divert the existing 450/600mm dia. foul sewer to minimise impact on mature trees on the edge of Dunsany Wood. From Ch. 22,350m the sewer is diverted on a slight embankment alongside the north side of railway but then crosses @ Ch. 22,900m to the south side of railway into a field to avoid Dunsany Wood. Extent of diversion to outfall @ Ch. 22,610m.

Chainage / Maps Link	Image	Potential Constraint
Ch. 24 – 28km.	 	@ Ch. 24,650m planning permission granted for extension to existing property bounded by mainline and realigned L62301 via new overbridge. Unclear if extension has been implemented. @ Ch. 26400m a 25m tall telecommunication tower has been constructed close to the railway and the northern approach of the realigned L6203 overbridge. Permission to replace this tower with a new 30m tall tower structure has been refused. @ Ch. 27020m location of Kilmessan Station. Lands available for station and P&R site. @ Ch. 27600m permission granted associated with new agricultural entrance. Existing access onto realigned L2202 to be reviewed.

Chainage / Maps Link	Image	Potential Constraint
Ch. 31 – 32km.		@ Ch. 31,000m new dwelling constructed in Assey on west side of railway. Existing access to this property to be maintained as part of the proposed accommodation works. 1st property in Assey @ Ch 31,180m is shown to be acquired, but 2nd agricultural property dwelling is shown in close proximity to mainline embankment @ Ch. 31,240m just before crossing of Boyne River. Potential impact on existing property to be assessed.
Ch. 33 – 35km.		Ch. 33,700m and Ch. 33,900m. Large proposed site compound areas required either side of M3 to support the construction works which include the 15m deep cutting and access to the existing box structure built as part of the M3 scheme. Retaining walls required to minimise potential impacts to adjacent properties either side of the cutting. Property ownership to be reviewed following completed M3 construction.
Ch. 35 – 36km.		Complex works required including new 80m long overbridge to M3 Navan South Link road, which is in an existing 10m deep cutting, and new retaining walls required to minimise potential impacts to adjacent properties either side of the proposed 10m deep railway cutting. @ Ch. 35,120m, permission has been granted for retention and operation of a 24m high telecommunications tower in close proximity to the railway line and proposed temporary work sites.

Chainage / Maps Link	Image	Potential Constraint
Ch. 36 – 37km.		@ Ch. 36,900m, Meath VEC Beaufort College has been extended. Potential impact on new building @ Ch. 37,000m and new all-weather pitch in close proximity to mainline which is in a slight cutting to be reviewed. @ Ch. 36,650m, proposed Meath CC R161 to R153 link road scheme has not been constructed. Provisional UB for the proposed link road where the mainline is on embankment to be confirmed.
Ch. 37 – 38 km.		@ Ch. 37,150m. A Lidl development is now located on the proposed temporary work site access road off R161 Trim Road. Appears that Planning Permission for a discount retail store on the southern adjacent site to Lidl has now expired. Provision for temporary access off R161 will need to be reviewed. @ Ch. 37,350m. Existing residential property on Trim Road immediately west of station site shown required for station temporary work site area and temporary access road, but not listed as permanently acquired. Review of acquisition status required. @ Ch. 37,430m. Location Navan Central Station. Noted that whilst the acquisition of the 3 no. large existing warehouses are indicated on the draft RO drawings for construction of Navan Central Station, the drawings do not indicate full acquisition of each building.

Chainage / Maps Link	Image	Potential Constraint
		
Ch. 38 – 39km.		@ Ch. 38,100m, disused railway gatehouse property adjacent to existing XK022 Commons Road Level Crossing on the Drogheda Freight Line is not listed as acquired. @ Ch. 38,500m. Beaufort Nursing Home now built in close proximity on the north side of the railway, where the Navan Line utilises the former Kingscourt Line.

Chainage / Maps Link	Image	Potential Constraint
Ch. 39 – 41km.		@ Ch. 39,100m, clarity on whether the 100m length of retail service/parking area on western boundary of Blackwater Retail Park is still potentially required. RO drawings show not acquired to minimise potential impacts. @ Ch. 40,480m. Location of Navan North Station. Lands available for station and large P&R site.

15.3 Option B

Table 15-2. Option B – potential built constraints

Chainage / Maps Link	Image	Potential Constraint
Ch. 5km – 6km.		Route continues on a high embankment. @ Ch. 5,260m, crosses the M3 motorway on a long skew over bridge. Adjacent land @ Ch. 5,400m shown as to be acquired.
Ch. 7km – 8km.		@ Ch. 7,900m existing horse training stables significantly severed by the route crossing the site diagonally on slight embankment. A new building constructed on the route now adds to the potential major impacts on this particular site.
Ch. 10km – 11km.		Route continues on a high embankment to cross R125 on north eastern outskirts of Dunshaughlin. @ Ch. 10,300m, Large residential estate is

		being built approximately 70-80m west of the railway corridor. Similarly property extension noted @ Ch. 10,800m.
Ch. 11km – 12km.		Route remains on 8-10m high embankment as it crosses a number of local roads including Bog Road via a new overbridge. @ Ch. 11,000m property shown as to be acquired. @ Ch. 11,400m, location of proposed Dunshaughlin Station North which needs to remain on a 10m high embankment due to the crossing of a number of local roads.
Ch. 12km – 13km.		@ Ch. 12,300m, route crosses the M3 via a long over bridge as the route heads due west back towards the former Navan railway formation northwest of Dunshaughlin. @ Ch. 12,900m – Number of plots of land acquired for the proposed crossing of L2208. However, since the FS 2009, there are now 3 no. new residential dwellings built where the new over bridge is proposed.
Ch. 16km – 17km.		As Option B will run along more of the former railway formation, a longer section of the existing Skane Valley Sewer running along the former rail formation will need to be diverted as described for Option A. Option B finally aligns with the Option A corridor to Kilmessan and Navan @ Ch. 16,750m just south of Dunsany Woods.

16. Appendix B

16.1 Transport modelling report

17. Appendix C

17.1 AECOM OMC reports