ATKINS

Member of the SNC-Lavalin Group

Navan Cycle Scheme – R147 Poolboy Bridge to Kells Road Roundabout

Part 8 Report

Meath County Council

November 2022

Notice

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Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 0	DRAFT	CC	DB	JMC	ST	Oct 2022
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Client signoff

Client	Meath County Council
Project	Navan Cycle Scheme – R147 Poolboy Bridge to Kells Road Roundabout
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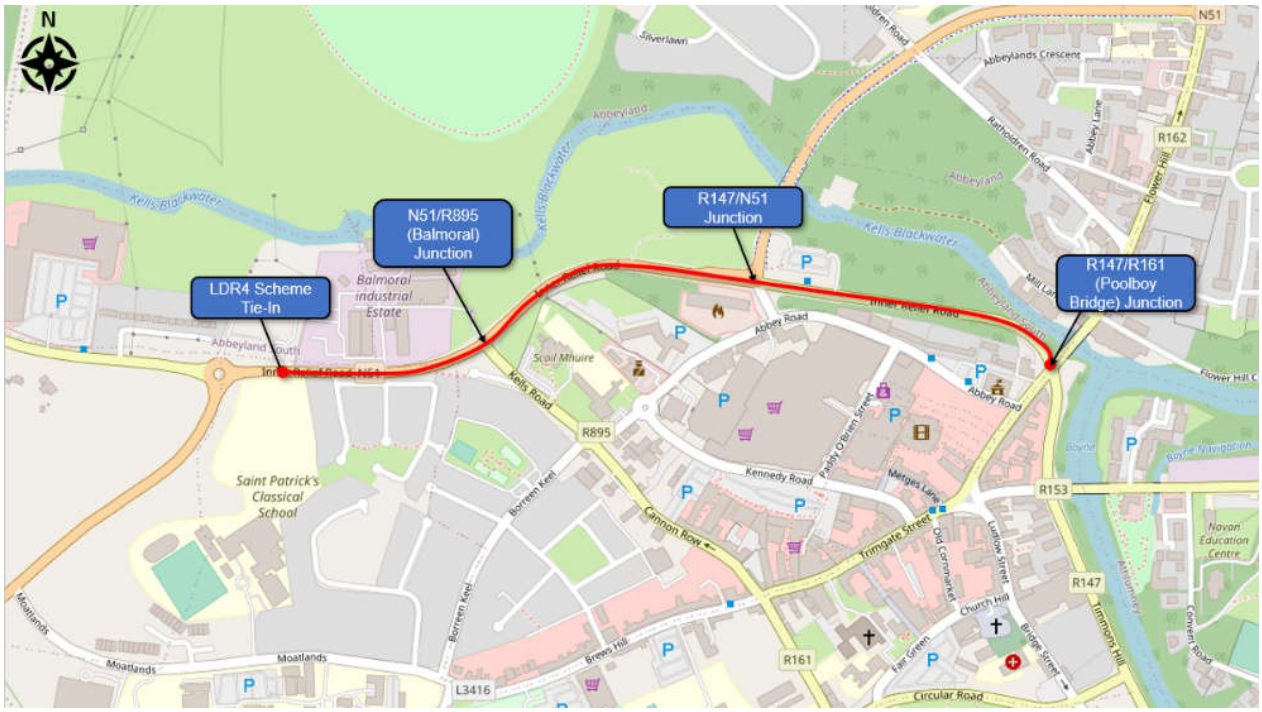
Contents

1. Introduction

1.1. Scheme Overview

Meath County Council (the Client/MCC) as the Contracting Authority, appointed Atkins (the Consultant) to provide Engineering-led Multi-disciplinary Consultancy and Design services for the concept development & option selection, preliminary design and statutory processes of cycle provisions and associated works including public realm and urban enhancements on the R147 from Poolboy Bridge to Kells Road in Navan, Co. Meath, as part of the Navan Cycle Scheme.

Figure 1-1 - Proposed Route Location



1.2. Stakeholder Consultation

Stakeholder Consultation has been undertaken with the following key stakeholders;

- National Transport Authority,
- Meath County Council,
- All other relevant bodies.

1.3. Part 8 Planning Documentation

This Part 8 planning report has been prepared in accordance with Part 8 of the Planning and Development Regulations, 2001 as amended. This report should be read in conjunction with the following complementary documentation (as appended):

- Drawings:
  - 5214376/HTR/DR/0001 – Site Context and Site Location Map
  - 5214376/HTR/DR/0003 – Site Location Map
  - 5214376/HTR/DR/0121 – General Arrangement Sheet 1 of 2
  - 5214376/HTR/DR/0122 – General Arrangement Sheet 2 of 2
- Appropriate Assessment Screening Report *(Atkins Ref: 5214376DG0034)*
- Environmental Impact Assessment Screening Report *(Atkins Ref: 5214376DG0035)*
- Traffic and Transport Analysis Technical Note *(Atkins ref. 5214376DG0044)*
- Flood Risk Assessment *(Atkins ref. 5214376DG0041)*

2. Purpose of the Scheme

2.1. Project Aim & Objectives

The overall purpose of the project is the delivery of a cycle network which will provide safe and attractive cycle routes, catering for all cycle users including commuters, leisure, and family cycling groups. Ultimately when the routes are delivered, they will help to improve safety, including a reduction in vehicle speeds and contribute towards an increased number of trips in the area by pedestrians and cyclists.

The objectives for the scheme are based on multi criteria requirements outlined by the Department of Transport in their report *'Common Appraisal Framework for Transport Projects and Programmes (March 2016, updated October 2021)'* (CAF). The multi-criteria headings are as follows:

- **Safety:** To reduce the potential for conflict between all road users along the routes through the provision of a facility which is in line with the current standards. The Scheme will seek to:
    - Reduce the frequency of conflict between all road users by providing a safer route for all users.
    - Improve priority for cyclists at junctions.
    - Improve safety for vulnerable road users and provide a better environment for vulnerable road users within the study area.
- **Physical Activity:** Provide improved opportunities for pedestrians and cyclists, thereby promoting physical activity, through improvements to footpaths and crossings, and the provision of new cycling facilities.
- **Environment:** To minimize impacts on the receiving environment.
- **Accessibility & Social Inclusion:** To improve accessibility for all road users and bring social inclusion benefits to those for whom non-motorized means are the predominate form of transit.
- **Integration:** To support the strategies set out in national and regional policies and guidelines.
- **Economy:** To provide an investment that offers good value for money.

Additional to the above CAF objectives, the following localised objectives are applicable:

- The route should be designed to provide a high Quality of Service (QoS) level, as per the National Cycle Manual.
- Improve local movement capabilities including access to Navan Town Centre from residential areas to the north and west of Navan for cyclists and pedestrians.
- Create a sustainable mode of active-travel access to the primary and secondary schools in the greater urban area of Navan.
- Provide a consistent and coherent standard of cycle facilities into Navan Town Centre.
- Improve pavement quality and width, increasing comfort for cyclists.
- Provide safe and convenient junction layouts for pedestrians and cyclists.
- Provide additional recreational links by linking the local communities to future Greenway and Cycling routes for Navan.

2.2. Design Principles

The cycle network has been designed in accordance with the guidance set out in the National Cycle Manual (NCM) and to provide a Quality-of-Service Level of A+ or A. Given the urban environment in Navan, the design was also considered in the context of the Design Manual for Urban Roads and Streets (DMURS).

It is also inherently critical that the cycle routes' requirements are balanced with the needs of pedestrians and that the requirements for vehicular traffic movement are appropriately considered.

The core principles which should be implemented in the development of a cycle network are;

- **Road Safety:** Measures should be implemented which increase safety and the perception of safety.
- **Coherence:** Route and link type should have continuity and layout to be obvious at junctions.
- **Directness:** Route should be direct, minimising delays and bestowing the advantage to cyclists.
- **Comfort:** Routes should be of adequate width and surface quality with minimal delays.
- **Attractiveness:** Route should be well maintained with landscaping and adequate lighting.

3. Planning and Policy Context

National, Regional and Local planning policy has been considered to ascertain compliance and is summarised below.

3.1. National Transport Policy

3.1.1. National Investment Framework for Transport in Ireland (NIFTI)

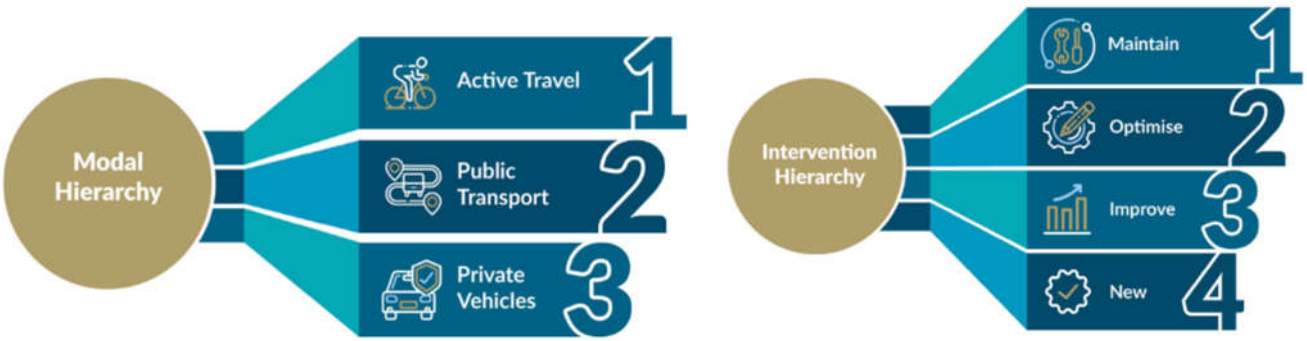
The purpose of NIFTI is to plan for how Ireland will invest in its transport system over the coming years and decades. As part of Project Ireland 2040, it notes that the population of Ireland will grow to almost 5.7 million people by 2040. This framework aims to improve the transport system while focusing on the most environmentally sustainable modes of transport so that the increase in demand brought on by the increased population is met sustainably.

NIFTI notes that decarbonising the transport sector is an urgent priority in the context of our climate change targets, and so aims to support sustainable mobility wherever it is feasible and encourage modal shift to these modes, namely active travel, and public transport. The Framework recognises that many of the same measures that reduce greenhouse gas emissions can also have a beneficial impact for other elements of environmental sustainability. Increased public transport and alternative fuel usage can help to improve air quality and reduce noise pollution, while active travel brings health benefits.

The four NIFTI Investment Priorities, which identify what will be invested in, are supplemented by modal and Intervention Hierarchies, which set out how NIFTI will undertake investment. It can be seen below in Figure 3-1 and Figure 3-2 that active travel is a core element of the four identified Investment Priorities and that NIFTI emphasises active travel as the most desirable mode of transport in the framework.

Figure 3-1 - NIFTI Four Investment Priorities (*source: gov.ie/transport)*

Figure 3-2 - NIFTI Modal and Intervention Hierarchies (*source: gov.ie/transport)*



As per the Intervention Hierarchy, NIFTI places emphasis on the use of existing assets (through maintenance, optimisation, or improvement), over the development of new. NIFTI recognises that investments in transport

networks and services, and the policies that drive these investments, can impact on the environment, and several environmental assessments have been carried out in parallel with its development, which includes a Strategic Environmental Assessment (SEA), which highlighted several potential impacts associated with the outcomes, Investment Priorities and Hierarchies proposed by NIFTI, as follows:

- Negative Impacts include, but are not limited to:
    - Short-term/localised negative impacts on water quality and increased noise pollution during construction.
    - Localised increases in pollution or increased CO2 emissions, or localised climate vulnerability such as flooding.
    - Long-term impacts on biodiversity, landscape, or cultural heritage features because of new infrastructure developments.
    - Long-term impacts because of land-take and changes in land use required for new developments.
- Positive Impacts include, but are not limited to:
    - Positive impacts to population and human health because of increased safety, with improvements to signage, adequate road surfacing, junction upgrades or realignment works.
    - Benefits for the economy, tourism and regional connectivity providing better social inclusion.
    - Reduced carbon emissions and improved air quality because of sustainable mobility developments.
    - Reduction in localised noise pollution and vibration because of development in sustainable and active travel modes and actions to promote electric vehicles.

3.1.2. National Cycle Policy Framework 2009 – 2020

The backdrop to this policy is the government's transport policy for Ireland. The NCPF sets out a suite of interventions to improve the ease and safety of cycling to achieve greater mode share going forward. The framework states that the focus needs to be on:

- Reducing volumes of through-traffic, especially HGVs, in city and town centres and especially in the vicinity of schools and colleges.
- Calming traffic/enforcing low traffic speeds in urban areas.
- Making junctions safe for cyclists and removing cyclist-unfriendly multi-lane one-way street systems.
- Paying special attention to integrating cycling and public transport.

Other interventions include the following:

- Schools will be a strong focus of the NCPF.
- Supporting the provision of dedicated signed rural cycle networks for Cycling Tourism.
- Ensuring surfaces used by cyclists are maintained to a high standard and are well lit.
- Ensuring that all cycling networks are sign-posted to a high standard.
- Supporting the provision of secure cycle parking at all destinations of importance.
- Integrating cycling and Public Transport, including cycle parking at stations, and the capability to carry bikes on Public Transport services.
- Creation of municipal bike systems to complement an improved Public Transport system.
- Ensuring proposals cater for a 10% modal share of cyclists.

The NCPF states that making provision for cyclists in the urban environment does not merely consist of providing dedicated cycling facilities, but also involves wider traffic interventions that benefit all vulnerable road users.

3.1.3. National Cycle Manual 2011 – Present

The National Cycling Manual (NCM) embraces the principles of Sustainable Safety, as this will offer a safe traffic environment for all road users including cyclists. The five principles of Sustainable Safety are described in the NCM (Section 1.1) and noted below:

- Functionality – i.e., the design which is fit for purpose is safer.

- Homogeneity – i.e., reducing the relative speed, mass and directional differences of different road users sharing the same space increases safety.
- Legibility – i.e., a road environment that all road users can read and understand is safer.
- Forgivingness – i.e., environments that contribute to benign outcomes of accidents are safer ("passive safety").
- Self-awareness – i.e., where road users are aware of their own abilities and limitations to negotiate a road environment, the environment is safer.

The NCM offers guidance on integrating the bicycle in the design of urban areas. Throughout the option selection and design process of this scheme the NCM is used.

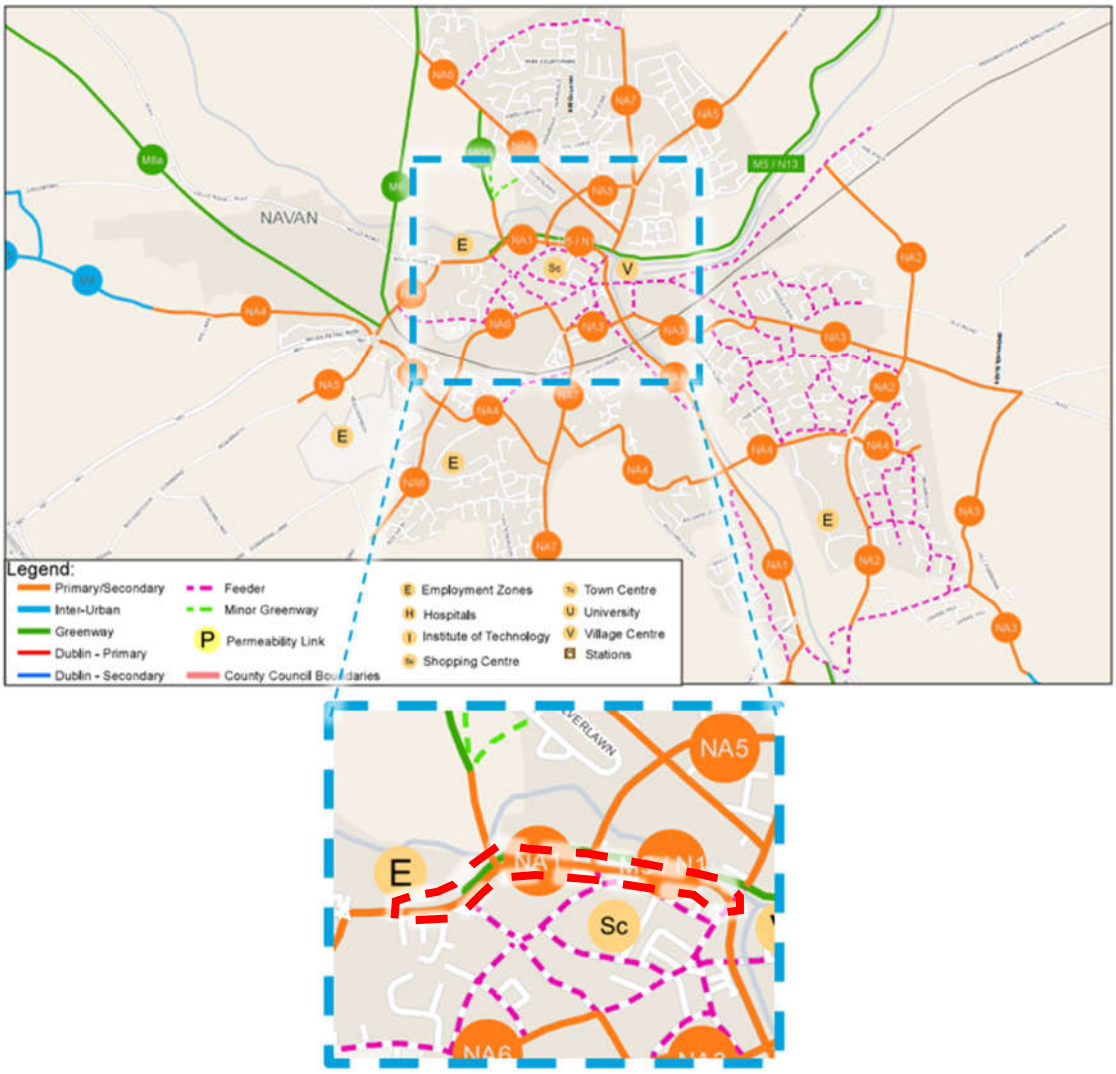
3.1.4. NTA Cycle Network Plan (Greater Dublin Area) 2013

The NTA Cycle Network Plan (Greater Dublin Area) was compiled to identify and determine in a consistent, clear, and logical manner, the urban cycle network at the primary, secondary and feeder levels in the greater Dublin area. Unlike area-based plans prepared previously by Local Authorities, this Cycle Network Plan is to be consistent across county boundaries such that there is continuity of route networks across these administrative boundaries. Within County Meath the study focused on establishing an inventory of the cycling facilities within the larger towns of the county and the existing primary facilities in Navan were assessed in the study to determine links throughout the town.

The NTA Cycle Network Plan sets out to develop a detailed understanding of cycling demand over a 10-year horizon period in the greater Dublin area. Over this 10-year period the demand for cycling in the GDA is forecast to increase due to two factors – population growth and the changes to the cycling mode share. The GDA Cycle model, developed as part of the Cycle Network Plan, provides a comprehensive representation of existing and projected future cycling demand patterns in the Greater Dublin Area. Trip assignment and route choice in the model is based on trip distance alone to provide a strategic plot of cycling desire lines on the network. The target is to provide a Quality of Service of Level B along all routes, regardless of the volume of demand.

Figure 3-3 shows the proposed routes for the Navan Cycle Scheme in relation to the NTA Cycle Network Plan. The R147 Poolboy Bridge to Kells Road Roundabout scheme (a section of "NA1") is noted as a Primary/Secondary Route. This section of road facilitates frequent cyclist and pedestrian movements due to its proximity to residential areas and amenities such as schools, sports clubs, and commercial properties. Tie-ins from this project to the existing R147/Flower Hill (Poolboy Bridge) and to the proposed "Local Distributor Road 4" (LDR4) Scheme integrate this project into the CNP as do the proposed Feeder Routes on Abbey Road and Canon Row.

Figure 3-3 - Routes in relation to the NTA Cycle Network Plan for the GDA



Greater Dublin Area Cycle Network Plan Primary / Secondary Routes, as shown above:

- M5/N13: Boyne Valley Greenway from Drogheda to Navan to Trim to the Royal Canal Greenway at Longwood.
- **NA1: R147 Dublin/Kells Road between the N51 and Old Balreask Woods.**
- NA2: Metges Road/ East Orbital.
- NA3: Fairgreen to Johnstown with a new bridge over the River Boyne.
- NA4: Southern Ring from Johnstown to Athboy Road.
- NA5: Northern Cross from Athboy Road to Slane Road.
- NA6: Windtown Road to Commons Road.
- NA7: Proudstown Road to Trim Road

3.1.5. Climate Action Plan 2021

The Climate Action Plan sets out a course of action over the coming years to address climate disruption, which is acknowledged as having diverse and wide-ranging impacts. The document outlines the aims for each sector of industry in Ireland. Electricity, Transport, Built Environment, Industry, Agriculture and Waste have all been assessed in the document with a roadmap laid out to deliver a reduction of emissions in each of these sectors between 2021 and 2030, and to reach net zero nationally by no later than 2050.

As part of the plans for a significant cut in transport emissions, the CAP states an objective of 500,000 extra walking, cycling and public transport journeys per day by 2030.

The promotion of walking, cycling and public transport, and a modal shift from the use of private vehicles will all contribute to the achievement of the targets set out in relation to climate action.

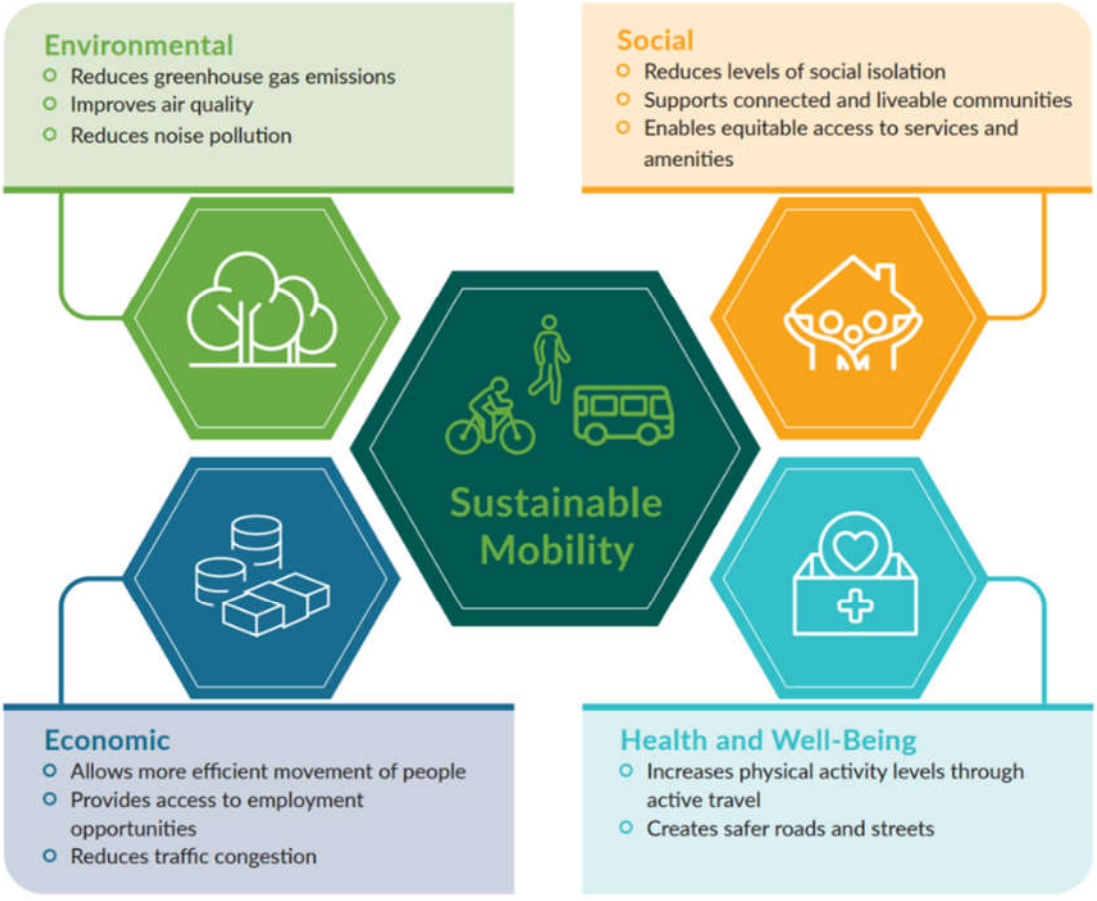
3.1.6. National Sustainable Mobility Policy

The National Sustainable Mobility Policy (NSMP) was published by the Department of Transport in 2022 and aims to achieve the high-level goal of "making it easier for people to travel by more sustainable modes – be that walking, cycling or public transport". The policy focuses on how to implement a more people-based transport network by encouraging healthier mobility choices, relieving traffic congestions, and improving urban environments while being cognisant of the climate crisis. This policy is set to accompany the Climate Action Plan 2021 and has the following targets;

- To deliver at least 500,000 additional daily active travel and public transport journeys.
- 10% reduction in kilometres driver by fossil fuelled cars by 2030.

The NSMP states the benefits of implementing sustainable mobility. In line with this policy, the implementation of the Navan Cycle Scheme will contribute to providing such benefits for the local populous in Navan and connecting towns, as shown in Figure 3-4:

Figure 3-4 - Sustainable Mobility Benefits ***(source: National Sustainable Mobility Plan)***



According to the NSMP, the above benefits can be achieved through ten goals, all of which are guided by three key principles, shown in Table 3-1.

Table 3-1 - NSMP Principles and Goals *(source: National Sustainable Mobility Plan)*

Principles	Goals
Safe and Green Mobility	1. Improve mobility safety.
	2. Decarbonise public transport.
	3. Expand availability of sustainable mobility in metropolitan areas.
	4. Expand availability of sustainable mobility in regional and rural areas.

Principles	Goals
	5. Encourage people to choose sustainable mobility over the private car. People Focused Mobility.
People Focused Mobility	6. Take a whole of journey approach to mobility, promoting inclusive access for all.
	7. Design infrastructure according to Universal Design Principles and the Hierarchy of Road Users model.
	8. Promote sustainable mobility through research and citizen engagement. Better Integrated Mobility.
Better Integrated Mobility	9. Better integrate land use and transport planning at all levels.
	10. Promote smart and integrated mobility through innovative technologies and development of appropriate regulation.

The Navan Cycle Scheme aims to deliver several of the goals above for all three principles, contributing to the shift to sustainable transport in Ireland.

3.2. Regional Policy

3.2.1. Regional Spatial and Economic Strategy (2019 – 2031)

The Regional Spatial and Economic Strategy provides a roadmap for effective regional development identifying key strategic assets, opportunities and challenges and sets out policy responses to ensure the people's needs are met. The document delivers a combination of response, design, and innovation; in how the Eastern & Midlands Region does business, delivers homes, builds communities and values land-use – creating healthy places and promoting sustainable communities. The RSES introduces the concept of a Growth Framework to achieve this integration as it is considered that regional growth cannot be achieved in linear steps. The report highlights Navan as a key location for development and sets out a policy objective to "support the promotion and development of greenway infrastructure and facilities in the Dublin Metropolitan area and to support the expansion and connections between key strategic cycle routes". The strategy sets out key objectives for cycling as follows:

- Provide safe cycling routes in towns and villages across the region.
- Investment priorities for feasibility and route selection studies for cycleways shall identify and subsequently avoid high sensitivity feeding or nesting points for birds and other sensitive fauna.
- Delivery of the National Cycle Plan within the region.

The Regional Spatial and Economic Strategy (RSES) published in June 2019 sets out an integrated policy to enable the creation of sustainable regions with the capability to be resilient to future climate change. The Regional Policy Objectives (RPOs) contained in the RSES are designed to promote efficiencies in water and energy use and the move towards a low carbon economy. They aim to encourage a modal shift towards green transport and energy options in addition to bolstering the robustness of local regional ecosystems through a regional green infrastructure strategy.

In the specific context of climate change RPO 7.30 refers to the preparation of a greenhouse gas inventory for the region to inform the preparation of a strategic mitigation action plan. RPO 7.31 requires Local Authorities to develop Climate Action Strategies (CAS) as well as local climate adaptation and mitigation strategies. The Meath Climate Action Strategy was adopted in September 2019. Scheme specific Regional Policy Objectives are shown below:

- RPO 7.30: Within 1 year of the adoption of the RSES, the Eastern and Midland Region Assembly (EMRA) shall seek with other stakeholders to carry out an assessment of transport emissions in the Region to identify greenhouse gas forecasting and to analyse the emissions impacts of development in the Region.
- RPO 7.31: Within 1 year of carrying out a regional emissions assessment, EMRA shall compile and publish an emissions inventory and, in collaboration with the relevant departments and agencies, agree emissions reductions targets in accordance with agreed national sectoral plans and to support an aggregate 40% reduction in greenhouse gas emissions by 2030 in line with the EU 2030 Framework.

The above RPOs are intrinsically linked to the modal shift towards green transport and subsequent reduction in greenhouse gases.

3.2.2. Meath County Council Development Plan (2021 – 2027)

The Meath County Council Development Plan states that a key priority for this Plan is the development of a sustainable transport system, promoting measures to increase the use of public transport, while also increasing the modal share for walking and cycling in towns and villages across the County. Its objectives align with current policies that focus on active travel, such as Ireland Project 2040, the NTA Cycle Network Plan (Greater Dublin Area) 2013, National Cycle Manual, among many others. MCC recognises the importance of both walking and cycling to the overall well-being and quality of life of residents. Walking and cycling trends are noted to vary across the county. This highlights the difference in the convenience of walking or cycling as an option, due to the level of connectivity, road safety and quality of facilities provided.

The Council engaged with the NTA to develop modal share targets for the promotion of measures to increase the use of public transport, while also increasing the modal share for walking and cycling in towns across the County. The Development Plan clearly sets out the development of cycling and pedestrian linkages with the following aims relevant to the Navan Cycle Scheme R147 Poolboy Bridge to Kells Road Roundabout, under the Movement Strategy Objectives and Policies (referenced as “MOV OBJ” and “MOV POL”, respectively).

- The Plan will seek to support and facilitate an increase in modal share for cycling and increases in the use of the bus network in the County.
- Inclusion of measures to improve the efficiency and sustainability of urban transport including improved and expanded public transport capacity; walking and cycling infrastructure; improved traffic management and bus priority; and better use of Intelligent Transport Systems (ITS), where appropriate.
- To promote the use of mobility management and travel plans to bring about behaviour change and more sustainable transport use.

It is the objective of the Council:

- MOV OBJ 3: To ensure that design for cycle infrastructure for all relevant developments shall be carried out in accordance with the Greater Dublin Area Cycle Network Plan, other relevant design standards or any successors to these documents.
- MOV OBJ 11: To provide bus priority measures on existing and planned road infrastructure, where appropriate, in collaboration with the NTA, Bus Éireann and TII.
- MOV OBJ 27: To implement, in conjunction with the NTA, the recommendations of the NTA strategy with regard to walking and cycling infrastructure.
- MOV OBJ 28: To revise road junction layouts, where appropriate, to provide dedicated pedestrian and cycling crossings, reduce pedestrian crossing distances, provide more direct pedestrian routes, and reduce the speed of turning traffic.
- MOV OBJ 29: To implement at appropriate locations pedestrian permeability schemes and enhancements.
- MOV OBJ 42: To develop and implement, in consultation with the Department of Transport a programme for the upgrading, improvement and maintenance of the non-national road network in the County.

The following are policies of the Council:

- MOV POL 8: To cooperate with the NTA and other relevant agencies to have ongoing reviews of the network of bus routes in Meath, and to support and encourage public transport operators to provide improved bus services in, and through the County.
- MOV POL 9: To ensure that the design and planning of transport infrastructure and services accords with the principles of sustainable safety, in order that the widest spectrum of needs, including pedestrians, cyclists, the ageing population and those with mobility impairments are taken into account.
- MOV POL 12: To support the implementation of recommendations presented in the NTA’s Transport Strategy for the Greater Dublin Area 2016-2035 and any subsequent reviews thereof. To ensure that design for cycle infrastructure for all relevant developments shall be carried out in accordance with the Greater Dublin Area Cycle Network Plan, other relevant design standards or any successors to these documents.
- MOV POL 17: To identify and seek to implement a strategic, coherent and high-quality cycle and walking network across the County that is integrated with public transport and interconnected with cultural, recreational, retail, educational and employment destinations, and attractions.
- MOV POL 18: To support the provision of a long-distance inter-connecting walking/cycling route(s) between the Irish Republic and Northern Ireland.
- MOV POL 19: To support the NTA in the development of a strategic pedestrian network plan for the main urban centres of the County.

- MOV POL 20: To encourage, where appropriate, the incorporation of safe and efficient cycleways, accessible footpaths, and pedestrian routes into the design schemes for town centres/neighbourhood centres, residential, educational, employment, recreational developments, and other uses.
- MOV POL 21: To require that adequate facilities for the secure parking of bicycles be provided at convenient locations close to public transport nodes and public transport interchanges.
- MOV POL 22: To prioritise the safe movement of pedestrians and cyclists in proximity to public transport nodes.
- MOV POL 28: To promote the carrying out of Road Safety Audits and Road Safety Impact Assessments on new road schemes, road and junction improvements and traffic management schemes in accordance with the TII Publication TII-GE-STY-01024 and advice contained in the DTTAS (DTO) Traffic Management Guidelines 2012.

3.2.3. Navan Development Plan

It is noted that the Navan Development Plan has been made redundant and has been incorporated into the Meath County Development Plan. The following is an extract from the MCC website[1]:

> *"Following the abolition of Town Councils and with the adoption of the Meath County Development Plan 2021-2027, all Town Development Plans are redundant and Planning policy and zoning relating to the former Town Councils are now incorporated into the Meath County Development Plan 2021-2027."*

[1] https://www.meath.ie/council/council-services/planning-and-building/development-plans/town-development-plans/navan-development-plan

4. Description of Existing Network on Proposed Route

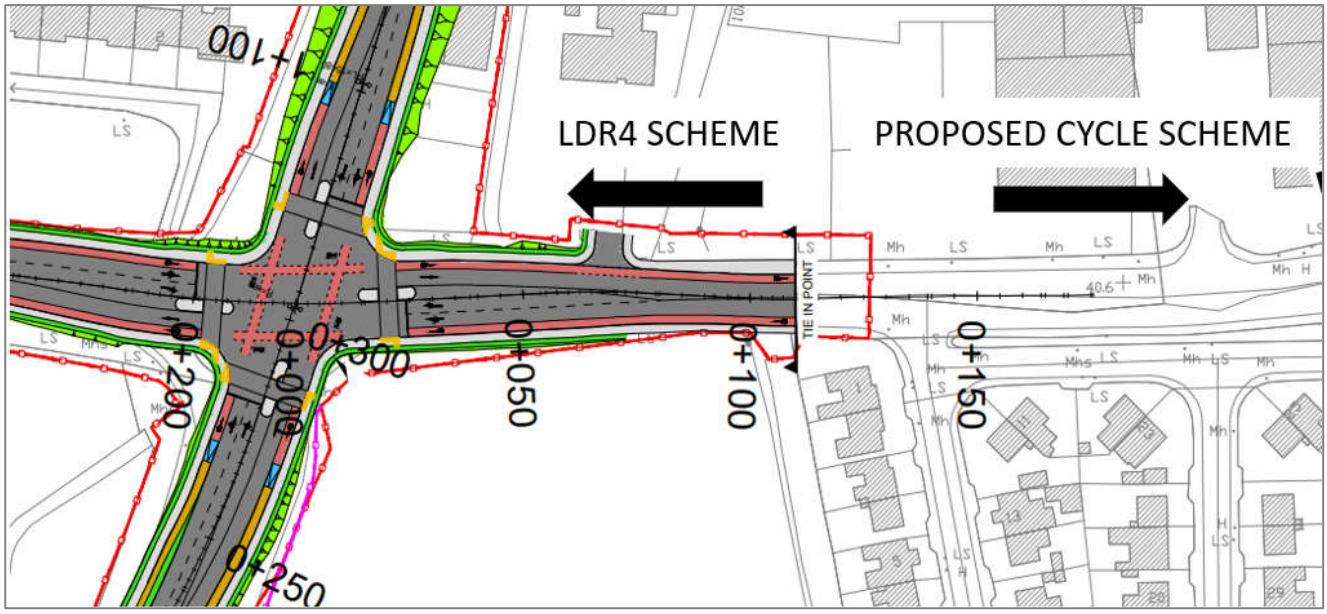
4.1. Road Network

The Project is located north of Navan Town centre, running to the south side of the River Blackwater. The eastern end of the scheme ties into the R147 / Flower Hill (Poolboy Bridge) while the western end ties into the proposed and permitted LDR4 Scheme at the Kells Road Roundabout. The scheme extents cover both the R147 and N51. The R147 Kells Road is designated as a regional road, originally the main route from Dublin to Kells through Navan prior to the construction of the M3. The N51 is designated as a national secondary road which runs from Delvin, County Westmeath and passes through Athboy, Navan and Slane, before terminating near Drogheda in County Louth.

Figure 4-1 – Existing Road Network

The typical cross section of the R147/N51 within the scheme's extents is a single carriageway (2 to 4 no. lanes) circa 7-14 m wide kerb to kerb with footpaths on both sides, bringing the total width (from back-of footpath to back-of footpath) to circa 11-18m. Public lighting columns are located at the back of the footpaths on both sides of the route. From the LDR4 Scheme Tie-in to the N51/R895 (Balmoral) Junction existing commercial and residential property boundary walls and vegetation are present along the northern and southern sides.

Figure 4-2 – Route Tie-in to LDR4 Scheme



The section of the route between the N51/R895 (Balmoral) Junction to the R147/R161 (Poolboy Bridge) Junction is bounded by dense vegetation on both sides accompanied by either stone bollards and/or knee-rail fencing.

Figure 4-3 - Example of Existing Cross Section on R147

A speed and traffic count survey were undertaken by IDASO in May 2022 with the counts being undertaken at each junction and halfway along the links (i.e., between junctions) within the extents of the scheme. From these counts the 85th percentile speed was shown to be 57 km/h which is within the posted speed limit (60 km/h).

4.2. Junctions

There are three junctions located within the extents of the scheme. Each of these junctions are signalised with two of the junctions serving through traffic for the N51 along with local traffic. Refer to Figure 4-1 for locations of the junctions.

4.3. Public Transport

2 No. bus stops are located between the R147/N51 and R147/R161 (Poolboy Bridge) Junctions. This is outlined within Table 4-1.

Table 4-1 - Public Transport Details

Direction	Description
Eastbound	Transport for Ireland (TFI), bus bay Stop No.: 105581 Service(s): 109, 190
Westbound	Transport for Ireland (TFI), in-line bus stop Stop No.: 189151 Service(s): 109A, 109X

4.4. Pedestrian & Cycle Facilities

There are controlled pedestrian crossings located at N51/R895 Balmoral junction, R147/N51 junction and Poolboy Bridge junction. The extents of the route features dropped kerbs and tactile paving across most crossing locations.

Formal cycling provisions have been installed (in 2018/19) at the N51/R147 junction in the form of cycle tracks, on road cycle lanes and shared spaces. However, the remainder of the route features no further cycling infrastructure.

Figure 4-4 - Example of N51/R147 Junction Existing Cycling Facilities

5. Description of Proposed Scheme

5.1. Link Provision

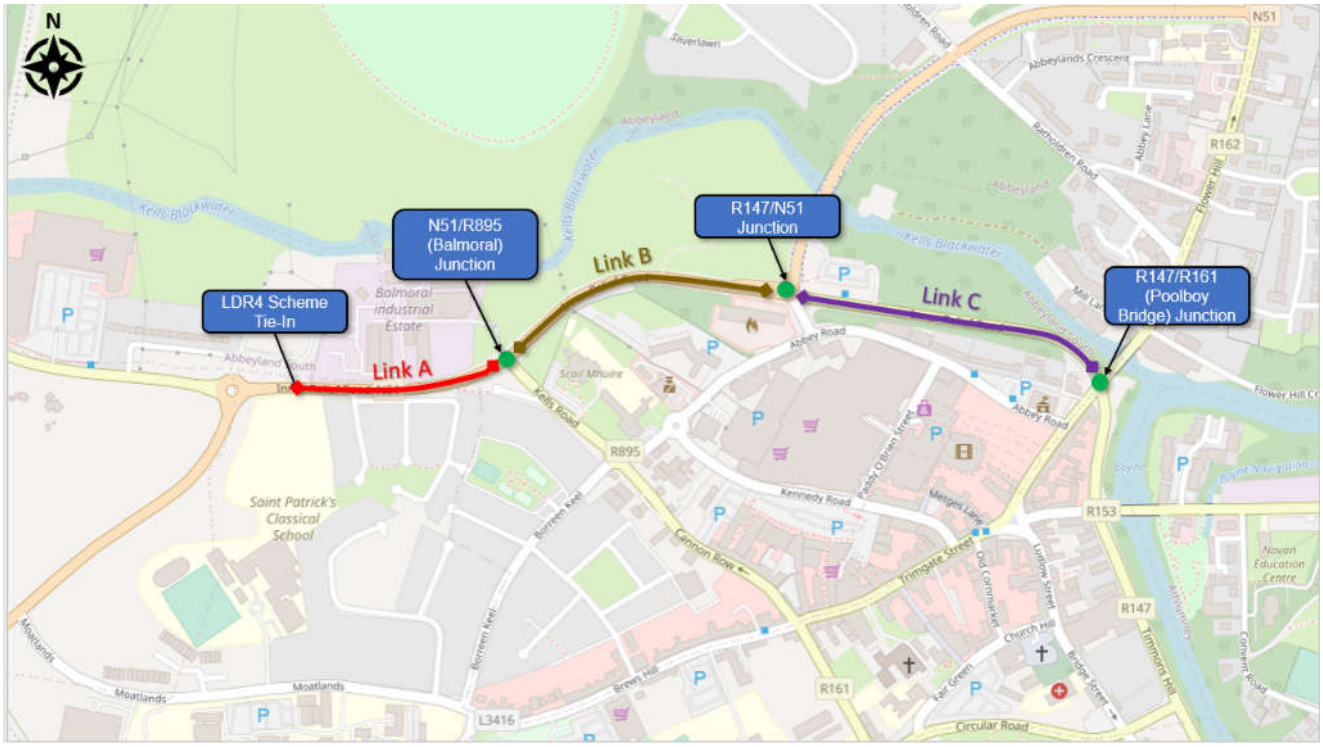
Following the completion of a detailed Options Appraisal, undertaken in line with the Department of Transport's Common Appraisal Framework, the Preferred Option for the Navan Cycle Scheme: R147 Poolboy Bridge to Kells Road Roundabout are outlined in the sections following.

5.1.1. Methodology for Options Assessment

For the ease of identification and the option selection process, the route was split into 3 links, these being:

- **Link A** (N51) – LDR4 Scheme Tie-in to N51/R895 (Balmoral) Junction (Ch. 0+090 – 0+230)
- **Link B** (N51) – N51/R895 (Balmoral) Junction to R147/N51 Junction (Ch. 0+390 – 0+640)
- **Link C** (R147) – R147/N51 Junction to R147/R161 (Poolboy Bridge) Junction (Ch. 0+770 – 1+050)

Figure 5-1 – Route Location and Link Extents



Each of the links was assessed individually with various cross section and junction options using a multi-Criteria Analysis based on their performance in terms of the needs of the cyclist and impacts on the community and environment. Each option was assessed in a comparative manner to each other, and the highest ranked option carried forward to become part of the Preferred Option.

5.1.2. Preferred Options

The preferred option determined for Link are as outlined in Table 5-1.

Table 5-1 - Link Types

Link Name	Link Type	NCM Ref.	Proposed Speed Limit
Link A	Single Cycle Track on each side	4.3.4	50 or 60 km/h [2]
Link B	Single Cycle Track on each side	4.3.4	50 or 60 km/h
Link C	Single Cycle Track on each side	4.3.4	50 or 60 km/h

[2] *Speed limit to be determined in Phase 5 (Detailed Design). Both 50 km/h and 60 km/h speed limits are compliant with the design standard requirements for the cycle tracks proposed (source: NCM Section 7.1).*

The desirable widths of each element of the links shall be as per Table 5-2. Widths which still comply with the minimum required in the design standards (NCM and DMURS) are denoted in brackets. The desirable widths are achieved at a minimum, unless noted otherwise within the Preliminary Design Drawings.

Table 5-2 - Table of Desired Widths

Link Type	Footway Width	Cycle Track Width	Verge Width	Trafficked Width	Total Width
Single Cycle Track (Both Sides)	2m (min. 1.8m)	2m (min. 1.75m)	-	2-4 x 3-3.25 m lanes	14-21m (min. 13.1m)

Further details of the scheme's design are outlined in Section 5.2, to be read in conjunction with the Drawings in Appendix A.1.

5.2. Key Ancillary Elements

5.2.1. Junctions & Entrances

Key junctions along the route will be upgraded with features as follows:

- Two of the signalised junctions are to be upgraded to a fully segregated style arrangement, with reduced corner radii throughout. This features details where kerb upstands and concrete islands are proposed at corners to enhance protection to cyclists waiting to cross. The cyclists passing through the junction will do so on their own cycle tracks with dedicated traffic signal phases which are separate to the pedestrian phasing.
- The signalised junction at R147/R161 (Poolboy Bridge) will feature partial segregation through the form of designated cycle lanes passing through the junction at road level. These facilities will cater for the movements along the R147 with future schemes along Watergate Street and Flower Hill tying into these facilities to allow for movements along the minor arms.
- Raised entry treatment to be provided on the adjoining roads (to slow approaching traffic and remove the need to dish-down pedestrian crossings).
- Tactile paving shall be provided at the crossings to advise visually impaired pedestrians.
- Along the links, a vertical separation will be provided between cyclists and traffic, with further vertical segregation provided between pedestrians and cyclists.
- Design considerations such as kerbline tapering and radii which are larger than that on other corners have been supplemented by careful consideration of the phasing to allow as much green time as possible for N51 through-traffic at the R147/N51 junction.
- At the R147/N51 junction, turning movements onto Abbey Road have been discouraged using tight radii and appropriate markings, therefore the only permitted traffic onto Abbey Road would be southbound from the N51 arm. The left turning lane form Abbey Road has also been removed as part of the scheme. This left turn lane was installed as a temporary measure by MCC. This will return the Abbey Road arm to its original 1 lane form.

5.2.2. Pedestrian Crossings

Given the location of the scheme (i.e., just outside of town centre locations, which would have higher pedestrian and cyclist activity) the widths of crossings shall be as per the minimum required within DMURS (Section 4.3.2) and the Traffic Sign Manual (Section 7.16):

- 4m wide for Shared crossings (i.e., for pedestrians and cyclists);
- 2m at all uncontrolled pedestrian crossings.

5.2.3. Drainage

Typically, drainage will be provided using the existing surface water drainage system with existing gullies relocated into the realigned carriageway channel. The new footpaths and cycle tracks will generally slope towards

the road to remove the need for additional drainage collection measures. The scheme generally retains the existing hard standing area; therefore, it is envisaged that there will be little impact on the existing stormwater runoff into local drainage systems. Further details of the drainage design will be developed as part of the detailed design.

A Stage 1 Flood Risk Assessment has been undertaken, which concluded that there will be no requirement to further review the risk of fluvial flooding at Stage 2. The Stage 1 report is appended (see Appendix F).

5.2.4. Lighting

All footpaths, cycle tracks and roads will be lit, in line with current best practice and design guidance in relation to public lighting

All existing lighting within the scheme will be upgraded to new energy-efficient LED lighting; the details of which will be developed as part of the detailed design.

5.2.5. Pavements

To give the highest quality of service for cyclists, it is envisaged that a smooth asphalt surface course will be used with 10mm aggregate as recommended by the National Cycle Manual, with sufficient base and foundation layers to prevent failure. Footpaths are intended to be a concrete surface, to provide colour-contrast when compared to road and cycle surfaces, to aid people with visual impairments. The exact construction depth for the footpath and cycle track pavements is subject to detailed design. The exact construction depth for the road construction in areas that need targeted interventions is subject to detailed design.

5.2.6. Services

At the outset of the project, utility companies were contacted seeking information relating to their plant and ducting within the route corridor. The following information was received.

Table 5-3 - Summary of Utility Companies' Infrastructure

Service Provider	Services Present
BT	No
Eir	Yes
Enet	Yes
ESB	Yes
GNI	Yes – Low and Medium Pressure
Irish water	Yes – Watermain and foul water services
SIRO	Yes – Utilising the ESB Network
Virgin Media	No

A Ground Penetrating Radar (GPR) has been undertaken and a utility survey will be undertaken to inform the Detailed Design Phase in determining the location of services to the most accurate extent possible. Any service diversions or protection works will be determined at that Phase. Given the nature of the scheme, which is contained within the existing boundary extents for most of the length of the routes, service diversions are expected to be minimal.

5.2.7. Land Take

There is land take required for the scheme as denoted in the Drawings. Folios and areas are as noted below:

Table 5-4 - Details of Land Take required for scheme

Folio No.	Approx. area of land take *(subject to Phase 5 Detailed Design)*
Scoil Mhuire (Not Registered)	7.5m^2

5.2.8. Tree Removal and Proposed Landscaping

To accommodate the provision of the necessary pedestrian and cyclist infrastructure, the proposed scheme does require the removal of several trees (as noted within the Preliminary Design Drawings), particularly between the Balmoral and Poolboy Bridge junctions. A targeted tree survey has been undertaken based on the preliminary design and the expert advice of an arboriculturist has been used to determine the value, age, and condition of all trees along the proposed route and any mitigation required where affected. A tree impact statement has produced by the arboriculturist, the values from which are summarised in Appendix B.

Landscaping, in the form of replacement trees, new trees, new hedging and street furniture is proposed at selected locations at junctions and along the links as noted in the Drawings.

5.3. Key Features

This route includes the key design features as aforementioned and additional points of note are contained within. The Preliminary Design Drawings for the route are contained within Appendix A.

The proposed cycle facilities generally comprise a with-flow single cycle track on each side of the road with at-grade cycle lanes across junctions, with upgraded cycle and pedestrian facilities provided at all junctions.

Table 5-5 – Key Features

Chainage	Details
0+090	The route will tie into the proposed and permitted LDR4 scheme, whose design includes a signalised junction as a replacement for the existing roundabout. It proposes single cycle tracks on the east side of the junction, on both sides of N51.
0+110 to 0+125	Access to Dean Cogan Place to be upgraded to facilitate the inclusion of remodelled footpaths and proposed cycle lanes.
0+125 to 0+255	Retaining feature proposed between the N51 and Dean Cogan Place to enable the required widening for active travel facilities.
0+230 to 0+390	The Balmoral junction is to be upgraded to include segregated cycle tracks along with dedicated traffic signal phases for cyclists which are separate to pedestrian phasing. Existing slip lanes are removed to facilitate the cycle crossings. The number of traffic lanes, and their designated movements (i.e., left/straight/right), are to remain as per existing.
0+400 to 0+415	Land take required to the south of the alignment from Scoil Mhuire.
0+405 to 0+485	Retaining feature proposed to enable the required widening for active travel facilities.
0+520 to 0+545	Private Access to be upgraded to facilitate the inclusion of remodelled footpaths and proposed cycle lanes.
0+620 to 0+670	Existing fire station access to be upgraded to facilitate the inclusion of remodelled footpaths and proposed cycle lanes.
0+640 to 0+770	The R147 / N51 junction is to be upgraded to include segregated cycle tracks, along with dedicated traffic signal phases for cyclists which are separate to pedestrian phasing. The existing slip-lane for N51 traffic (turning left) is to be removed, in accordance with DMURS guidance to promote slower speeds through the junction. To mitigate the traffic flow impact of this change, (and given the strategic nature of the route), the left turn lane is to be extended to the west, and the traffic signal stages will be such that they will allow for two phases to this left-turn movement. The junction has been geometrically designed to enable left and right turning HGVs movements to happen concurrently at this northwest corner (and so tapers have been provided with a 6m radius at the corner). The number of traffic lanes, and their designated movements (i.e., left/straight/right), are to remain as per existing, except for Abbey Road northbound, where the left-turn lane will be removed. Whilst this left-turn lane is part of the existing arrangement, the junction was designed and constructed in 2018/19 without this left-turn lane, which was later reconfigured as per the existing arrangement on an interim basis only.
0+730 to 0+770	The existing eastbound bus layby stop is to be upgraded with a cycle track detail designed as per BusConnects Guidance with retaining features proposed to the rear of the tapers to enable the required widening for active travel facilities.
0+730 to 1+040	Retaining feature proposed to enable the required widening for active travel facilities.

Chainage	Details
0+775 to 0+795	The existing westbound bus stop is to be upgraded with a cycle track detail designed as per BusConnects Guidance.
0+780 to 0+805	Car Park Access to be upgraded to facilitate the inclusion of remodelled footpaths and proposed cycle lanes.
0+835 to 0+850	Private Access to be upgraded to facilitate the inclusion of remodelled footpaths and proposed cycle lanes.
1+050 to 1+135	The Poolboy Bridge junction is to be upgraded to include tightened radii and cycle facilities consisting of cyclists being provided a specific lane on-road. This is in conjunction with dedicated traffic signal phases which are separate to pedestrian and traffic phasing. Pedestrian crossings are to be refined by providing new signalised crossing points on R147 (West) and Flower Hill and removing the need for a Two-Stage crossing on the R147. The number of traffic lanes, and their designated movements (i.e., left/straight/right), are to remain as per existing.
1+150	Cycle facilities begin / terminate and tie in to the existing R147.

6. Environmental & Quality Assessments

6.1. Appropriate Assessment

As part of the Preliminary Design Phase a Screening for Appropriate Assessment Report was undertaken (Atkins ref. *5214376DG0034)*. The purpose of the Screening for Appropriate Assessment Report is to determine the likelihood of significant effects, if any, that the proposed project could have on Natura 2000 sites either alone or in combination with other plans or projects.

This Screening for Appropriate Assessment report is based on the best available scientific information. It is concluded by the authors of this report that the proposed Navan Cycle Scheme - R147 Poolboy Bridge to Kells Road Roundabout project, either alone or in-combination with other plans or projects, will not result in likely significant effects on River Boyne and River Blackwater SAC, River Boyne and River Blackwater SPA or any other European site. Thus, it is recommended that it is not necessary for the project to proceed to Appropriate Assessment.

6.2. Environmental Impact Assessment

As part of the Preliminary Design Phase an Environmental Impact Assessment Screening Report was prepared (Atkins ref. *5214376DG0035*). The purpose of this report is to determine whether the project requires the preparation of an Environmental Impact Assessment Report (EIAR), Key findings are summarised as follows;

- Due to the limited nature of the works, it is considered that there will be no significant cumulative impacts with other developments in the general area;
- Limited noise, vibration and dust emissions may be generated during construction; however, this is anticipated to be minimal in effect and will cause no significant impacts;
- There will be no significant impact on biodiversity, groundwater, surface water or traffic; and,
- There will be no significant impacts on recorded monuments or historic features.
- In summary, no significant adverse impacts to the receiving environment will arise because of the proposed scheme.

Accordingly, we consider that the preparation of an EIAR is not required for the Navan Cycle Scheme – R147 Poolboy Bridge to Kells Road Roundabout. However, the competent authority will ultimately determine whether an EIAR is required or not.

6.3. Quality of Service Assessment

The routes have been designed to provide the highest quality of service possible for all users, within the constraints identified. Segregation along the routes allows for minimal conflicts between pedestrians and cyclists, increasing comfort and attractiveness for both. Table 6-1 shows the level of service being achieved along each route (as assessed in accordance with the National Cycle Manual).

Table 6-1 - Quality of Service

PCI Range	No. Adjacent Cyclists	No. of Conflicts (Per 100m)	Journey Time delay	HGV Influence	Quality of Service
86 - 100	1+1	0.5	10 %	0%	A

7. Impact of the Proposed Scheme

7.1. Pedestrians, Cyclists, Traffic & Transportation

7.1.1. Pedestrians

The new routes will provide safe, accessible, and attractive routes for pedestrians with minimum 1.8m wide footpaths for all areas where new paths are to be provided, except for a limited number of narrowed sections, as noted on the Drawings. New and improved crossings will allow pedestrians to cross all the roads within the scheme extents in a safe manner. The location of many of these crossings will improve access and permeability for pedestrians to the residential, recreational, and retail areas within the scheme extents; and onwards to the commercial, educational and transport hubs closer to the town centre.

Facilities for those users with visual or mobility impairments will be much improved, with tactile paving, flush kerbs and raised crossings provided throughout.

7.1.2. Cyclists

The provision of improved cycling facilities throughout this route will be beneficial to cyclists using the R147/N51 to travel within Navan. The provision of this high-quality cycle infrastructure (QoS Level A) will provide attractive and safe routes for cyclists linking many residential, educational, and commercial areas in the Town Centre, as well as connections to proposed greenway projects in the area.

7.1.3. Public Transport

The provision of upgraded bus stops (with Kassel kerbs) will improve facilities for public transport users in the area.

7.1.4. Vehicular Traffic

There will be some impacts to the existing vehicular traffic on the surrounding road network. Given the nature of the proposals (e.g., reduction in carriageway width, reduction in junction radii and an increase in pedestrian/cyclists crossings) there will be a slowing of traffic speeds compared to that existing, resulting in some increase in journey time. The upgrades to the junctions to bring them in-line with current standards (i.e., DMURS, the National Cycle Manual and NTA BusConnects Guidance) will result in a reduction in capacity of each of the junctions.

This however is a necessity to provide a scheme which is safe and in line with best practice, guidelines, and national policy. These proposals will help to reduce the likelihood of conflicts between all road users. The improvements to pedestrian and cycling infrastructure will encourage a modal shift away from the private vehicle, which should have a corresponding effect on reducing traffic volumes locally.

Refer to Appendix E for the Traffic and Transport Analysis Technical Note, for further details.

7.1.5. Road Safety

The scheme's preliminary design has been subject to an independent Stage F and Stage 1 Road Safety Audit, the findings of which have been accounted for in the current proposals; and it will be subject to Stage 2 and 3 Road Safety Audits upon completion of the Detailed Design and after Construction, respectively.

7.1.6. Construction Traffic

During the construction phase, vehicular movement will increase in the immediate area, and temporary vertical elements such as hoarding or protective fencing, will be put in place. All construction impacts will be temporary. Prior to the commencement of works, the contractor should prepare a Construction Environmental Management Plan to set out the site-specific measures being put in place to avoid and minimise potential impacts on sensitive environmental receptors that could potentially occur during the construction phase.

7.2. Landscape and Visual

The proposed route has been designed to minimise the requirement for land take. The proposed works will take place majorly within the existing roadway cross section and will increase the pedestrian and cycling provisions along the route.

To accommodate the provision of the necessary pedestrian and cyclist infrastructure, the proposed scheme does require the removal of several trees (as noted within the Drawings), particularly between the Balmoral and Poolboy Bridge junctions. A targeted tree survey has been undertaken based on the preliminary design and the expert advice of an arboriculturist has been used to determine the value, age, and condition of all trees along the proposed route and any mitigation required where affected. A tree impact statement has produced by the arboriculturist, the values from which are summarised in Appendix B.

Landscaping, in the form of replacement trees, new trees, new hedging and street furniture is proposed at selected locations at junctions and along the links as noted in the Drawings.

7.3. Built and Cultural Heritage

A desk-based review of the receiving environment with regards to archaeology, architecture and cultural heritage, and identification of any potential associated constraints has been undertaken using the following sources:

- Meath County Development Plan 2021-2027 (MCC, 2021).
- Navan Development Plan 2009-2015, as varied (MCC, 2009); and,
- National Monuments Service (NMS) Historic Map viewer (NMS, 2022)

2no. SMR[3] features are identified within the study area: Stone sculpture (ME025-024002) and Bridge (ME025-044008), with 1no. SMR feature immediately bordering the study area; Font (ME025-024004).

1no. National Inventory of Architectural Heritage Area (NIAH) feature has been identified within the study area; Bridge (Reg. No. 14006018). This bridge ("Poolboy Bridge") is described by National Monuments Service (NMS, 2022) as '*Seven arch roughly dressed stone bridge, c.1740, over the Blackwater River. Flattened cutwaters down-stream and 'V' cutwaters up-stream which carry up into the parapet walls to provide refuges of similar profile. Round arches with dressed stone voussoirs and centring stones through vault, ashlar voussoirs to downstream elevation.'*

The study area incorporates the Zone of Notification (ZoN) of numerous SMR features. Therefore, it is required that the appropriate authorities, including the National Monument Services, will need to be notified of any works prior to construction works commencing.

The details of all NIAH, SMR's and Zone of Notifications located within the study area and its vicinity are as noted in Figure 7-1.

The eastern portion of the study area is located within the Navan Historic Core Architectural Conservation Area (ACA). [4]As stated by Meath County Council the 6 objectives for the Navan Historic Core Architectural Conservation Area are as follows:

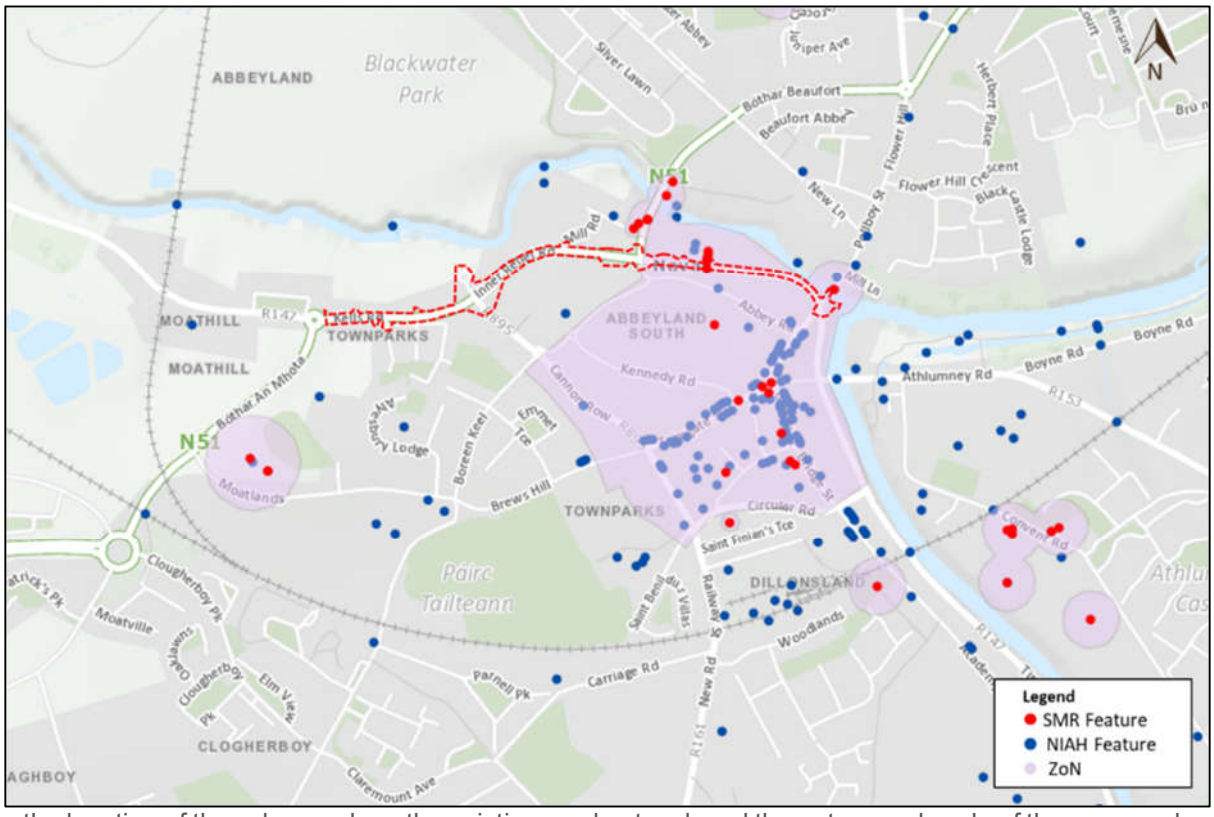
1. *'To preserve the character of the Navan Historic Core Architectural Conservation Area, its buildings, streetscape, and public realm.*
2. *To preserve the historic street pattern within the core of the town, including the laneways.*
3. *To require the retention of all structures which contribute in a positive manner to the character of the ACA.*
4. *To support and encourage the re-use of suitable redundant or obsolete buildings within the ACA.*
5. *To protect the character of the existing streetscape by considering the suitability of style, construction materials, colour, and decoration to be used in any proposals for development taking place within this area and to require that all new developments within or adjacent to the ACA shall observe the existing scale of the town.*
6. *To retain historic architectural and townscape elements such as shop fronts, sash windows, gutters and down pipes, decorative plasterwork, etc. that contribute to the character and appearance of the ACA.'*

   (Meath County Council's *meath.ie*, 2022).

[3] Archaeological Survey of Ireland Sites and Monuments Record

[4] https://consult.meath.ie/en/consultation/meath-draft-county-development-plan/chapter/navan-historic-core-architectural-conservation-area

Figure 7-1 - Archaeological features located within the study area and around the surrounding areas. (archaeology.ie, 2022, date reviewed: 01/06/2022)



Given the location of the scheme along the existing road network and the nature and scale of the proposed works, it is not anticipated that there will be a significant impact on archaeology, architecture, and cultural heritage.

7.4. Other Environmental Impacts

Other Environmental Impacts (ecology, noise, air quality, etc) are as noted in the EIA Screening Report, which as noted in Section 6 is recommended to be screened out.)

7.5. Conclusion

The preliminary design for the scheme has been undertaken in line with DMURS, the NCM and BusConnects guidance, developing the preferred options as outlined in the *Feasibility Study and Options Selection & Appraisal Report (Atkins Ref: 5214376DG0006)*.

The proposed improvements realised as part of the scheme align with the aims and objectives, as follows:

- **Safety (Conflict)**
  - The potential for conflicts shall be reduced through the provision of formalised crossing facilities throughout.
  - Where traffic volumes and speeds require it, the potential for conflicts shall be reduced by the segregation of cyclists from vehicular traffic.
  - The potential for conflicts between cyclists and pedestrians shall be reduced through the implementation of segregated facilities for most of the scheme.
- **Safety (Priority)**
  - Cyclists' priority shall be improved at all junctions.
- **Safety (Vulnerable Road Users)**
  - Vulnerable road users shall be catered for through formalised crossing facilities, footways, and the provision of kerbing and tactile paving in line with best practice.

- **Physical Activity**
  - The provision of the proposed facilities shall bring enhancements for pedestrians and cyclists, thereby promoting physical activity, particularly for those travelling to the adjacent residential, recreational, commercial, and educational areas.
- **Accessibility and Social Inclusion**
  - Likewise, as with Physical Activity, accessibility and social inclusion shall be improved for those road users who rely on a non-motorised means of transport.
- **Environment**
  - The impact on the environment will be minimal, and the scheme is recommended to be screened-out for EIAR and AA.
- **Integration and Economy**
  - From these benefits the proposals will offer good value for money, both at a strategic level, and to those individual users for whom the scheme shall enable a modal switch from the private car to walking / cycling.
  - The scheme aims to improve integration within the local area of Navan by aligning with several national and regional policies. At a national level the scheme aligns with the objectives of NIFTI, Sustainable Mobility Policy, National Cycle Policy Framework 2009 – 2020, National Cycle Manual 2011, NTA Cycle Network Plan (Greater Dublin Area) 2013 and the Climate Action Plan 2021 whilst at a regional level, the scheme aligns with the Regional Spatial and Economic Strategy (2019 – 2031) and Meath County Council Development Plan (2021 – 2027).
- **Localised objectives**
  - The route should be designed to provide a high Quality of Service (QoS) level, as per the National Cycle Manual (Level A).
  - Improve local movement capabilities including access to Navan Town Centre from residential areas to the north and west of Navan for cyclists and pedestrians.
  - Create a sustainable mode of active-travel access to the primary and secondary schools in the greater urban area of Navan.
  - Provide a consistent and coherent standard of cycle facilities into Navan Town Centre.
  - Improve pavement quality and width, increasing comfort for cyclists.
  - Provide safe and convenient junction layouts for pedestrians and cyclists.
  - Provide additional recreational links by linking the local communities to future Greenway and Cycling routes for Navan.

8. Submissions

Submissions or observations with respect to the proposed development, dealing with the proper planning and sustainable development of the area in which the development would be situated, may be made in writing to the Local Authority; *Planning Department, Meath County Council, Buvinda House, Dublin Road, Navan, Co. Meath*, through the Council's website (www.meath.ie or https://consult.meath.ie) or emailed to planning@meathcoco.ie.

Submissions shall be made on or before the deadline as noted on Meath County Council's website with respect to the scheme.

Submissions should be headed: **"Navan Cycle Scheme – R147 Poolboy Bridge to Kells Road Roundabout"**

All comments, including names and address of those making submissions regarding this scheme will form part of the statutorily required report to be presented to the monthly meeting of Meath County Council. Accordingly, these details will be included in the meeting minutes of that meeting and may appear in the public domain.

Appendix A. Graphics

A.1. Drawings

A.2. Photomontages

Appendix B. Tree Impact Summary

Appendix C. AA Screening Report

Appendix D. EIA Screening Report

Appendix E. Traffic and Transport Analysis Technical Note

Appendix F. Flood Risk Assessment

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