N63 Liss to Abbey Realignment Scheme

Phase 3 - Design Report
Volume 1

Galway County Council

AECOM Project reference: 60597858
GCC Project reference: GC/16/13416

N63-ACM-PH03-ZZ-RP-ZZ-0001

15th February 2022

Quality information

Prepared by	Checked by	Verified by	Approved by
Daniel Stewart Graduate Engineer	Luca Bellini Senior Engineer	Colin Acton Regional Director	Eoin Greene Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
Rev 0	15/02/2022	Final	Yes	Eoin Greene	Technical Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Galway County Council
Áras an Chontae,
Prospect Hill,
Galway
H91 H6KX

Prepared by:

AECOM-ROD
4th Floor
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin A96 T927
Ireland

T: +353 1 238 3100
aecom.com

© 2022 AECOM Ireland Limited. All Rights Reserved.

This document has been prepared by AECOM Ireland Limited and Roughan & O'Donovan Limited ("AECOM-ROD") for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM-ROD and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM-ROD, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM-ROD.

Table of Contents

Figures

Tables

0 Executive Summary

0.1 Introduction

The N63 Liss to Abbey Realignment Scheme, referred to as the Proposed Road Development, is located in Abbeyknockmoy Co. Galway and will facilitate a number of objectives in the Galway County Development Plan (2015-2021), including the provision of higher-quality national roads and the separation of regional and local traffic. The Proposed Road Development will also meet a number of objectives of the Road Safety Authority's Road Safety Strategy.

AECOM-ROD were commissioned to provide Engineering Consultancy Services for the Proposed Road Development in May 2019. The Proposed Road Development has been progressed by AECOM-ROD through the Phase 1 (Concept and Feasibility) and Phase 2 (Option Selection) of the TII Project Management Guidelines 2019 (PE-PMG-02041).

0.2 Summary of Design Report

The purpose of this Design Report is to describe the developments made to Option B, which was selected as the Emerging Preferred Option in Phase 2 of this project. A detailed design of this route option has been prepared as part of the Phase 3 Preliminary Design stage and has been designed in accordance with the TII Road Design Standards, the TII Environmental Assessment and Construction Guidelines and other relevant best practice guidelines.

As recommended in the conclusions of the Option Selection Report, a detailed topographical survey and Geotechnical Investigations have since been undertaken. These provided sufficient information to carry out a full Environmental Impact Assessment and complete the Preliminary Design of the realignment scheme.

This Design Report is broken down into 13 chapters in accordance with the TII Project Manager's Manual for Minor National Road Projects 2020 (PE-PMG-02043). The need for the scheme in relation to various road development policies is explained and a summary of the transport modelling results is given before detailing the following aspects of the preliminary design:

- Geometry (Including Relaxations and Departures)
- Strategy for Junctions & Side Roads
- Ground Investigation, Soil Classification & Earthworks
- Drainage
- Structures
- Pavement
- Signing and Lighting
- Services, Land Use & Accommodation Works
- Cost Estimation
- Economic Assessment

0.3 Conclusion

The Design Report concluded that all aspects of the scheme have been designed in accordance with the TII Road Design Standards, the TII Environmental Assessment and Construction Guidelines and other relevant best practice guidelines.

It is recommended that the N63 Liss to Abbey Realignment Scheme be progressed to the Statutory Process stage of the project (Phase 4).

1 Introduction & Description

AECOM-ROD has been commissioned by Galway County Council to provide Engineering Consultancy Services for the development of the N63 Liss to Abbey Realignment Scheme including the Feasibility Stage, Option Selection, Preliminary Design and Preparation of the Environmental Impact Assessment Report (EIAR).

1.1 Description of the Proposed Road Development

The Proposed Road Development, also referred as N63 Liss to Abbey Realignment Scheme, is located in the north-east of County Galway along the N63 route, a national secondary route, and includes the realignment of approximately 2.3km of the N63 to the eastern edge of Abbeyknockmoy. The Proposed Road Development crosses the River Abbert, which is part of the Lough Corrib Special Area of Conservation (SAC). The Proposed Road Development is also located in close proximity to Abbeyknockmoy Abbey, a National Monument.

The Proposed Road Development includes the following;

- Approximately 2.3km of new Type 2 Single Carriageway road (predominantly offline);
- One new roundabout at the western end of the scheme to provide connection with the existing N63;
- Two new priority junctions to provide connection to the existing L6159 and L6234, including some minor local road realignments;
- One new clear span bridge crossing of the River Abbert;
- Seven new piped culverts and five box culverts over existing field ditches;
- Flood culverts to minimise impact on the Abbert River;
- New pedestrian and cycle facilities, predominantly located along the existing N63;
- Associated earthworks including excavation of unacceptable material, excavation and processing of rock and other material, and recovery of unacceptable material for re-use in the works;
- Accommodation works, including the provision of access roads and accesses;
- Drainage works, including the construction of attenuation ponds;
- Utilities and services diversion works;
- Safety Barrier, Public Lighting, Fencing;
- Landscaping works; and
- Environmental measures and other ancillary works.

The location and extent of the proposed road development is shown in Figures N63-ACM-PH03-0000-DR-HW-0001 and Figures N63-ACM-PH03-0000-DR-HW-0010 to N63-ACM-PH03-0000-DR-HW-0015 respectively and are contained in Volume 2 of this Design Report.

1.1.1 Overview of Project Development to Date

AECOM-ROD commenced engineering consultancy services for the Proposed Road Development in May 2019. The Proposed Road Development has been progressed by AECOM-ROD through the Phase 1 (Concept and Feasibility) and Phase 2 (Option Selection) of the TII Project Management Guidelines 2019 (PE-PMG-02041).

This Design Report follows on from the work undertaken during Phase 1 (Concept and Feasibility) and Phase 2 (Option Selection) which led to the identification of the 'Preferred Route Option' of the proposed road development and is outlined in two reports, which form the background to this report:

- Scheme Feasibility Report, published in August 2019, which investigates the feasibility and verifies the need for the scheme. It also identifies the extent of the study area.

- Option Selection Report, published in April 2020, which details the constraints within the study area and identifies feasible route options and records the selection of the Preferred Route Corridor for the proposed road development following the examination of alternative route options and public consultation.

1.2 Purpose of the Design Report

This Design Report describes the development of the preferred route, building on the conclusions of the Route Selection Report. This involved detailed topographic survey, geotechnical investigations development of the engineering requirements of the proposed road development, assessment of the environmental impacts resulting from the road project and the identification of mitigation measures to eliminate or reduce any likely significant effects. As part of the design process, consultation was held with directly affected landowners and interested third parties.

The design described in this report represents the final planning phase for this road development and describes in detail, the characteristics of the proposed design that enables the preparation of the Compulsory Purchase Order (CPO) documents, Environmental Impact Statement (EIS) and Natura Impact Statement (NIS).

1.3 Project Operational Goals

The Operational Goals of the N63 Liss to Abbey Realignment Scheme align with the scheme specific objectives, as already detailed at Feasibility Stage, and are as follows:

1.3.1 Economy

The key economic objectives are:

- To reduce journey times and improve journey time reliability on the N63 for long distance trips between the West and North-West Regions and medium distance trips between Longford/Roscommon and Galway; and
- To assist in supporting the economic performance of the counties of Galway, Longford and Roscommon through the provision of improved transport infrastructure, which will reduce the cost of travel for business and tourism and assist in reducing the overall cost of production, thereby improving competitiveness.

1.3.2 Safety

The key safety objectives are:

- To reduce the collision rate along the national road network between Abbeyknockmoy village and Derreen to below the national average rate;
- To reduce the severity of collisions along the national road network between Abbeyknockmoy village and Derreen;
- To improve safety for all road users including pedestrians and cyclists along both the national road network and on the surrounding road network between Abbeyknockmoy village and Derreen;
- To support the RSA Road Safety Strategy 2013-2020; and
- To improve the security of vulnerable road users by providing for non-motorised users.

1.3.3 Environment

The key ecological receptor identified within the vicinity of the proposed development is the Abbert River which is within the Lough Corrib Special Area of Conservation (SAC). (Site Code 000297). The SAC boundary extends to include adjacent wet grassland to the south of the river. The existing Liss bridge crosses over the Abbert river.

Abbeyknockmoy Cistercian Abbey (National Monument No. 166; GA058-004001) and one National Monument subject to Preservation Order (earthworks and buildings associated with Abbeyknockmoy Cistercian Abbey; NM No. 166 & PO No. 4/1989; GA058-004004) are situated in close proximity to the proposed development. The Abbey is a very well-preserved ruin of an important 13th-century Cistercian foundation, with royal patronage and at least one royal burial. It's fabric and setting are protected by the National Monuments Acts. Preserving the character and visual amenity of the ruins will be an important challenge for the present development.

The key environmental objectives of the development are:

- To avoid adverse impacts on the internationally important European Sites;
- To improve road drainage;
- To be sensitive to the visual amenity of the Abbey; and
- To minimise any noise impacts on properties.

1.3.4 Accessibility & Social Inclusion

The principal accessibility and social inclusion objectives are:

- To improve accessibility to key facilities, such as employment, education, transport, and healthcare for all road users, but in particular for vulnerable groups;
- To improve accessibility and reduce severance particularly within the community of Abbeyknockmoy village and in turn support social and economic development within the village and its hinterland; and
- To support the accessibility and social inclusion objectives of national, regional and local planning policy including the Updated National Action Plan for Social Inclusion 2015-2017;

1.3.5 Integration

The proposed development is required to integrate with general policies and plans under the headings of Transport, Land Use, Geographical and Government Policy. The following objectives are outlined for integration:

- To support the integration objectives set out in European, National, Regional and Local planning policy by upgrading the N63 National Secondary between Abbeyknockmoy village and Derreen;
- To support initiatives to bring investment into the West Region; and to support transport integration within the wider region, maximising the benefits of previous investment in the N63 route, integrating with regional public transport facilities, and improving access to the main ports and airports;

1.3.6 Physical Activity

The following objectives are outlined for physical activity:

- To improve facilities and segregation between national and regional traffic, and the movement of local non-motorised users such as pedestrians and cyclists;
- To provide a dedicated route for pedestrians and cyclists along the existing road network, promoting healthy lifestyle choices, particularly with regard to children's movement to and from school; and
- To improve connectivity to the community facilities in the local area.

1.4 Proposed Construction Procurement Method

It is envisaged that the construction of the N63 Liss to Abbey Realignment Scheme will be tendered under a Public Works Contract for Civil Engineering Works Designed by the Employer. However, the construction could also be carried out under a Public Works Contract for Civil Engineering Works Designed by the Contractor (Design & Build).

The advantage of the Employer Designed Works contract is that the design team that have undertaken the preliminary design continue with the detailed design, ensuring a continuity of knowledge through the phases which can sometimes be lost during a design and build procurement method. The Design & Build procurement method also presents advantages, as the contractor is involved at an earlier stage in the works allowing the contractor to make amendments to the detailed design to improve constructability of the proposed development.

Further detailing of the design of the N63 Liss to Abbey Realignment Scheme will be required to fully inform the procurement and construction. This further detailing will ensure that no design changes are incorporated that have the potential to undermine the basis of assessment of the environmental impacts assessed as part of the EIA and AA processes and will be in compliance with the mitigation described in the EIAR and any subsequent conditions that may be imposed as part of any planning consent.

1.5 Summary of the Option Selection Process

1.5.1 Constraints Study and Options

The initial step in the Option Selection process was to identify the nature and extent of significant constraints within a defined study area. The definition of a suitable study area was progressed during the Feasibility Study (Phase 1) and presented in the resulting Feasibility Report (August 2019).

The Constraints Study informed the development of numerous potentially feasible Options. In addition to the six Options that were developed, the Do-Nothing and Do-Minimum options were assessed, but it was found that without the provision of a new river crossing, it would not be possible to address the congestion and associated safety issues inherent in the existing road network.

Due to the minor differences between the Do-Nothing and Do-Minimum Options, it was agreed to combine these options into the Do-Nothing/Do-Minimum Option for this report.

1.5.2 Stage 1 - Preliminary Options Assessment

The potentially feasible Options were assessed by applying the three-stage option selection process set out in the TII Project Management Guidelines 2019 (PE-PMG-02041). At Stage 1, all Options were subject to a Multi Criteria Analysis assessing Engineering, Economy and Environment.

The six Stage 1 Options can be seen in Figure 1-1 below. The results of the Stage 1 Preliminary Options Assessment can be seen in Table 1-1Table 12-1.

Table 1-1 Stage 1 Preliminary Option Assessment Summary

	Do-Nothing / Do-Minimum Option	Option A (Cyan)	Option B (Green)	Option C (Yellow)	Option D (Pink)	Option E (Blue)	Option F (Red)
Engineering	Minor or slightly negative	Moderately positive	Major or highly positive	Minor or slightly positive	Not significant or neutral	Minor or slightly negative	Minor or slightly negative
Environment	Not significant or neutral	Major or highly negative	Moderately negative	Moderately negative	Moderately negative	Moderately negative	Moderately negative
Economy	Minor or slightly negative	Minor or slightly positive	Moderately positive	Minor or slightly positive	Not significant or neutral	Minor or slightly negative	Not significant or neutral
Overall Ranking	**Minor or slightly negative**	**Not significant or neutral**	**Minor or slightly positive**	**Not significant or neutral**	**Minor or slightly negative**	**Moderately negative**	**Minor or slightly negative**

In addition to the feasible route options A to F described above, the Stage 1 Assessment also includes the base case do-nothing/do-minimum option and management option for comparison purposes.

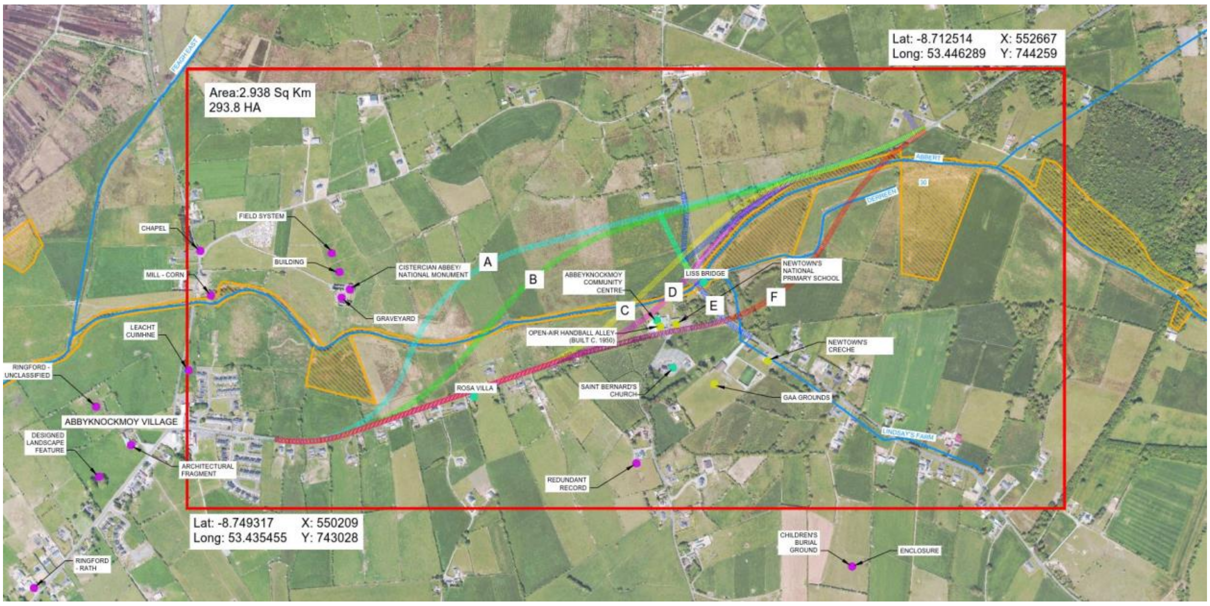


Figure 1-1 Stage 1 Options

A Public Consultation was held in October 2019 to present the study area, and the six Options (A-F) that arose from the Stage 1 Preliminary Options Assessment.

Following the Stage 1 Preliminary Options Assessment, it was decided that three Options (A, B and C) and the Do-Nothing/Do-Minimum should be brought forward to Stage 2 Project Appraisal.

Following review of the submissions at the first Public Consultation, it was observed that the majority of the public in attendance were in support of an improvement scheme, with significant requests for non-motorised user facilities to connect the community facilities to the residential area of Abbeyknockmoy.

1.5.3 Stage 2 - Project Appraisal Matrix

The three Options that were taken forward to Stage 2 Project Appraisal are shown in Figure 1-2.

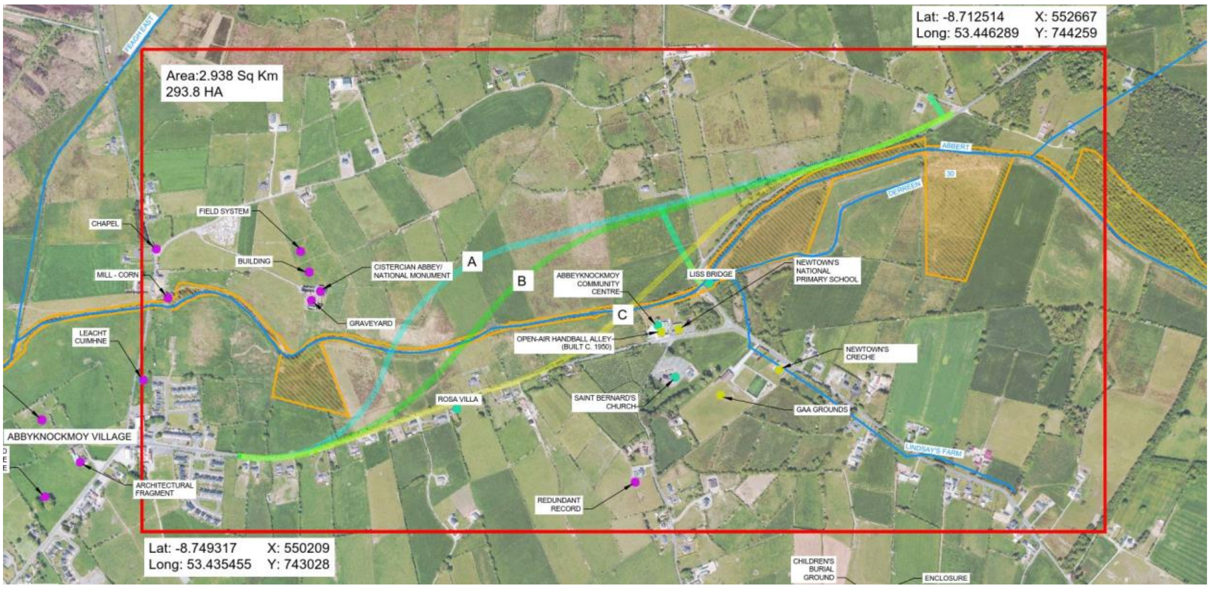


Figure 1-2 Stage 2 Options

A detailed and informed comparative assessment was undertaken in accordance with the TII Project Management Guidelines 2019 (PE-PMG-02041) and the Common Appraisal Framework (published by the Department of Transport, Tourism and Sport). The results of these assessments under the six required criteria are summarised in Table 1-2 below.

	Do-Nothing / Do-Minimum Option	Option A (Cyan)	Option B (Green)	Option C (Yellow)
Economy	Major or highly negative	Moderately positive	Major or highly positive	Minor or slightly positive
Safety	Moderately negative	Moderately positive	Moderately positive	Moderately positive
Environment	Not significant or neutral	Major or highly negative	Moderately negative	Moderately negative
Integration	Not significant or neutral	Moderately positive	Moderately positive	Moderately positive
Accessibility & Social Inclusion	Not significant or neutral	Moderately positive	Moderately positive	Moderately positive
Physical Activity	Not significant or neutral	Moderately positive	Moderately positive	Moderately positive
Overall Ranking	**Minor or slightly negative**	**Not significant or neutral**	**Minor or slightly positive**	**Not significant or neutral**

Table 1-2 Stage 2 Project Appraisal Matrix Summary

Following the Stage 2 Project Appraisal, it was recommended that Option B (Green) should be taken forward as the Emerging Preferred Option for the N63 Liss to Abbey Realignment Scheme.

1.5.4 Emerging Preferred Option - Public Consultation

A second Public Consultation was held in February 2020 to present the Emerging Preferred Option and seek public input to inform its further development.

Following review of the submissions at the second Public Consultation, it was observed that the majority of the public in attendance were in support of the Emerging Preferred Option, with the request for non-motorised user facilities to connect the community facilities to the residential area of Abbeyknockmoy being reiterated. Some concerns about visual impact and land take were raised and these were reviewed at the preliminary design stage.

1.5.5 Conclusion

The Option Selection process concluded that the Emerging Preferred Option is Option B (Green).

It was recommended that detailed topographical surveys and geotechnical investigations should be undertaken to inform the further development of the design of this preferred option, sufficient to inform a full Environmental Impact Assessment.

It was recommended that Option B should be taken forward to the design stage of the project (Phase 3) and concurrently to the Environmental Impact Assessment Report (EIAR) and Statutory Process stage of the project (Phase 4).

1.6 Summary of the Peer Review Process

No formal Peer Review Process was undertaken for the N63 Liss to Abbey Realignment Scheme.

As part of best practise, technical peer reviews will take place throughout the course of the design and construction of the development. As part of this process, independent peer reviewers within the AECOM-ROD team were identified to review elements of the preliminary design.

The purpose of technical peer reviews is to remove defects as early as possible in the development process. By removing defects at their origin technical peer reviews prevent the likelihood of errors propagating through multiple phases and reduce the risk of rework necessary on the project.

2 Identification of Need

2.1 Road Development Policies

The need for N63 Liss to Abbey Realignment Scheme has been identified within the Project Brief and is consistent with the following international, national, regional and local planning policy documents:

International and National Policy Context

- TEN-T Trans European Transport Network;
- National Planning Framework (NPF);
- National Development Plan 2021-2030;
- Strategic Investment Framework for Land Transport;
- Programme Government – Our Shared Future 2020; and
- Road Safety Authority Road Safety Strategy 2013 – 2020.

Regional Policy Context

- Northern and Western Region - Regional Spatial Economic Strategy 2022-2032

Local Policy Context

- Galway County Development Plan (2015-2021).
- Draft Galway County Development Plan (2022-2028).

2.1.1 International and National Policy

2.1.1.1 TEN-T Trans European Transport Network

The TEN-T Trans European Transport Network, which was the subject of Regulation (EU) No. 1315/2013, provides for the TEN-T Trans European Network and requires the development of a core network by 2030 with a connecting comprehensive network of high-quality routes incrementally by 2050.

The requirements for the comprehensive network, is described by the regulations as follows:

> *"The comprehensive network should be a Europe-wide transport network ensuring the accessibility and connectivity of all regions in the Union, including the remote, insular and outermost regions, as also pursued by the Integrated Maritime Policy established by Regulation (EU) No 1255/2011 of the European Parliament and of the Council, and strengthening social and economic cohesion between them. The guidelines laid down by this Regulation ("the guidelines") should set the requirements for the infrastructure of the comprehensive network, in order to promote the development of a high-quality network throughout the Union by 2050.1"*

While the N63 does not form part of the comprehensive TEN-T Network, the proposed improvements will support the objectives of the TEN-T in broad terms by improving the connection to Junction 19 on the M17 TEN-T network which in turn feeds into:

> *"...the core network at regional and national level. The aim is to ensure that progressively, throughout the entire EU, the TEN-T will contribute to enhancing internal market, strengthening territorial, economic and social cohesion and reducing greenhouse gas emissions. "*

2.1.1.2 National Planning Framework (NPF)

The NPF is the Government's high-level strategic plan for shaping the future growth and development of Ireland to the year 2040. Its overarching visions are to:

- Develop a new region-focused strategy for managing growth;
- Linking this to a new 10-year investment plan, the Project Ireland 2040 National Development Plan 2018-2027;
- Using state lands for certain strategic purposes;
- Supporting this with strengthened, more environmentally focused planning at local level; and
- Backing the framework up in law with an Independent Office of the Planning Regulator.

The goals and objectives of the NPF are expressed within the Plan as 'National Strategic Outcomes', which include:

1. Compact Growth;
2. Enhanced Regional Accessibility;
3. Strengthened Rural Economies and Communities;
4. High Quality International Connectivity;
5. Sustainable Mobility;
6. A Strong Economy, supported by Enterprise, Innovation and Skills;
7. Enhanced Amenities and Heritage;
8. Transition to a Low Carbon and Climate Resilient Society;
9. Sustainable Management of Water, Waste and other Environmental Resources;
10. Access to Quality Childcare, Education and Health Services.

The proposed upgrade of the N63, will directly support 'Strengthened Rural Economies and Communities' and 'Sustainable Mobility', which are defined below:

Strengthened Rural Economies and Communities

Rural areas play a key role in defining our identity, in driving our economy and our high quality environment and must be a major part of our country's strategic development to 2040. In addition to the natural resource and food sector potential as traditional pillars of the rural economy, improved connectivity, broadband and rural economic development opportunities are emerging which offer the potential to ensure our countryside remains and strengthens as a living and working community.

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.

The provision to of dedicated pedestrian and cycle facilities, the segregation of the national and regional traffic, and the removal of safety hazards at Liss Bridge will improve the connectivity between the community facilities and residential properties and support the use of sustainable modes in the area. The introduction of the Proposed Road Development will assist the bus services. The locations of the bus stops mean they will not be by-passed by the new section of road, but the buses will be able to use the new section of road minimising their journey time along this section of national road.

Of most significance in terms of the NPF, is the fact that the N63 connects directly to the core component of the Atlantic Economic Corridor (AEC), which is defined within the Plan as:

… a linear network along the Western seaboard, stretching from Kerry to Donegal, which has the potential to act as a key enabler for the regional growth objectives of the National Planning

Framework. The corridor straddles parts of both the Northern and Western Region and the Southern Regions, with the potential to further extend its scope by building on the Cross-Border relationship between Letterkenny and Northern Ireland, and into Cork City and County to the south. The overarching objective of the AEC initiative is to maximise the infrastructure, talent and enterprise assets along the western seaboard and to combine the economic hubs, clusters and catchments of the area to attract investment, improve competitiveness, support job creation and contribute to an improved quality of life for the people who live there. [The lack of high-quality connectivity between the regions within the AEC has been a major impediment to its development as a counter-balance to Dublin and the East coast.]

Improved connectivity between Counties Galway, Longford, Roscommon and Clare via the M17/M18 will be delivered through this project; thereby enhancing accessibility for the region.

Consequently, the principle of the Proposed Road Development is encouraged and supported by the overarching planning framework for Ireland; the NPF outlines the multiple benefits of a development of this nature.

2.1.1.3 National Development Plan 2021-2030

The National Development Plan (revised NDP) 2021 – 2030 was drafted over two phases of review commencing back in October 2020 and later published in October 2021. The revised NDP supersedes the previous NDP published in 2018.

As part of Project Ireland 2040 the revised NDP (Government of Ireland, 2021a) sets out the Government's over-arching investment strategy and budget for the period up to 2030. The primary purpose of the revised NDP aims to balance the demand for public investment across all sectors and regions of Ireland with a specific emphasis on improving the delivery of infrastructure projects. In this regard, the revised NDP has allocated a total public investment of €165 billion (an increase of €49 billion from previous NDP) of for the lifetime of the plan. It is noted that the revised NDP is not intended to provide a comprehensive list of all the public investment projects, however, a notable element does outline the range of expenditure commitments.

The revised NDP also sets out the framework through which investments of the relevant sectoral strategies and subsequent strategic investment priorities across each of the ten NSOs set out in the NPF. In addition, the revised NDP will continue to align with the NPF, with a particular focus on enhancing Ireland's regional cities by ensuring regional connectivity is enabled through the previously identified national roads projects.

In reference to the Government's commitment in the previous NDP, in regard to investment in regional access being complemented by investment and maintenance of local and regional routes throughout the country, this will enhance local communities through access to local, national and international markets and services.

> *"….the objective is to complete those linkages so that every region and all the major urban areas, particularly those in the North-West, which have been comparatively neglected until recently, are linked to Dublin by a high-quality road network."*

> *"…the other major objective is to make substantial progress in linking our regions and urban areas not just to Dublin but to each other. This will be a major enabler for balanced regional development to occur. A particular priority in this is substantially delivering the Atlantic Corridor, with a high quality road network linking Cork, Limerick, Galway and Sligo."*

Of further relevance, is NSO 3: Empowered Rural Economies and Communities, which sets out for full participation of rural communities in the strategic development of the State, as envisaged in the NPF. The NDP outlines a number of key rural initiatives that set out to revitalise rural areas and to enhance economic growth. In particular;

> *"Public capital investment has a vital role to play to support the regions, including rural areas, in achieving their economic and social potential, and in particular to facilitate the jobs growth necessary to support future population growth."*

The NDP also sets out that the investment in regional access will be complemented by investment in and maintenance of local and regional routes throughout the country. This aimed to enable communities access local, national and international markets and services. Protecting the quality and value of past investments is a priority with the NDP stating; "*It is an investment priority to ensure that the existing extensive transport networks, which have been greatly enhanced over the last two decades, are maintained to a high level to ensure quality levels of service, accessibility and connectivity to transport users*.

The revised NDP has acknowledged that when evaluating the progression of such identified national roads projects, prioritisation must be in line with *the '2:1 Programme for Government commitment on new public transport and new roads, the NIFTI framework, the National Planning Framework and the requirements of the Climate Action Plan.'*

In considering the forementioned policies are aligned with the overarching NPF and requirement to be consistent with the associated NSOs, of particular relevance, NSO 2 '*Enhanced Regional Accessibility',* the revised NDP re-confirms that the government is fully focused on delivering such infrastructure that will facilitate with the projected growth for Ireland's towns and cities. The previous NDP listed significant investment in new inter-urban roads, strengthening the connection between regions and urban centres. The revised NDP re-confirms that investment will continue, with regard to the potential for carrying public transport services and better integrating public transport and active travel networks on the approaches to urban areas.

> *"A key priority will be to maintain the existing national road network to a robust and safe standard and a significant percentage of national roads expenditure over the course of this NDP will relate to maintenance works, in order to protect and renew existing assets."*

The concept of the Proposed Road Development is considered compliant with the previous and revised NDP with strong confluence between NSO 2 and NSO 3, that aim to improve regional accessibility, maintain the strategic capacity and safety of the national roads network and enhance economic growth for the Northern and Western Region.

2.1.1.4 Strategic Framework for Investment in Land Transport - 2015

The Strategic Framework for Investment in Land Transport (SFILT) which was published by the Department of Transport, Tourism and Sport (DTTAS) in 2015 outlines the key principles against which national and regional, comprehensive and single mode-based plans and programmes will be drawn up and assessed. The framework does not set out a list of projects to be prioritised however the following three priorities are noted in terms of investment:

- Priority 1 – Achieve steady state maintenance;
- Priority 2 – Address urban congestion; and
- Priority 3 – Maximise the value of the road network.

In terms of Priority 3, the report states that "the value of the road network will be maximised through targeted investments that:

- Enhance the efficiency of our existing network, particularly through the increased use of ITS applications;
- Support identified national and regional spatial planning priorities;
- Provide access for large-scale employment proposals; and
- Support identified national and regional spatial planning priorities"

The Proposed Road Development will support the objectives of the SFILT by improving the efficiency of this section of the national road network.

The SFILT will be updated by the National Investment Framework for Transport in Ireland which is currently in draft format.

2.1.1.5 Programme for Government: Our Shared Future – October 2020

In October 2020, the Government launched "Programme for Government: Our Shared Future" outlining the policies and objectives over the term of the government. The proposed road development aims to support the objectives and policies contained within the programme for a partnership government, by continuing *“to invest in new roads infrastructure to ensure that all parts of Ireland are connected to each other.”*

The Programme also seeks to introduce an ambitious road safety strategy targeting the Vision Zero principle;

> *“Introduce a new road safety strategy focused on reducing death and injuries of vulnerable road users, pedestrians, and cyclists.*
>
> *Prioritise the consolidation of the existing road traffic legislation and use that as an opportunity to rectify any anomalies that may have developed which hinder appropriate enforcement.”*

The Proposed Road Development will directly assist this Programme by improving this important rural section of the national road network.

2.1.1.6 Road Safety Authority Road Safety Strategy 2021 - 2030

The Road Safety Authority (RSA) Road Safety Strategy 2021 – 2030, sets outs targets to be achieved in terms of road safety in Ireland as well as policy to achieve these targets. As mentioned in the previous section, the government has adopted Vision Zero in the Programme for Government 2020 which underpins the EU Road Safety Policy Framework (2021–2030):

> *“At the core of the 2021–2030 strategy is our aim to achieve Vision Zero in Ireland by 2050. Vision Zero is an overarching, international, long-term goal aimed at the eventual elimination of deaths and serious injuries in road traffic collisions, with the focus of achieving not just fewer but zero deaths and serious injuries.*
>
> *In best practice, Vision Zero is supported by time-limited targets and performance indicators to reduce deaths and serious injuries. These targets and indicators are then used to drive effective, multi-sectoral interventions provided through enhanced mechanisms of delivery.”*

The primary target set out in the strategy is set out with:

> *“…..the aim of achieving Vision Zero by 2050 in Ireland, the 2021–2030 strategy has set the following targets, in line with the EU and UN targets to reduce fatalities and serious injuries by 50% by 2030.*
>
> *We will reduce deaths on Ireland’s roads by 50% from 144 to 72 or lower and reduce serious injuries on Ireland’s roads by 50% from 1,259 to 630 or lower.”*

The principles of the proposed road development will support the proposed road safety strategy by providing essential transport infrastructure to meet these demands and ensure improved facilities are provided. This will reduce the levels of traffic congestion on the road network in proximity to the existing Liss Bridge, providing a corresponding reduction in collisions along this link. By segregating a significant proportion of the regional traffic and the local traffic there will be less chance of conflict between these two types of road users. In addition, the proposed road development will be compliant with the current design standards, which will help improve road safety through enhanced VRU provision.

2.1.2 Regional Policy

2.1.2.1 Northern and Western Region - Regional Spatial Economic Strategy 2020-2032

There are three regional assemblies in Ireland, they comprise; the Southern, Eastern and Midlands and Northern and Western regions. These regional assemblies have a primary function to identify regional policies and coordinate initiatives that support the delivery of national planning policy. The primary driver for this is the implementation of the Regional Spatial and Economic Strategies (RSES) 2040 (Government of Ireland, 2020b). The RSES provides regional level strategic planning and economic policy in support of the implementation of the National Planning Framework and provides a greater level of focus around the NPO and NSO of the NPF.

The RSES recognises the need to significantly improve the integration of Land-use and Transport Planning across the region:

> *"Economic activity is a driver of demand in the regions transport system, whether it be for the local, regional, inter-regional, inter-island or international movement of people and goods. Our landscape and dislocation from cities of scale present challenges of transport connectivity."*

A list of relevant Regional Policy Objectives (RPO) from the Northern and Western RSES are outlined in Table 2-1.

Table 2-1: Northern and Western Region RSES 2020-2032 Relevant policies

Policy Ref.	Objective
RPO 3.6.1	It is an objective to establish a collaborative approach between the Regional Assemblies (NWRA & SRA), the local authorities and other stakeholders to enable all their metropolitan areas to collaborate to harness their combined potential as an alternative to Dublin.
RPO 6.5	The capacity and safety of the region's land transport networks will be managed and enhanced to ensure their optimal use, thus giving effect to National Strategic Outcome No.2 and maintaining the strategic capacity and safety of the national roads network including planning for future capacity enhancements.
RPO 6.8	The delivery of the following projects shall be pursued, in consultation with and subject to the agreement of TII, through pre-appraisal, early planning and to construction as priority projects to be delivered to an appropriate level of service in the medium-term. • N3 North of Kells to Enniskillen, via Cavan and the A509 in Fermanagh • N5/N26/N58 Mount Falcon to Swinford, Castlebar East to Bohola Project • N13 Manorcunningham to Bridgend/Derry • N13 Stranorlar to Letterkenny • N15 Sligo to Bundoran • N15 Stranorlar to Lifford • N16 Sligo to Blacklion • N53 Dundalk to N2 at Carrickmacross • N54/A3 Cavan to Monaghan Town • N55 Cavan Town to Athlone • N56 Inver to Killybegs • N59 Upgrade (including the N59 Oughterard Bypass and the N59 Clifden to Oughterard Scheme) • N61 Athlone to Boyle improvement • N63 Longford to M17 at Annagh (Junction 18).
RPO 8.12	To ensure that adequate infrastructure is in place to meet demands from continuing growth and development of the economy and to cater to existing and increased population levels.

Source: Northern and Western Region Regional Spatial Economic Strategy 2020-2032

The RSES does acknowledge that local authorities are progressing a wide range of regional and local roads projects across the region and these should be prioritised in accordance with their respective settlement strategies and road safety considerations. The Proposed Road Development is specifically referred to within the RSES under RPO 6.8 (Table 2-1) as a project integrated with the targeted development of the major urban centres for the region.

With respect to these policies, the Proposed Road Development will satisfy the objectives of the RSES.

2.1.3 Local Policy

2.1.3.1 Galway County Development Plan (2015-2021)

The national and regional objectives identified above have been developed further and translated into local objectives through the Galway County Development Plan (2015-2021) (CDP). The CDP stated the N/M6 and M17/M18 as the main access routes in the region and the N59, N63, N83 and N84 as important inter-regional routes within the Galway County Development Plan (2015-2021). The CDP makes specific reference to the wider N63 Leacht Seoirse-Ballygar route of which the N63 Liss to Abbey is a sub-section.

A primary aim of the CDP is to promote, guide and enforce high quality standards of development for urban and rural areas throughout County Galway. The general emphasis to enhance the quality of life, environment, community and economy in a manner that supports the sustainable development of the entire County. The concept, principles and design process of the Proposed Road Development is considered compliant with the policies and objectives set out in the CDP.

2.1.3.2 Draft Galway County Development Plan (2022-2028)

The Draft Galway County Development Plan (Draft CDP) 2022 – 2028 has been prepared in accordance with the provisions of the Planning and Development Act 2000 (as amended). In view of recent implementation of new policies on a national and regional level as referred to in the previous sections, the Draft CDP states to have considered these changes associated with these overarching policy frameworks in Ireland.

The Draft CDP has not yet been adopted, however has been on public display and available for public consultation from the 20th May 2021 to the 30th July 2021. The adoption of the Draft CDP is required to be completed by May 2022. In reviewing the Draft CDP for 2022-2028, it is our view that the concept, principles, and design process of the Proposed Road Development is considered compliant with the policies and objectives set out in the current Draft CDP.

2.1.4 Policy Summary

The Policy section of this Design Report has highlighted that the Proposed Road Development is compliant with planning policies at a European, national, regional and local levels. The principles of the Proposed Road Development will particularly assist with;

- Supporting the objectives of the TEN-T in broad terms by improving the connection to Junction 19 on the M17 TEN-T network;
- Enhancing regional and local accessibility, by providing improved accessibility and social inclusion to community facilities and to heritage resources;
- Maintain the strategic capacity and safety of the national roads network including planning for future capacity enhancements;
- Sustaining the economic growth through the provision of improved transport connectivity in this rural location;
- Enhancing environmental benefits, through a reduction in traffic queuing and journey time reliability;
- Improved safety through improved road alignment, pedestrian and cycle user segregation, and ultimately reducing collisions in line with the Road Safety Strategy;
- Ensuring adequate transport infrastructure is in place to meet demands from continued population growth; and
- Protecting and safeguarding investment made in strategic transportation infrastructure.

2.2 Project Specific Need

The N63 forms part of the National Secondary Road network. The TII National Roads Network Indicators 2018 report describes that the N63 is operating at a volume / capacity ratio of below 80% in most areas but at a number of pinch points it is operating at a volume/ capacity ratio of 100%-120%. Along one section, the N63 is operating at above 120% volume capacity. A review of the existing road condition of the network in the vicinity of the study area was carried out and is reported in the following paragraph.

The existing N63 within the study area is generally narrow with no hard shoulders. Alignment of the road is poor in both the horizontal and vertical planes. There is no off-carriageway provision for pedestrians or cyclists. The existing Liss Bridge is narrow is significantly restricts traffic flows, with two HGV’s travelling in opposite directions unable to safely pass on the Liss Bridge. Given the rural nature the development, agricultural vehicles conflict with local road traffic on the Liss Bridge on a regular basis, which in turn generates localised traffic issues. There have been collisions at this location as identified in TII and RSA collision data. The Liss Bridge is significantly below standard both in terms of alignment and containment. During a site inspection a number of bridge strikes were apparent, with the existing sub-standard parapet walls repaired in several locations.

As set out in Section 2.1.4 above, the N63 Realignment Scheme is considered to be consistent with national, regional and local policy guidelines. The development is described as a specific objective within both the current Galway County Development Plan and the Northern and Western RSES. The Proposed Road Development is a multi-modal transport development, with a provision for both cyclists and pedestrians. The development will improve journeys across the Abbert River, with improved horizontal and vertical alignments. In addition, improved cross-sections, realignment and upgraded junctions will improve safety, particularly for pedestrians and cyclists. The development also forms a key east / west transport link across the Abbert River, thus, providing a link to the national primary road network and motorway network via the M17 Junction 19.

In addition, the N63 currently experiences significant traffic congestion issues in the vicinity of the Liss Bridge. This development will assist in the alleviation of these issues at the local level, while improving safety for both motorised and non-motorised users.

3 Transport Modelling, Road Type & Safety

3.1 Model Development Process / Methodology

3.1.1 Modelling Overview

A simple model (link-based projections) approach has been used for the traffic assessment of this Proposed Road Development. As per TII Project Appraisal Guidelines (TII, 2016), this approach can be adopted for minor projects (costing between €5m and €20m) where significant re-routing does not take place, instead of building a full traffic assignment model (zone-based projections). In order to calculate the number of vehicles which will use the Proposed Road Development (regional traffic), the number of vehicles that will remain on the existing route (local traffic) were determined first. Based on the traffic survey data, a simple model was created which calculated the percentage of local and regional traffic.

For simple models, traffic flows are generally represented as vehicular traffic flows on links, with limited information on origin, destination, or trip length. In such cases, future year traffic growth is projected using growth rates which describe likely traffic growth that may occur over the appraisal period of the scheme.

The derivation of link-based growth rates is based on an aggregate projection of growth in vehicle kilometres within a defined geographical area, with appropriate classifications by vehicle type and projected period. This allows the specification of a series of growth rates which can be applied directly to traffic flows on simple networks to generate an appropriate estimate of future traffic flows.

3.1.2 Traffic Data Collection

Traffic survey data was required to develop and validate the Base Year traffic model. A baseline review was undertaken to determine the existing traffic conditions in the area surrounding the Proposed Development. This included commissioning a series of detailed traffic surveys to determine the existing traffic levels and conditions and to inform the development of the scheme. The following traffic surveys were undertaken:

- Junction Turning Counts (JTC)
  - Classified JTC data gives an indication of the turning movements observed at key junctions in the network. These were commissioned in the 5 locations shown below in Figure 3-1, and recorded in 15-minute intervals between 07:00 and 19:00 on Tuesday 21st May 2019.
- Automatic Traffic Counts (ATC)
  - ATC data provides link count data over a longer time period, which smooths out any day-to-day variations that may not be picked-up when undertaking a single day count. ATCs were also used to assess the speed distribution of the traffic along the existing N63. ATC data was collected at the 3 sites shown in Figure 3-1. Each site was active for two weeks, with the majority of sites actively collecting data between 21st May and 3rd June 2019.
- TII Traffic Monitoring Units (TMU)
  - TII maintains a network of permanent traffic counters (TMU - Traffic Monitoring Units) on the National Road Network. One such traffic counter (Ref. TMU N63 080.0W) is located on the N63 between Roscommon and Galway at Derreen, Co. Galway. This location is shown also in Figure 3-1.

Figure 3-1 JTC, ATC and TII TMU Locations Map

3.1.3 Network Development

The future year 'Do-Minimum' road network which forms the basis of the future traffic models, should include the existing road network plus any committed infrastructure improvements in the study area. As there are no significant road improvements committed currently within the study area, the 'Do-Minimum' future road network for the proposed road development consists of only the existing road network, which is assumed to be maintained over time. The 'Do-Minimum' road network is shown in Figure 3-2, with the3 location of the existing bridge shown in red.

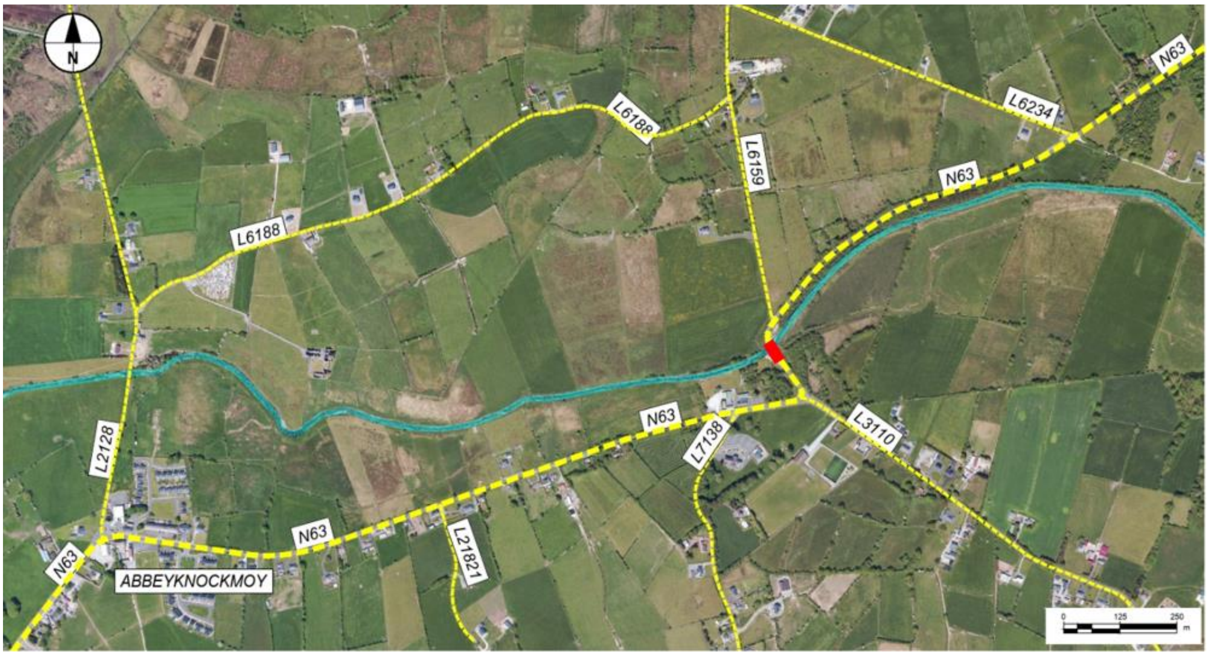


Figure 3-2 'Do-Minimum' Road Network

The future year 'Do-Something' road network includes all the assumptions of the Do-Minimum network plus the Proposed Road Development. The 'Do-Something' road network is shown in Figure 3-3, with Proposed Road Development shown in red.

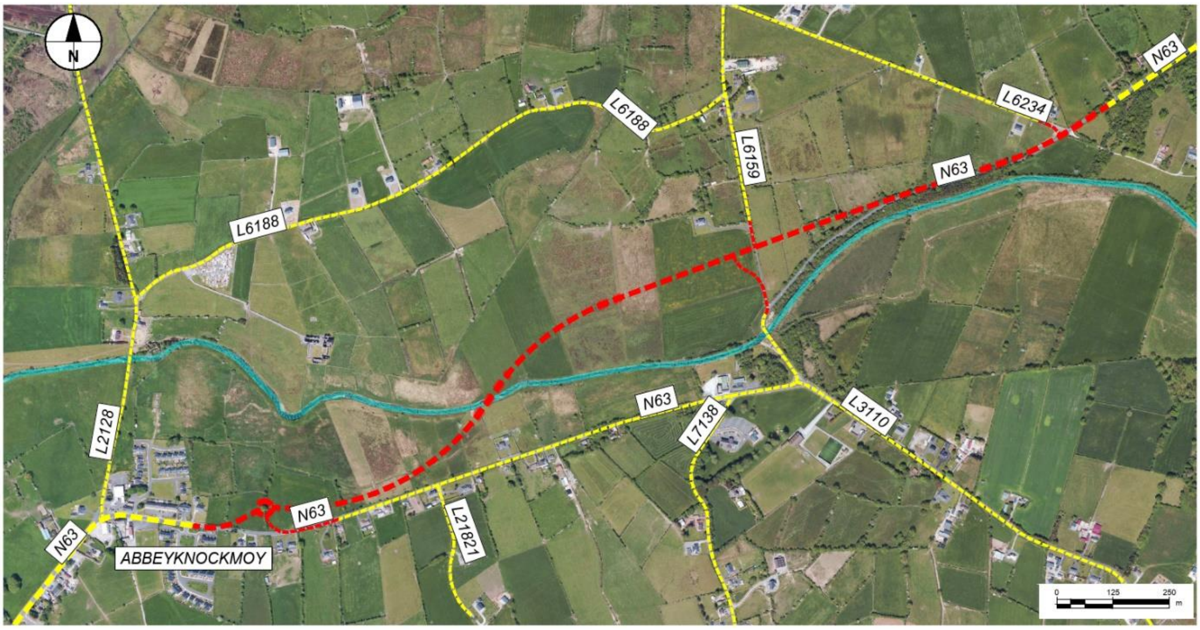


Figure 3-3 'Do-Something' Road Network

3.1.4 Future Years Traffic Forecast

The development of the traffic growth forecasts for the future year has been based on the requirements set out in TII PAG Unit 5.3 - Travel Demand Projections (May 2019).

Future Year traffic has been forecasted for the following years in accordance with TII PAG Unit 5.1 – Construction of Transport Models:

- Assumed Opening Year - 2023; and
- Design Year - 2038 (assumed Opening Year + 15 years).

The TII PAG specifies that the proposed road development should be assessed using three future traffic growth scenarios, namely the TII central growth scenario and two sensitivity scenarios (low and high). The TII central traffic growth scenario is based on the population and employment projections from the National Planning Framework. The TII low and high traffic growth projections assume the same distribution of population and employment as the National Planning Framework but with lower and higher total growth projections. The model and scenarios outlined above were used to assess the traffic impacts of the proposed road development.

The link-based growth rates for Galway from Table 6.2 of TII Project Appraisal Guidelines for National Roads Unit 5.3 - Travel Demand Projections (PE-PAG-02017 - May 2019) were applied to the model. An extract from PAG Unit 5.3 can be seen in Table 3-1 below.

Table 3-1 Link-Based Growth Rates (Galway)

Area	Growth Sensitivity Scenario	2016-2030		2030-2040		2040-2050		2050+	
Galway	Low Sensitivity Growth	LV	HV	LV	HV	LV	HV	LV	HV
		1.0243	1.0430	1.0087	1.0177	1.0088	1.0218	1.0000	1.0000
	Central Growth	LV	HV	LV	HV	LV	HV	LV	HV
		1.0259	1.0446	1.0109	1.0198	1.0105	1.0236	1.0000	1.0000
	High Sensitivity Growth	LV	HV	LV	HV	LV	HV	LV	HV
		1.0294	1.0480	1.0148	1.0236	1.0181	1.0336	1.0000	1.0000

Source: Table 6.2 of TII PE-PAG-02017 Project Appraisal Guidelines for National Roads Unit 5.3 - Travel Demand Projections

Using the link-based growth rates that have been provided for County Galway, the future AADT flow was determined for the Do-Minimum and Do-Something scenarios, for both the assumed Opening Year (2023) and Design Year (2038).

Traffic growth projections were developed for each of the three TII growth scenarios in line with methodology set out in TII PAG Unit 5.3 - Travel Demand Projections (May 2019).

3.2 Base Year Traffic Models (2019)

The traffic volumes for the Base Year (2019) scenario arising from the analysis of the traffic surveys and the base year traffic model are shown in Table 3-2. The traffic flows are illustrated graphically in Figure 3-4.

The AADT flows within the study area were supplied to the design team including environmental experts and used to assess the potential environmental impact of the traffic from the Proposed Road Development.

Table 3-2 AADT Summary for Base Year (2019)

No.	Link	2019 Base AADT (%HGV)
1	Existing N63 between the eastern end of Abbeyknockmoy and L7138	4859 (5.9% HGV)
2	Existing N63 between L7138 and L3110	3764 (6.8% HGV)
3	Existing N63 between L3110 and L6159 (at Liss Bridge)	3499 (6.5% HGV)
4	Existing N63 between L6159 and L6234	4859 (5.9% HGV)

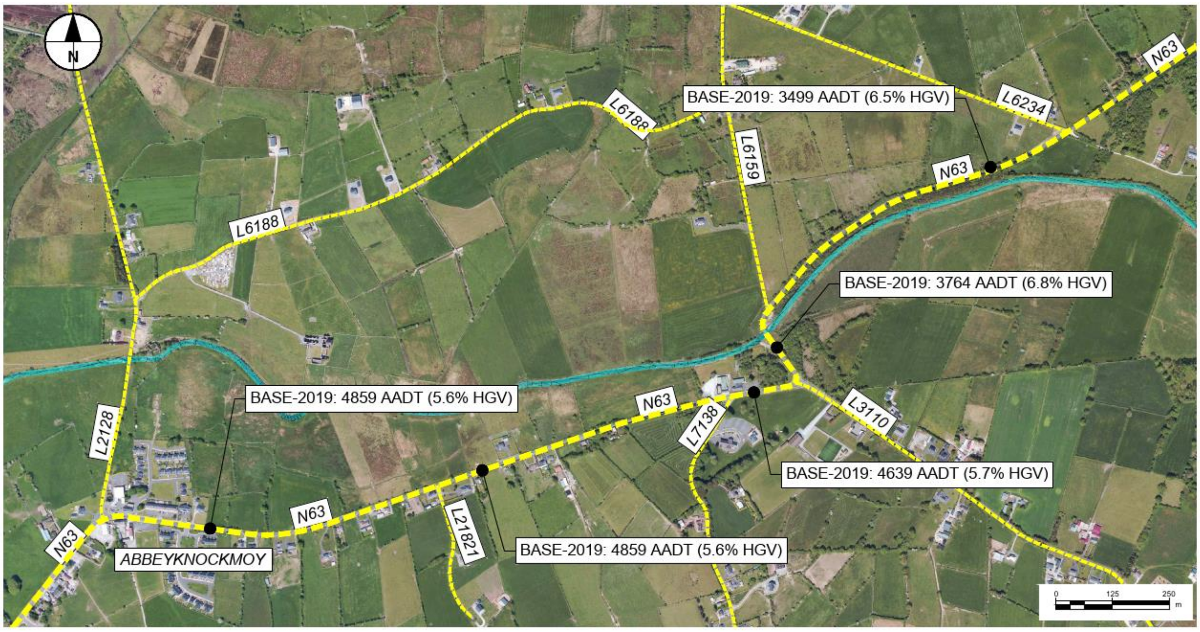


Figure 3-4 AADT Values: Base Year 2019

3.3 Traffic Impact

3.3.1 Traffic Impact - Opening Year (2023) and Design Year (2038)

Forecast traffic flows in the Do-Minimum and Do-Something scenarios for the assumed Opening Year (2023) are outlined in **Error! Reference source not found.** alongside the Base Year (2019) traffic flows.

Forecast traffic flows in the Do-Minimum and Do-Something scenarios for the Design Year (2038) are outlined in **Error! Reference source not found.** alongside the Base Year (2019) traffic flows.

The traffic flows in each of these scenarios are illustrated graphically in Figure 3-5 and Figure 3-6.

Results for both the Opening Year (2023) and Design Year (2038) show that implementation of the Proposed Road Development will cause a substantial decrease in AADT on the following sections:

- Existing N63 between the proposed roundabout and the L7138;
- Existing N63 between the L7138 and L3110 (at the Newtown National School and Abbeyknockmoy Community Centre); and
- Existing N63 between L3110 and L6159 (across the existing Liss Bridge).

Table 3-3 AADT Summary for Assumed Opening Year (2023)

No.	Link	2019 Base AADT (% HGV)	2023 Do-Minimum AADT (% HGV)	2023 Do-Something AADT (% HGV)	Change between Do-Some and Do-Min AADT	% change between Do-Some and Do-Min AADT
1a	Proposed N63 between the eastern end of Abbeyknockmoy and proposed roundabout *(Base/Do-Min: Existing N63 between the eastern end of Abbeyknockmoy and L7138)*	4859 (5.9% HGV)	5405 (6.0% HGV)	5405 (6.0% HGV)	0	0%
1b	Existing N63 between proposed roundabout and L7138 *(Base/Do-Min: Existing N63 between the eastern end of Abbeyknockmoy and L7138)*	4859 (5.9% HGV)	5405 (6.0% HGV)	1994 (4.9% HGV)	-3411	-63%
2	Existing N63 between L7138 and L3110	4639 (5.7% HGV)	5161 (6.1% HGV)	1750 (5.1% HGV)	-3411	-66%
3	Proposed local link between L3110 and N63/L6159 junction (at Liss Bridge) *(Base/Do-Min: Existing N63 between L3110 and L6159 (at Liss Bridge))*	3764 (6.8% HGV)	4190 (7.2% HGV)	484 (8.8% HGV)	-3706	-88%
4	Proposed N63 between L6159 and L6234 *(Base/Do-Min: Existing N63 between L6159 and L6234)*	3499 (6.5% HGV)	3895 (6.9% HGV)	3895 (6.9% HGV)	0	0%
5	Proposed N63 between proposed roundabout and L6159 *(New Link)*	-	-	3411 (6.7% HGV)	3411	+100%

Table 3-4 AADT Summary for Design Year (2038)

No.	Link	2019 Base AADT (% HGV)	2038 Do-Minimum AADT (% HGV)	2038 Do-Something AADT (% HGV)	Change between Do-Some and Do-Min AADT	% change between Do-Some and Do-Min AADT
1a	Proposed N63 between the eastern end of Abbeyknockmoy and proposed roundabout *(Base/Do-Min: Existing N63 between the eastern end of Abbeyknockmoy and L7138)*	4859 (5.9% HGV)	7142 (7.2% HGV)	7142 (7.2% HGV)	0	0%
1b	Existing N63 between proposed roundabout and L7138 *(Base/Do-Min: Existing N63 between the eastern end of Abbeyknockmoy and L7138)*	4859 (5.9% HGV)	7142 (7.2% HGV)	2629 (5.9% HGV)	-4513	-63%
2	Existing N63 between L7138 and L3110	4639 (5.7% HGV)	6822 (7.4% HGV)	2309 (6.1% HGV)	-4513	-66%
3	Proposed local link between L3110 and N63/L6159 junction (at Liss Bridge) *(Base/Do-Min: Existing N63 between L3110 and L6159 (at Liss Bridge))*	3764 (6.8% HGV)	5551 (8.7% HGV)	643 (10.5% HGV)	-4908	-88%
4	Proposed N63 between L6159 and L6234 *(Base/Do-Min: Existing N63 between L6159 and L6234)*	3499 (6.5% HGV)	5157 (8.3% HGV)	5157 (8.3% HGV)	0	0%
5	Proposed N63 between proposed roundabout and L6159 *(New Link)*	-	-	4513 (8.0% HGV)	+4513	+100%

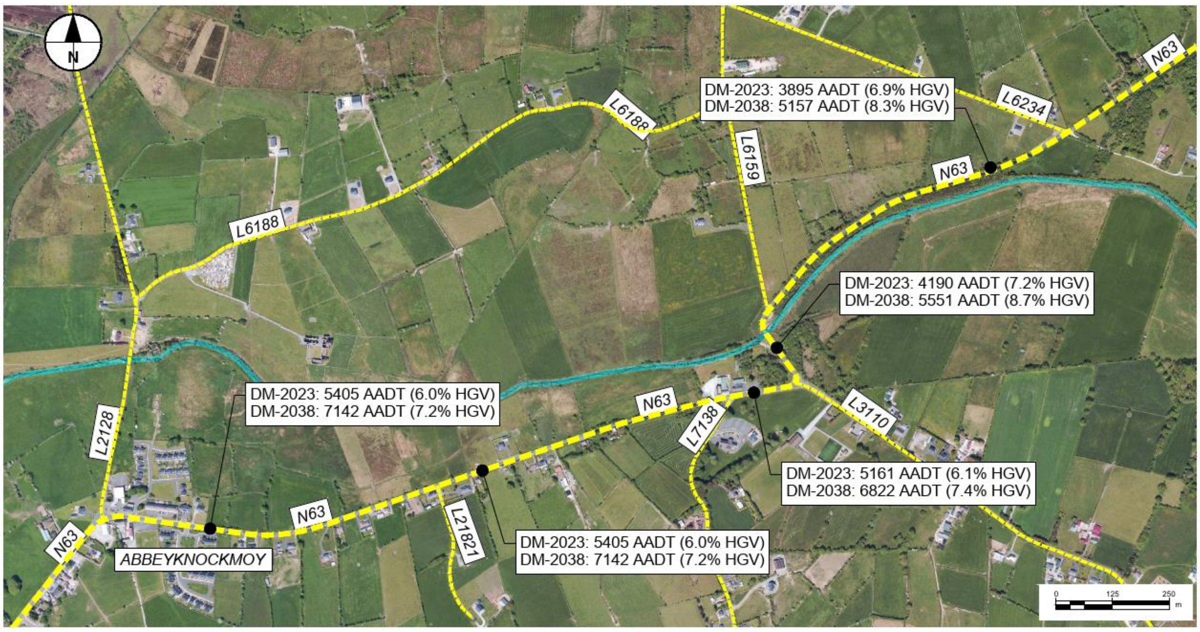


Figure 3-5 AADT Values: Do-Minimum 2023 and Do-Minimum 2038

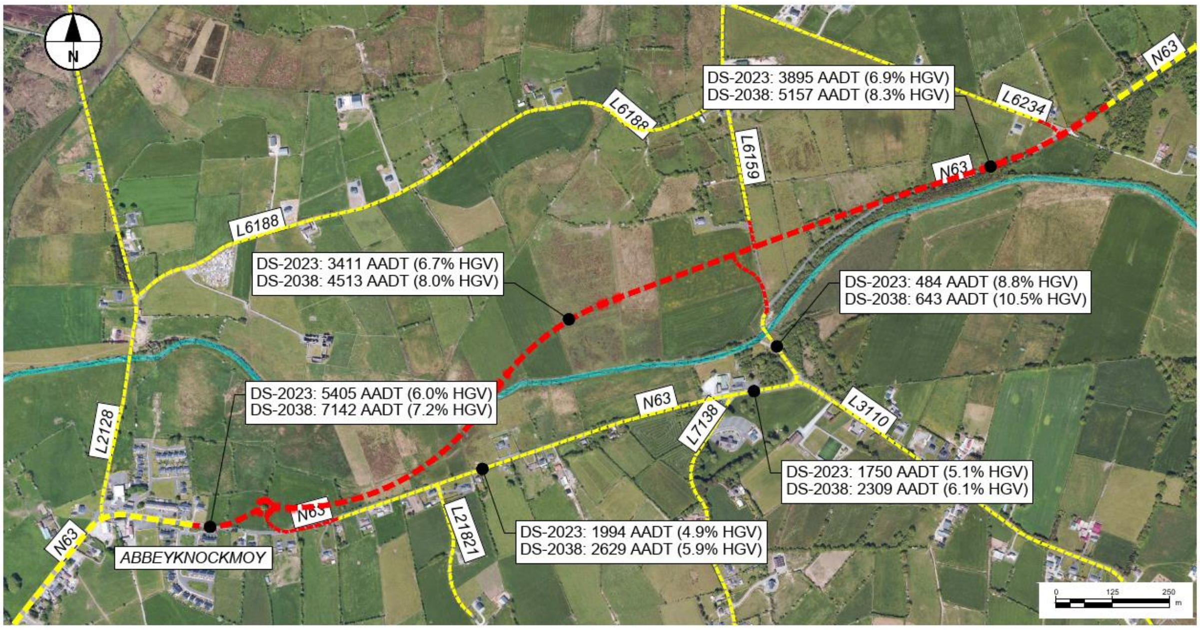


Figure 3-6 AADT Values: Do-Something 2023 and Do-Something 2038

Figure 3-7 below also illustrates the relative differences in traffic volumes between the Do-Minimum and Do-Something scenarios for the Opening Year (2023) and Design Year (2038); where the positive figures indicate increased traffic volumes as a consequence of the Proposed Road Development implementation and negative figures indicate reduced traffic volumes as a consequence of the Proposed Road Development implementation.

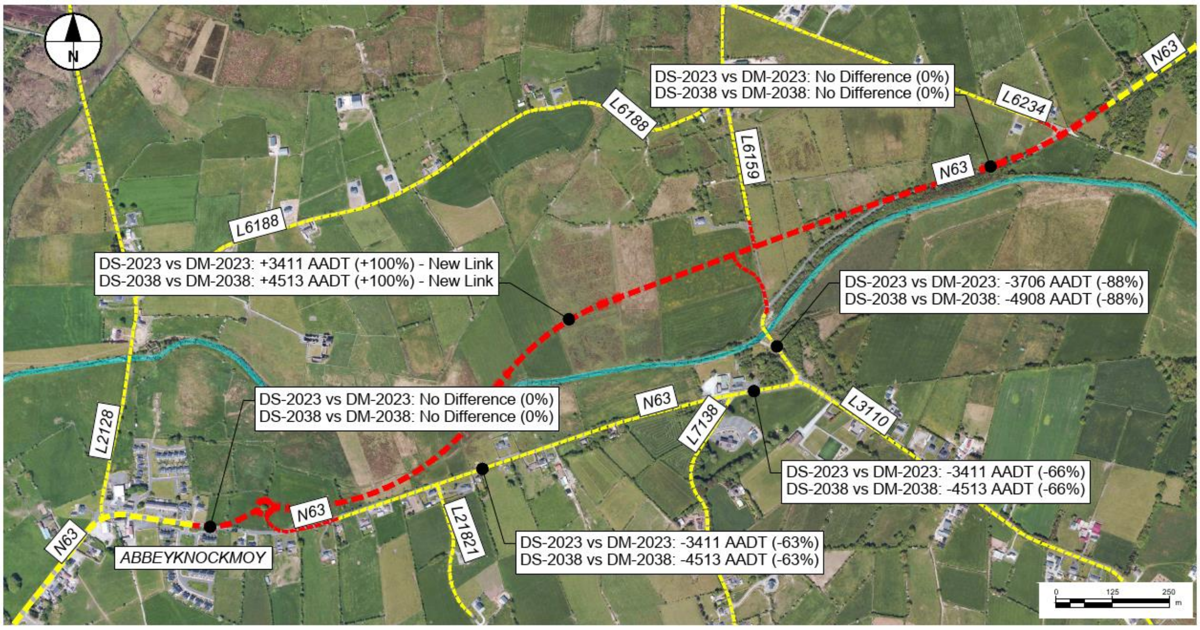


Figure 3-7 AADT Difference between Do-Something and Do-Minimum

3.4 Network Statistics

Network statistics were extracted from the traffic models and a comparison made against the Do-Minimum option for the Design Year (2038). The key network statistics comprise the following:

- Total Vehicle km;
- Total Network Travel Time (hrs); and
- Average Vehicle Speed (kph).

Table 3-5 below outlines the key daily network statistics. Overall, the table shows that the Proposed Road Development (Do-Something) will provide benefits for the entire network compared to the Do-Minimum option.

The network statistics outlined below illustrate that the Proposed Road Development will provide a reduction in total distance travelled, a reduction in travel time_and an increase in average speed throughout the entire modelled road network.

Table 3-5 Daily Network Statistics (All Vehicles)

Route Option	Total Vehicle km	Total Network Travel Time (hrs)	Average Vehicle Speed (kph)
2038 Do-Minimum	15455.6	249.3	62.0
2038 Do-Something	14769.3	198.3	74.5
Relative Difference	-4.4%	-20.4%	+20.1%

3.5 Safety Impact

3.5.1 Safety Assessment

An assessment of the potential safety benefits of the scheme has been undertaken using the TII software programme COBALT. COBALT (COst and Benefit to Accidents – Light Touch) is a computer program developed by the UK Department for Transport (DfT) to undertake the analysis of the impact on collisions as part of the economic appraisal for a road scheme. An Irish specific version of the COBALT program was developed by TII for use on road schemes in the Republic of Ireland and is referred to as COBALT – Ireland. COBALT assesses the safety aspects of road schemes using detailed inputs of links that may be impacted by the scheme.

The results of the COBALT Model are used for the safety assessment of the scheme in the Project Appraisal Balance Sheet (PABS). The Proposed Road Development will be of a higher safety standard than the existing road network and will therefore contribute to a network-wide reduction in collisions. This is reflected in the COBALT model which forecasts a reduction of 15 collisions over the 30-year design life appraisal period. This equates to a reduction of 27 casualties categorised as follows:

- 1 Fatal;
- 2 Serious; and
- 24 Slight.

Table 3-6 below outlines the key safety assessment results from the COBALT model which were included in the PABS:

Table 3-6 PABS Safety Assessment (COBALT Results)

	Proposed Road Development
Total Collision Benefits Saved by Proposed Road Development	€ 1.354m
Total Collisions Saved by Proposed Road Development	17
Total Casualties Saved by Proposed Road Development (Fatal, Serious, Slight)	1, 2, 24

3.5.2 Road Safety Audit

AECOM was commissioned to undertake a Stage 1 Road Safety Audit (RSA) on the proposed development of the N63 Liss to Abbey Realignment Scheme. The Safety Audit represents the response of an independent Audit Team to various aspects of the scheme. The recommendations contained therein are the opinions of the Audit Team and are intended as a guide to the designers on how the scheme as designed can be improved to address issues of road safety.

All the problems identified in the audit were accepted along with the proposed measures. A copy of the Stage 1 RSA for the N63 Liss to Abbey Realignment Scheme can be found in Appendix B.

3.5.3 Health and Risk Safety Assessment

Under the Safety, Health and Welfare at Work (Construction) Regulations 2012, road designers must identify hazards that the design may present during the construction of the project and the subsequent maintenance.

A Designers Health and Safety Hazards Management Audit Form was completed in August 2019. This identified potential hazards from a number of the scheme's construction processes and work activities, which were grouped under the following headings:

- Particular Risks During Construction,
- Other Significant Risks During Construction,
- Significant Hazards During Operation, Maintenance and Decommissioning.

Where a hazard was identified, a provision to make the residual hazard easier to manage was proposed and the consequence of each proposed measure was assessed.

3.6 Selection of Road Type

3.6.1 Incremental Analysis

As required under the TII Project Management Guidelines (TII, 2020) an incremental analysis of the carriageway type was undertaken to inform the selection of the cross-section for the Proposed Road Development. As part of the incremental analysis, an assessment of the operating capacity of the N63 Liss to Abbey section of the Proposed Road Development was undertaken.

The notional traffic capacity of the various road cross-sections is defined in Table 6.1 of TII Standard DN-GEO-03031. A Type 2 Single Carriageway is appropriate for flows of up to 8,600 AADT, which will have sufficient capacity to comfortably cater for the projected traffic demand in the Design Year (2038).

In consideration of the expected level of traffic volumes along the N63 mainline, the rural nature of the Proposed Road Development and to maintain a route consistency with road improvement already completed to the west of Abbeyknockmoy, a Type 2 Single Carriageway has been selected (in compliance with TII Standard Construction Detail CC-SCD-00002).

4 Geometry (including Relaxations & Departures)

4.1 Applicable Technical Standards

The Proposed Road Development has been designed in accordance with the relevant TII Road Design Standards, the TII Environmental Assessment and Construction Guidelines (available on the TII Publications website[1]) and other best practice guidelines. The most relevant geometric design standards are:

- DN-GEO-03031 Rural Road Link Design (TII, 2017);
- DN-GEO-03036 Cross Sections and Headroom (TII, 2017);
- DN-GEO-03060 Geometric Design of Junctions (priority junctions, direct accesses, roundabouts, grade separated, and compact grade separated junctions) (TII, 2019);
- DMURS - Design Manual for Urban Roads and Streets (DTTAS,2019); and
- NCM – National Cycle Manual (NTA, 2011).

4.2 Principal Geometric Parameters

Table 4-1 below details the principal geometric parameters used in the mainline design, this doesn't cover the 50 km/h section West of the Roundabout (60 km/h design speed) which is designed in accordance with DMURS (2019).

Table 4-1 Principal Geometric Parameters

Design Headings	Design Element	Design Requirement	Standards Ref.
Road Type	Road Type Road Menu Type Traffic Type	All Purpose Road Type 2 Single Carriageway Rural	- - -
Design Speed	Mandatory Speed Limit Design Speed Alignment Constraint Ac Layout Constraint Lc	100 km/h 100 km/h N/A (Offline) N/A (Offline)	- Section 1.1.3 DN-GEO-03031 Section 1.1.1 DN-GEO-03031 Section 1.1.2 DN-GEO-03031
Sight Distance	Stopping Sight Distance Full Overtaking Sight Distance	215 m 580 m	Table 1.3 DN-GEO-03031 Table 1.3 DN-GEO-03031
Horizontal Alignment	Road Camber Superelevation Range Min. R (no superelevation) Desirable Minimum R 1-Step below Des. Min. R	2.5% 2.5% < S < 7.0% 2040 m 720 m 510 m	Section 3.1 DN-GEO-03031 Table 1.3 DN-GEO-03031 Table 1.3 DN-GEO-03031 Table 1.3 DN-GEO-03031 Table 1.3 DN-GEO-03031
Vertical Alignment	Desirable Minimum Crest K FOSD Overtaking Crest K Desirable Minimum Sag K 1-Step Below Des. Min. Sag K	100 400 37 26	Table 1.3 DN-GEO-03031 Table 1.3 DN-GEO-03031

[1] http://www.tiipublications.ie/

Design Headings	Design Element	Design Requirement	Standards Ref.
	Absolute Min. Vertical Curve length Desirable Max. Gradient Max. Gradient with Relaxation Minimum Gradient	N/A (Single Carriageway) 5% 6% 0.5%	Table 1.3 DN-GEO-03031 Table 1.3 DN-GEO-03031 Table 1.3 DN-GEO-03031 Table 4.1 DN-GEO-03031 Table 4.2 DN-GEO-03031 Section 4.1.3 DN-GEO-03031
Cross-Section & Headroom	Cross-Section Headroom (Road over Road) Headroom (Road over Rail)	Type 2 Single Carriageway 5.30 N/A	Table 4.2 DN-GEO-03036 Table 6.1 DN-GEO-03036 -
Overtaking Value	Overtaking Value	20%	Table 7.3 DN-GEO-03031 Or Section 7.6.1 DN-GEO-03031
Junctions	Permitted Junction Types	Simple: YES Ghost Island: YES Left-in/Left-out: YES Signalised: YES Roundabout: YES Compact Grade Separated: YES Grade Separated: NO Major Interchange: NO	- - - - - - Table 2.1 DN-GEO-03060 -
Cycle Facilities	Recommended Design Speed Horiz. Alignment: Recommended Min R. for Cycle Facilities Vert. Alignment: Des. Max. Gradient for Cycle Facilities Vertical Alignment: 1-Step Below Des. Max Gradient Cross-Section (Minimum)	30km/h 25m 3% 5% 1.75m Raised Cycle Track (1 way) 2.50m Segregated Cycle Track (2 way)	Section 1.4 DN-GEO-03031 Table 3.1 DN-GEO-03031 Table 4.3 DN-GEO-03031 Table 4.3 DN-GEO-03031 Width Calculator NCM

4.3 Determination of Posted Speed Limit

A speed limit of 100 km/h will be imposed on the realigned mainline section of the Proposed Road Development in line with existing conditions. In the interim, GCC have reduced the speed limit in the vicinity of the study area from 100 km/h to 80 km/h (see GCC Byelaws 2018[2]). The extent of the imposed speed limit can be seen in **Error! Reference source not found.** below. Following consultation with G CC, it was agreed that the design speed for the mainline section of the Proposed Road Development will remain as 100 km/h.

[2] Road Traffic Special Speed Limits. County Galway Bye-Laws 2018: http://www.galway.ie/en/services/roads/trafficmanagement/speedlimits/

A 50 km/h speed limit will be applied to the short section of realigned N63 mainline to the west of the proposed roundabout towards Abbeyknockmoy village. The roundabout junction will introduce a combination of alignment deflection and speed control and will provide a suitable transition from higher posted speed zone to lower speed zones close to the Abbeyknockmoy village.

A 50 km/h speed limit will also be applied to the remaining section of the existing N63, reclassified from National Secondary to Local road, between the proposed roundabout and the Newtown National School and Abbeyknockmoy Community Centre, and across the existing Liss Bridge, in combination with proposed pedestrian and cycle facilities.

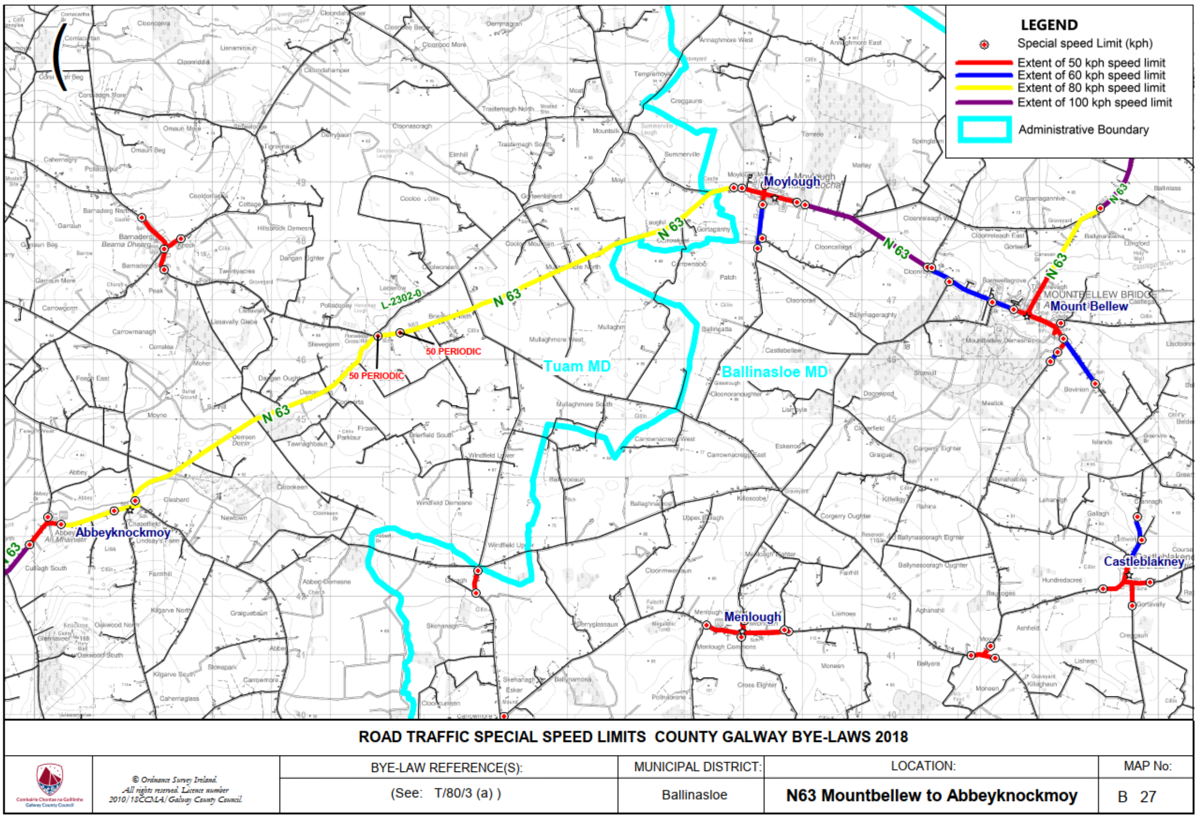


Figure 4-1 Updated Speed Limits - N63 Mountbellew to Abbeyknockmoy (County Galway Byelaws 2018)

4.4 Mainline

The mainline alignment will compose two unique individual sections, running from the south-west to north-east for a total length of 2.30 km:

- Section A: Ch. 0+070 to 0+250 – From the western tie-in along the existing N63 in the village of Abbeyknockmoy to the proposed roundabout. This section of the mainline alignment was developed to achieve a design speed of 60 km/h, consistent with the posted speed limit of 50 km/h within the village of Abbeyknockmoy (DMURS 2019).
- Section B: Ch. 1+000 to 3+120 – From the proposed roundabout to the eastern tie-in along the existing N63 east of the junction with the L6234. This section of the mainline alignment was developed to achieve a design speed of 100 km/h, consistent with the posted speed limit of 100 km/h for Type 2 Single Carriageway National Roads (TII DN-GEO-03031 (TII, 2017) Table 1.2).

It is noted that the remaining section of the existing N63 which will be reclassified from National Secondary to Local road is between Ch. 10+000 to 12+550.

The mainline alignment is illustrated in Figures N63-ACM-PH03-0100-DR-HW-0111 and N63-ACM-PH03-0100-DR-HW-0112 (Plan & Profiles) contained in Volume 2 of this Design Report.

4.5 Cross Section

The mainline single carriageway of the Proposed Road Development has been designed as a rural all-purpose Type 2 Single Carriageway road, in accordance with TII DN-GEO-03036 (TII, 2017). Section A of the mainline alignment has been designed in accordance with DMURS (2019) due to its posted speed limit of 50 km/h.

The traffic volumes along the mainline of the Proposed Road Development for the assumed Opening Year and Design Year are described in Section 3 and highlight the need for a Type 2 Single Carriageway to achieve the desired traffic safety and performance. Table 6.1 of TII DN-GEO-03031 (TII, 2017) indicates that a Type 2 Single Carriageway will have a capacity of 8,600 AADT. This capacity figure (expressed in AADT) represents the approximate two-way flows corresponding to Level of Service D in reasonably level terrain.

In general, the proposed cross-sections of side roads intersected as part of the Proposed Road Development have been designed to closely follow that of the existing road. The DMURS design standard has been applied for all the realigned side roads located within the 50 km/h zone. TII standards have been considered, where possible, as a reference point for the definition of the horizontal and vertical alignment.

Table 4-2, below, indicates the carriageway, verge, and hard shoulder width appropriate for each road class that has been incorporated into the design of the Proposed Road Development. The cross-section for each classification of road is in accordance with TII Standard DN-GEO-03036 (TII, 2017) and, in general, the proposed width of a realigned local road will reflect the existing road width. However, where an existing road is less than 4 m, a minimum cross-section of 4 m carriageway with 1 m verges has been applied.

Template cross-sections are detailed in Figures N63-ACM-PH03-0100-DR-HW-0101 and N63-ACM-PH03-0100-DR-HW-0102 contained in Volume 2 of this Design Report.

Table 4-2 Standard Road Cross-Section Dimensions

Road	Road Classification	Carriageway Width	Verge Width
Proposed N63 (mainline)	National Secondary Road	7.0 m carriageway	Without pedestrian/cycle facilities: 3.0 m verge including 0.5 m hard strip and 2.5 m grassed verge. With pedestrian/cycle facilities: 5.5 m verge, including 0.5 m hard strip, 1.5 m grassed verge, 3.0 m shared pedestrian and cycle facility and 0.5 m grassed verge.
Existing N63	Local Road (reclassification from National Secondary Road)	6.0 m carriageway	With pedestrian/cycle facilities: 3.0 m shared pedestrian and cycle facility.
L6159, L6234, L21821, L7138, L3110	Local Road	4.0 m to 6.5 m carriageway	1.0 m to 2.5 m verge

The design of the Proposed Road Development has been developed on the basis of providing a working space requirement of either 5 m or 8 m between the earthworks and the boundary fence line for the proposed main road and junctions, depending on whether road drains are required. A standard clear space of 3 m to 5 m has also been adopted for other road developments. The overall land acquisition is increased further at other locations to allow for parallel access roads for farms, dwellings, drainage ponds, etc. Where space constraints or construction and maintenance methodology demand, the working space has been reduced or increased locally.

Where the cuttings are in glacial till materials, finished side slopes of between 1(v):2(h) and 1(v):3(h), depending on the degree of weathering may be appropriate to ensure long term stability. The groundwater table and landform will determine the need for toe, crest and slope drains. Slope face drains may also be required in some locations where water bearing granular layers and lenses daylight in the cutting faces.

The side slope was increased to 1(v):1(h) on the South side of the cycle track between Ch. 2+575 and Ch. 2+675 to avoid a small boundary wall which was identified in the topographical survey. Increasing the slope through this section ensures the earthworks are substantially reduced in plan and they will fall entirely within the existing road boundary.

4.6 Horizontal Alignment

4.6.1 Section A

The mainline alignment commences at the western limit of the scheme where it ties into the existing N63 in the village of Abbeyknockmoy. The alignment then runs east before turning north-east with a left hand 136 m radius curve across agricultural land to the north of the existing N63, where it joins the proposed roundabout at Ch. 0+250.

4.6.2 Section B

From the proposed roundabout at Ch. 1+000, the mainline alignment continues to run east before turning north-east with a left hand 510 m radius curve and crossing the Abbert River with a skew angle of 35° and a span of 60.5 m at Ch. 1+600. The bridge will be designed to avoid disturbance to the SAC by clear spanning the Abbert River and maintaining setbacks on the riverbanks of between 5 m and 10 m. Further details of the river bridge can be found in Section 8.1.

The mainline alignment then turns east with a right hand 510 m radius curve and continues through agricultural land until it crosses the existing L6159 at Ch. 2+275. The L6159 will be realigned to the south to form a staggered right/left priority junction at Ch. 2+225 and 2+275. The mainline alignment continues east with a long right hand 8160 m radius curve and joins the existing N63 at Ch. 2+600.

The mainline alignment then turns north-east with a left hand 720 m radius curve, with the existing L6234 realigned to form a priority junction at Ch. 3+000. The mainline alignment then continues to run north-east along the existing N63 until the proposed tie-in at Ch. 3+120.

4.7 Vertical Alignment

4.7.1 Section A

The mainline vertical alignment starts with a short section at grade where it matches the existing N63 profile and then slowly rises to an embankment section with a longitudinal gradient of +1.5% until it reaches the proposed roundabout at Ch. 0+250 with an embankment height of approximately 2 m.

4.7.2 Section B

From the proposed roundabout at Ch. 1+000, the mainline vertical alignment will start to descend with an embankment height of approximately 1.5 m and a constant -0.8% gradient. The vertical alignment has a low point at Ch. 1+260 and then rises in level with a +1.9% gradient approaching the Abbert River crossing where the embankment height exceeds 6 m.

The vertical alignment includes a K=100 crest curve, with the high point at Ch. 1+620, will then descend with a constant -2.0% gradient. This is followed by a K=37 sag curve with a low point at Ch. 1+970. The vertical alignment will then rise in level with a constant +0.75% gradient and an embankment height of approximately 0.5 m, followed by a long K=400 crest curve between Ch. 2+250 and 2+750, with the embankment height increasing to approximately 1.5 m.

From Ch. 2+750 the vertical alignment descends with a constant gradient of –0.49% gradient before following a K=37 sag curve, resulting in a minor cutting section (0.5 to 1.0 m deep) between Ch. 2+725 and 2+875. From the low point at Ch. 2+810, the vertical alignment rises in level with a 0.55% gradient before tying-in at-grade with the existing N63 profile as far as Ch. 3+120.

4.8 Sightlines

Desirable Minimum Stopping Sight Distance (SSD) for a particular design speed is in accordance with TII DN-GEO-03031 Table 1.3 and 10.3 shown in **Error! Reference source not found.** below.

Desirable Minimum SSD is generally provided for an object height of between 0.26 metres and 2.00 metres with an eye height of between 1.05 metres and 2.00 metres (TII DN-GEO-03031 Section 2.1). The Desirable Minimum SSD for Type 2 single carriageway with a design speed of 100km/h is 215m.

Table 4-3 Desirable Minimum Stopping Sight Distance

Road Design Speed (km/h)	Stopping Sight Distance (m)
100	215
85	160
70	120
60	90

The Desirable Minimum SSD in Table 4-3 have been accommodated within the design of the Proposed Road Development. Areas of verge widening required to achieve acceptable SSD have been incorporated into the design where required.

4.9 Overtaking

The Full Overtaking Sight Distance (FOSD) for a particular design speed is in accordance with TII DN-GEO-03031 Table 1.3 and 10.3 shown in **Error! Reference source not found.** below. These values a pply to new construction and online improvement schemes exceeding 2km in length. The Desirable Minimum FOSD for Type 2 single carriageway with a design speed of 100km/h is 580m.

Table 4-4 Desirable Minimum Full Overtaking Sight Distance

Road Design Speed (km/h)	Full Overtaking Sight Distance (m)
100	580
85	490
70	410
60	345

There are a number of constraints that have restricted the provision of the desirable minimum FOSD of 580m and these are described below:

- The overall extent of the scheme only exceeds the 2km limit by a few hundred metres;
- Mixed realignment solution which includes online improvement and new offline construction;
- The presence of lower speed areas and associated approaches (including rural fringe) where overtaking manoeuvres are prohibited or should be discouraged;
- The presence of a contiguous section (to the eastern end of scheme) with overtaking opportunity; and
- Limited alignment options given by the environmental constraints in the study area.

These constraints have led to the required overtaking value (20%) not being achieved and hence a departure from the TII DN-GEO-03031 standard is required. The FOSD and overtaking values for the Proposed Development are as follows:

- Eastbound: 375m approx. (18% Overtaking Value);
- Westbound: 470m approx. (22% Overtaking Value); and
- Overall: 20% Overtaking Value over 2.10km (from proposed roundabout to eastern tie-in).

Further details of this departure from the TII Publications (Standards) are given in section 4.11 below.

4.10 Roadside Equipment & Safety Barriers

The Proposed Road Development has been designed in accordance with the principles of forgiving roadsides and with cognisance of the requirements of the latest versions of the following design standards:

- TII DN-REQ-03034 (Design of Road Restraint Systems (Vehicle and Pedestrian) for Roads and Bridges) (TII 2019); and
- TII DN-REQ-03079 (Design of Road Restraint Systems for Constrained Locations (Online Improvements, Retrofitting and Urban Settings)) (TII 2019).

In general, hazards have been eliminated within the design, or relocated outside the clear zone. However, safety barriers will be required on the approach to the bridge parapets. These will be designed in accordance with the requirements of TII DN-REQ-03034 (TII 2019).

4.11 Relaxations and Departures

TII Publications (Standards) define the desirable standard to be achieved in new road design. Having regard for the need to balance road safety needs with local environmental constraints, relaxations of certain design parameters are permitted, within strictly defined limits. However, where further reductions below these standards or combinations of relaxations are necessary to mitigate the impacts of the proposed road, then a departure from standard is required

There are a total of three departures from TII Publications (Standards), a summary of which can be seen in Table 4-5 below. The departures are illustrated in Figures N63-ACM-PH03-0000-DR-HW-0021 to N63-ACM-PH03-0000-DR-HW-0023 contained in Volume 2 of this Design Report.

There are a total of ten relaxations from the TII Publications (Standards) and a summary of these can be seen in Table 4-5 below.

Table 4-5 Summary of Departures

Departure Ref.	Departure Category	Departure Type	Location of Departure	TII Standard	Departure Outline	Reason for Departure
DEP-JN-001	Road Design - Junction (Direct Access)	Direct Access located on the inside of a sharp curve	Mainline Ch 1+170	Figure 5.1 of DN-GEO-03060 indicates that a junction located on the inside of a sharp curve (defined as "below Desirable Minimum R in accordance with DN-GEO-03031") is considered a Departure from Standards	Combined field access for agricultural properties located between the proposed road and Abbert River.	SAC boundary and existing ditch (Approx. Ch 1+225) does not allow for design of an access track running parallel to the mainlined connecting further west.
DEP-JN-002	Road Design - Junction (Crossroad or Left/Right Staggered Junctions)	Crossroad or Left/Right Staggered Junctions	Mainline Ch 3+000	Cl. 5.3.4 of DN-GEO-03060 states that "*the use of a crossroads is not allowed on rural national roads and shall be regarded as a Departure from Standard*". Cl 5.3.5 of DN-GEO-03060 states that "*the use of left/right staggered junctions is a Departure from Standard*".	Northern arm (L6234) to be realigned to improve junction skew and overall visibility (*At skew junctions the centreline of the minor road shall have a minimum radius of 50m that meets the major road nearside channel at right angles - Cl. 5.6.9 of DN-GEO-03060*). Southern arm (private/field access): no major alteration to the access layout apart from modification of the road level to tie-in with the proposed mainline and interference with the proposed pedestrian/cycle facility.	Existing crossroad to upgraded as part of the mainline realignment scheme. Northern arm is a local road (L6234) and southern arm is a mixed used private/field access. Traffic movement, from the southern arm in particular, is extremely low. In the 2038 design year the AADT is 332 for the northern arm and 19 for the southern arm.
DEP-OV-001	Road Design - Mainline Alignment (Overtaking Value)	Sub-Standard Overtaking Value	Mainline (Approx. Ch 2+275 to Ch 2+850)	Cl. 7.6 of DN-GEO-03031 defines the minimum Overtaking Values in Table 7.3 for the different road types. These values apply to new construction and online improvement schemes exceeding 2km.	Overtaking details: •Eastbound: 375m approx. (18% Overtaking Value) •Westbound: 470m approx. (22% Overtaking Value) •Overall: 20% Overtaking Value over 2.10km (from proposed roundabout to eastern tie-in)	In consideration of the following item: •Overall extent of the scheme which exceeds the 2km limit by only few hundred meters (for the provision of minimum overtaking values); •Mixed realignment solution which includes online improvement and new construction (offline); •Presence of low speed area and associated approach (including rural fringe) where overtaking manoeuvres are prohibited or

Departure Ref.	Departure Category	Departure Type	Location of Departure	TII Standard	Departure Outline	Reason for Departure
						should be discouraged; •Presence of a contiguous section (to the eastern end of scheme) with overtaking opportunity; •Limited alignment options given by the aforementioned environmental constraints.

Table 4-6 Summary of Relaxations

Relaxation Ref.	Relaxation Category	Relaxation Type	Location of Relaxation	TII Standard	Relaxation Outline	Reason for Relaxation
REL-HA-01	Road Design - Mainline Alignment (Horizontal)	Sub-Standard Horizontal Alignment	Mainline Ch 1+150 to Ch 1+550	Cl. 1.3 of DN-GEO-03031	R=510m horizontal curve @ 100km/h Design Speed - 1 Step Relaxation	River crossing (length and skew of bridge structure) Constraints (SAC on south side and residential property on the north side)
REL-HA-02	Road Design - Mainline Alignment (Horizontal)	Sub-Standard Horizontal Alignment	Mainline Ch 1+700 to Ch 1+850	Cl. 1.3 of DN-GEO-03031	R=510m horizontal curve @ 100km/h Design Speed - 1 Step Relaxation	River crossing (length and skew of bridge structure) Constraints (SAC on south side and residential property on the north side)
REL-HA-03	Road Design - Mainline Alignment (Horizontal)	Sub-Standard Horizontal Alignment	Mainline Ch 1+080 to Ch 1+150	Cl. 3.10.1 of DN-GEO-03031	L1=70m length of transition curve @ 100km/h Design Speed [adopting q=0.6 (rate of increase of centripetal acceleration)] - Relaxations	River crossing (length and skew of bridge structure) Constraints (SAC on south side and residential property on the north side)
REL-HA-04	Road Design - Mainline Alignment (Horizontal)	Sub-Standard Horizontal Alignment	Mainline Ch 1+550 to Ch 1+625	Cl. 3.10.1 of DN-GEO-03031	L1=70m length of transition curve @ 100km/h Design Speed [adopting q=0.6 (rate of increase of centripetal acceleration)] - Relaxations	River crossing (length and skew of bridge structure) Constraints (SAC on south side and residential property on the north side)
REL-HA-05	Road Design - Mainline Alignment (Horizontal)	Sub-Standard Horizontal Alignment	Mainline Ch 1+625 to Ch 1+700	Cl. 3.10.1 of DN-GEO-03031	L1=70m length of transition curve @ 100km/h Design Speed [adopting q=0.6 (rate of increase of centripetal acceleration)] - Relaxations	River crossing (length and skew of bridge structure) Constraints (SAC on south side and residential property on the north side)
REL-HA-06	Road Design - Mainline Alignment (Horizontal)	Sub-Standard Horizontal Alignment	Mainline Ch 1+850 to Ch 1+925	Cl. 3.10.1 of DN-GEO-03031	L1=70m length of transition curve @ 100km/h Design Speed [adopting q=0.6 (rate of increase of centripetal acceleration)] - Relaxations	River crossing (length and skew of bridge structure) Constraints (SAC on south side and residential property on the north side)

Relaxation Ref.	Relaxation Category	Relaxation Type	Location of Relaxation	TII Standard	Relaxation Outline	Reason for Relaxation
REL-HA-07	Road Design - Side Road Alignment (Horizontal)	Sub-Standard Horizontal Alignment	Mainline Ch 1+000: South arm of the proposed roundabout (connection to existing N63).	Cl 4.4.6 of DMURS and Table 4.3 of DMURS	R=46m horizontal curve @ 50km/h Poster Speed Limit *[1 Step Relaxation (Table 4.3 of DMURS indicates R=46m horizontal curve @ 40km/h Design Speed with superelevation of 2.5 %)]*	The location of the roundabout has been optimised in consideration of the following elements: - Maximise the length of free-flow and high-speed (100km/h) section along the N63 corridor. - Optimise the alignment to improve the river crossing (length and skew of bridge structure) - Constraints: SAC - Constraints: residential properties to the south of the existing N63 - roundabout located in front of of a gap (field) between residential properties.
REL-JN-01	Road Design - Junction (Direct Access)	Direct Access Siting within 90m of a roundabout on a Local Road	Mainline Ch 1+000: Cul-de-sac at roundabout (off the existing N63)	Cl. 5.2.2 of DN-GEO-03060: The provision of new priority junctions or direct accesses on minor roads shall not be permitted within 90m of a roundabout or priority junction on national roads; this may be reduced to 50m as a relaxation on Regional and Local roads		The location of the roundabout has been optimised in consideration of the following elements: - Maximise the length of free-flow and high-speed (100km/h) section along the N63 corridor. - Optimise the alignment to improve the river crossing (length and skew of bridge structure) - Constraints: SAC - Constraints: residential properties to the south of the existing N63 - roundabout located in front of of a gap (field) between residential properties.
REL-JN-02	Road Design - Junction (Direct Access)	Direct Access Siting within 90m of a T-junction on a Local Road	Mainline Ch 2+275: Catherine & Declan Forde (Folio G321) private access off the L6058.	Cl. 5.2.2 of DN-GEO-03060: The provision of new priority junctions or direct accesses on minor roads shall not be permitted within 90m of a roundabout or priority junction on national roads; this may be		Existing Access

Relaxation Ref.	Relaxation Category	Relaxation Type	Location of Relaxation	TII Standard	Relaxation Outline	Reason for Relaxation
				reduced to 50m as a relaxation on Regional and Local roads		
REL-JN-03	Road Design - Junction (Direct Access)	Direct Access Siting within 90m of a T-junction on a Local Road	Mainline Ch 2+275: Brian Forde (Folio GYG3311F) field access off the L6058.	Cl. 5.2.2 of DN-GEO-03060: The provision of new priority junctions or direct accesses on minor roads shall not be permitted within 90m of a roundabout or priority junction on national roads; this may be reduced to 50m as a relaxation on Regional and Local roads		Existing Access
REL-JN-04	Road Design - Junction (Direct Access)	Direct Access Siting within 90m of a T-junction on a Local Road	Mainline Ch 3+000: Geraldine Walsh (Folio GY1072F) private access off the L6234.	Cl. 5.2.2 of DN-GEO-03060: The provision of new priority junctions or direct accesses on minor roads shall not be permitted within 90m of a roundabout or priority junction on national roads; this may be reduced to 50m as a relaxation on Regional and Local roads		Existing Access

5 Strategy for Side Roads & Junctions

5.1 Junction Strategy

5.1.1 Overview

The junction strategy has been divided into five main areas described as follows and illustrated in Figure 5-1 below.

- Area 1: Western Tie-In
- Area 2: Central Tie-In
- Area 3: Eastern Tie-In
- Area 4: L3110 Tie-In
- Area 5: Liss Bridge

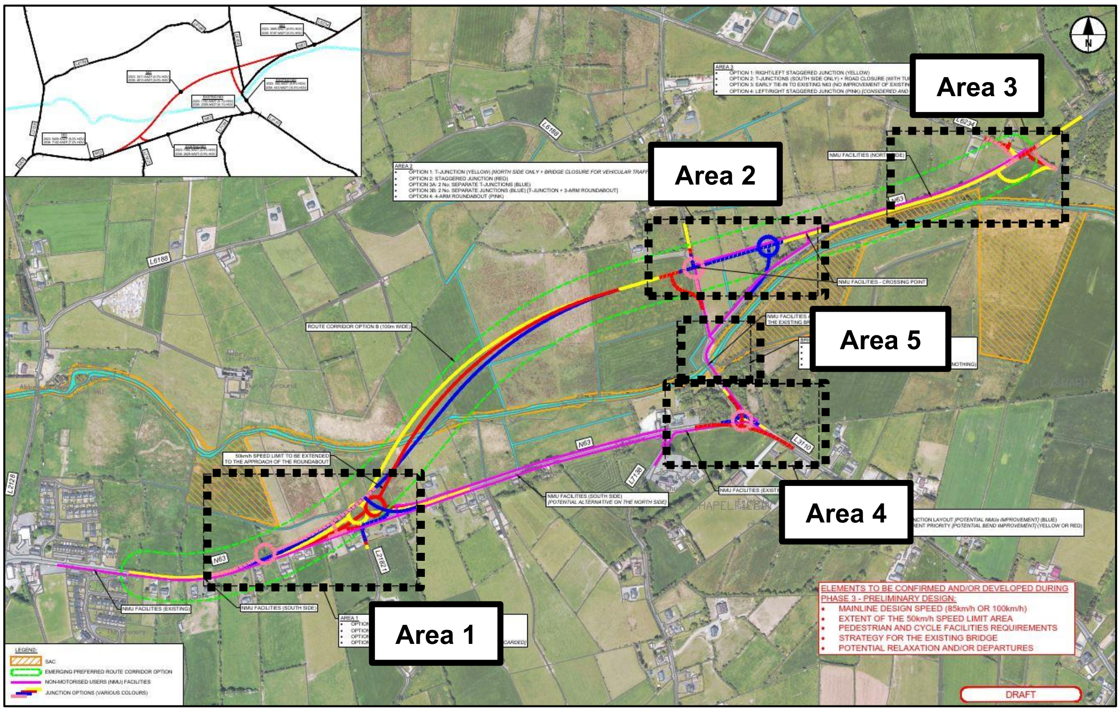


Figure 5-1 Junction Areas

The main assumptions adopted in the development of the junction options are described below:

- The preliminary layout of the junctions has been designed in accordance with TII Standards DN-GEO-03060.
- Full 3D analysis of each option for SSD, swept paths, cross-sections, vertical alignment and horizontal alignment.
- Traffic analysis of each junction has been undertaken to ensure the junction options are operating at an acceptable Level of Service (LoS).
- For all options, the existing N63 (between Area 1 and Area 4) will be reclassified as a local road.

- For all options, Non-Motorised Users (NMU) facilities will be provided along the reclassified section of existing N63 and across the existing Liss Bridge to tie into the proposed alignment.
- Accesses to dwellings along the reclassified section of the N63 will be connected directly onto this section of the existing N63, where required.
- All options are designed based on a 100km/h design speed.

More detail on the junction options is given in the Junction Options Report which can be found in Appendix A.

5.1.2 Traffic Flows

An initial review of the forecasted traffic volumes in the Opening Year and Design Year was undertaken. The traffic volumes on the main link roads were extracted from the relevant section of the Option Selection Report (Option B - Emerging Preferred Route) and are shown in Figure 5-2 below.

The traffic review highlighted that, from a traffic capacity perspective, a priority junction would provide sufficient traffic capacity at any of the junctions upgraded as part of this scheme (see Figure 5-3 below). Nevertheless, alternative junction options including roundabout design have been developed in accordance with TII DN-GEO-03060 to investigate the relative advantage or disadvantages associated with these options.

It is also noted other junction options, as traffic signals and grade separated junctions have been discounted for this project, due to the rural nature of the area and the low traffic volumes respectively.

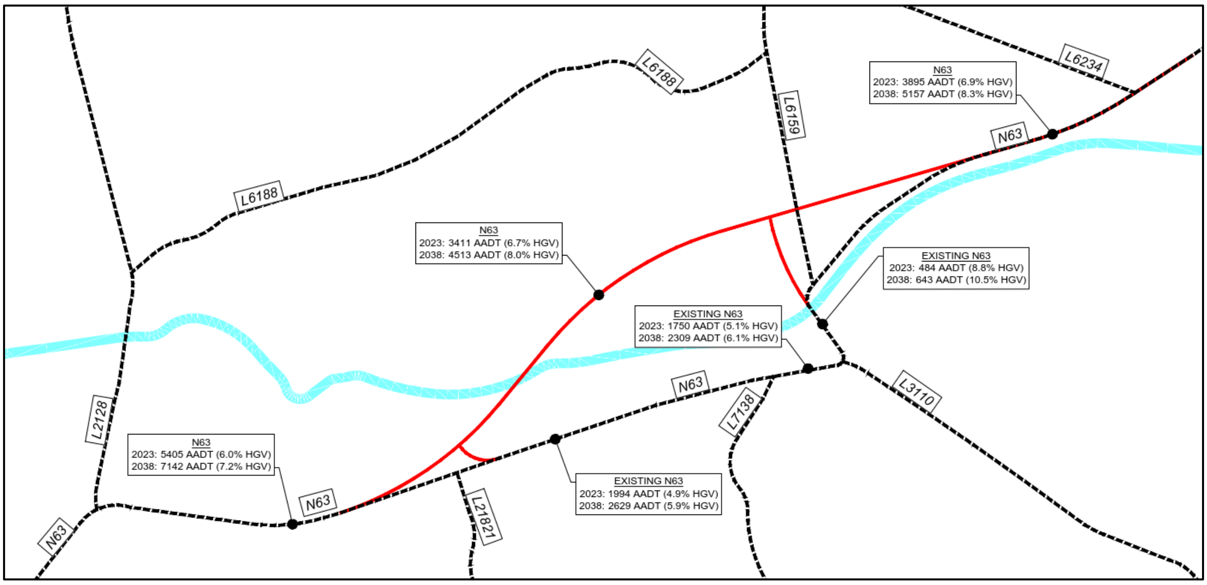


Figure 5-2 Traffic Volumes

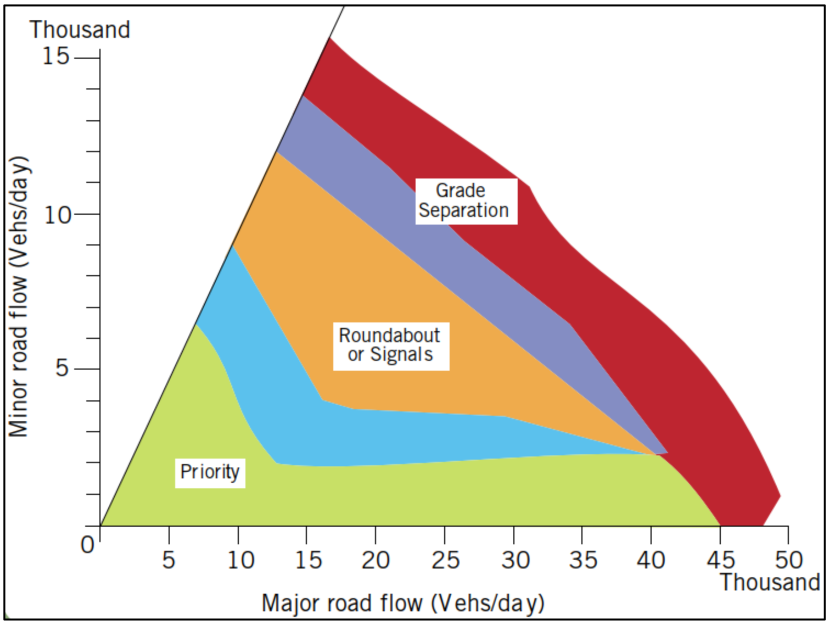


Figure 5-3 Type of junction based on traffic flow levels (Traffic Management Guidelines 2003)

5.1.3 Proposed Junction Types

Appendix A presents a detailed review of the junction options at each junction area, providing advantages and disadvantages of each junction option to support the identification of the preferred junction option.

The proposed junctions and types along the mainline of the Proposed Road Development are detailed in Table 5-1 below and in Figures N63-ACM-PH03-0100-DR-HW-0130 to N63-ACM-PH03-0100-DR-HW-0137 contained in Volume 2 of this Design Report.

Table 5-1 Junction Types and Locations

Junction Name	Chainage	Type and Size	Comment	Drawing No.
Junction 1 (N63 Roundabout)	N63 Mainline - Ch. 0+250 (or Ch. 1+000)	Roundabout (ICD=36 m)	Proposed new roundabout	N63-ACM-PH03-0100-DR-HW-0131
Junctions 2A and 2B (L6159 North and South)	N63 Mainline - Ch. 2+225 and Ch. 2+275	Staggered Right/Left Priority Junction	Proposed new junction	N63-ACM-PH03-0100-DR-HW-0135
Junctions 3A and 3B (L6234 and Access Road)	N63 Mainline - Ch. 3+000 and Ch. 3+020	Staggered Left/Right Priority Junction	Alteration and upgrade of existing crossroad junction	N63-ACM-PH03-0100-DR-HW-0137
Junction 4 (L21821)	Existing N63 - Ch. 10+640	Priority Junction	Alteration and upgrade of existing priority junction	N63-ACM-PH03-0100-DR-HW-0132
Junction 5 (L7138)	Existing N63 - Ch. 11+310	Priority Junction	Alteration and upgrade of existing priority junction	N63-ACM-PH03-0100-DR-HW-0134
Junction 6 (L3110)	Existing N63 - Ch. 11+450	Priority Junction	Alteration and upgrade of existing priority junction with change of priority	N63-ACM-PH03-0100-DR-HW-0134

5.2 Side Roads

All non-mainline roads that will be affected by the Proposed Road Development are referred to as side roads. Each side road affected by the Proposed Road Development is detailed below in Table 5-1, together with the existing and proposed cross section and the proposed length of road realignment.

It is proposed that the side roads will be reconfigured to tie-in with existing or realigned roads, where necessary. Where side roads have been realigned, they have been designed to tie-in to the existing carriageway with efforts made to minimise the impact of the Proposed Road Development on the surrounding environment in each case.

With due regard to the environmental and land-use constraints, the geometric design of the proposed alignments and layouts of realigned side roads have been developed using the design speeds in Table 5-2, to the extent appropriate and feasible at each location.

For the local roads, the design speeds are suitable to the existing low-speed character of these roads and will assist to minimise any impact on the environment at those locations. Where side roads have existing speed restrictions, proposed speed restrictions, or are in more built-up areas, the appropriate design speed has been established in accordance with Sections 1.1 and 10.2 of DN-GEO-03031(TII, 2017) and DMURS (2019) (DTTAS, 2019). The realigned local roads have been designed in accordance with Chapter 10 of DN-GEO-03031(TII, 2017) and DMURS (2019) (DTTAS, 2019).

Table 5-2 Side Road Class and Desirable Design Speeds

Road Class	Desirable Design Speed (km/h)
National Roads	N/A
Regional Roads	N/A
Local Roads	42-85
Access Roads	30

Table 5-3 Side Roads

Road Name	Townland	Mainline Chainage (m)	Figure Ref. No.	Existing			Proposed Sideroad treatment	Realigned / New Section	
				Paved Width (m)	Speed Limit (km/h)	Length (m)		Cross-Section	Design Speed (km/h)
1C – Existing N63 (East)	Liss	1+000	N63-ACM-PH03-0100-DR-HW-0131	6.5 – 7.5m	100	100	Significant upgrade to the existing carriageway and the provision of shared footway	6.0m carriageway, 3.0m verge + 3.0m shared footway (0.5m grass verge where required)	60
2A - L6159 (South)	Abbey	2+225	N63-ACM-PH03-0100-DR-HW-0135	5.5m	80	130	Upgrade section of road and tie in with existing carriageway	4.0m to 6.5m carriageway, 1.0m to 2.5m verge	70
2B - L6159 (North)	Abbey	2+275	N63-ACM-PH03-0100-DR-HW-0135	5.5m	80	70	Upgrade section of road and tie in with existing carriageway	4.0m to 6.5m carriageway, 1.0m to 2.5m verge	70
3A - L6234	Moyne	3+000	N63-ACM-PH03-0100-DR-HW-0137	3m	80	70	Upgrade section of road and tie in with existing carriageway	4.0m to 6.5m carriageway, 1.0m to 2.5m verge	70
3B – Access Road	Clashard/Newtown	3+020	N63-ACM-PH03-0100-DR-HW-0137	NA	NA	40	Upgrade section of road and tie in with existing carriageway	4.0m to 6.5m carriageway, 1.0m to 2.5m verge	30
4A - L21821	Liss	10+640 (existing N63)	N63-ACM-PH03-0100-DR-HW-0132	3.5m	80	20	Upgrade section of road and tie in with existing carriageway	4.0m to 6.5m carriageway, 1.0m to 2.5m verge	70
5A - L7138	Liss/Chapelfield	11+310 (existing N63)	N63-ACM-PH03-0100-DR-HW-0134	5.5m	80	30	Upgrade section of road and tie in with existing carriageway	4.0m to 6.5m carriageway, 1.0m to 2.5m verge	70
6A -L3110	Chapelfield/Clashard	11+450 (existing N63)	N63-ACM-PH03-0100-DR-HW-0134	7m	80	40	Upgrade section of road and tie in with existing carriageway	4.0m to 6.5m carriageway, 1.0m to 2.5m verge	70

5.3 Pedestrian and Cycle Facilities

The existing road network has limited dedicated pedestrian and cycle facilities within the immediate and surrounding areas. However, project-specific objectives, and feedback received from the public consultation process, clearly outlined the need to provide dedicated pedestrian and cycle facilities segregated from the national and regional (high-speed) traffic, improving the connectivity between the community facilities and residential properties.

During the design of the Proposed Road Development, cognisance has been taken of these objectives and the needs to ensure that the design will address these specific requirements. Connections to existing formal and informal pedestrian facilities have been incorporated into the design.

Along the length of the existing N63 which will be reclassified to a local road, between Ch. 10+080 and 11+450, a 3.0 m wide shared use pedestrian and cyclist facility will be incorporated on the south side. Un-controlled crossings will be provided at junctions with the existing L21821 (Ch. 10+640) and L7138 (Ch. 11+310). One new controlled pedestrian crossing of the existing N63 is proposed at Ch. 11+290, to provide connection with the Newtown National School and Abbeyknockmoy Community Centre.

A new crossing at the junction between the existing N63 and L3110 Monivea Road will be provided, and a shared use pedestrian and cyclist facility (with minimum width of 2.5 m) will continue on the east side of the existing N63, between Ch. 11+450 and 11+650, crossing over the Abbert River at the existing Liss Bridge, where some localised restrictions of the proposed pedestrian and cycle facility width will be required.

A 2.5 m wide shared use pedestrian and cyclist facility will be provided along the existing N63 between Ch. 11+650 and 12+000 where it will then continue parallel to the proposed N63 mainline between Ch. 2+600 and 3+120, making use of the paved surface of the existing N63 where possible.

Pedestrian and cycling facilities are presented in Figures N63-ACM-PH03-0100-DR-HW-0130 to N63-ACM-PH03-0100-DR-HW-0137 contained in Volume 2 of this Design Report.

5.4 Viewing Area

A Viewing Area Lay-by for Liss Abbey will be provided on the western side of the proposed roundabout with parallel parking spaces for four cars. This will be located to the northern side of the Proposed Road Development at Ch 0+ 160 within a 50kph posted speed limit and will allow for unobstructed views of Liss Abbey. The viewing area parking lay-by will also be connected to the village of Abbeyknockmoy by the provision of a 2.5m wide footpath on the north side of the proposed mainline.

6 Ground Investigation, Soil Classification & Earthworks Balance Optimisation

6.1 Walkover Survey

Site walkovers were carried out along the proposed route extents, prior to the undertaking of the Preliminary Ground Investigations. The primary purpose of the site walkover was a review of access and limitations to access for ground investigation plant. The geotechnical constraints of the scheme were also reviewed

6.2 Ground Investigations

Ground investigations were carried out in 2020 during design development for the Proposed Road Development. The scope of the investigations was to determine the soil, bedrock, and groundwater conditions and to establish the presence of any contaminants along the route. The investigations comprised the following:

- Ten boreholes (BH01 to BH10) were advanced using a cable percussive rig, to between 2.2 and 7.9 m below ground level (bgl). In four of these locations (BH04, BH05, BH09 and BH10), shallow obstructions resulted in re-drilling of the boreholes (BH04A, BH05A, BH09A and BH10A);
- Standard penetration tests (SPTs) were undertaken at regular intervals and samples were taken for laboratory analysis;
- Rotary coreholes (RC02 to RC07 and RC10) were advanced to depths of between 12.0 m bgl and 21.1 m bgl adjacent to corresponding boreholes to investigate the presence of bedrock; and
- Ten trial pits (TP01 to TP10) were excavated to a maximum depth of 3.0m bgl.

6.3 Laboratory testing

6.3.1 Soil Testing

Soils tests, undertaken as part of the ground investigation, included the following:

- Classification tests: moisture content, Atterberg Limits, and particle size distribution by wet sieving and sedimentation;
- Compaction related tests: MCV at natural moisture content;
- Consolidations tests: 1-D oedometer test; and
- Shear strength (total stress): unconsolidated undrained, single stage triaxial tests on nominal 100mm diameter specimens prepared from U100 samples.

6.3.2 Rock Testing

Rock tests as detailed below were undertaken:

- Point load strength tests; and
- Uniaxial compressive strength (UCS) tests.

6.3.3 Chemical Testing

The following chemical tests were undertaken:

- pH;
- Organic content;
- Water soluble sulfate content;
- Acid soluble sulfate content; and
- Total Sulfate (erroneously carried out instead of Total Sulfur).

6.3.4 Contamination Testing

No environmental samples were taken as part of the ground investigation as contamination was not expected at any of the trial pit locations.

6.4 Ground Summary

The existing ground conditions are summarised as follows in approximate stratigraphic order:

- Topsoil;
- Peat/Organic Soils;
- Alluvium;
- Fluvio-glacial Gravels;
- Fine-Grained Glacial Till; and
- Bedrock (rock).

6.4.1 Topsoil

Topsoil was encountered in all testholes and ranged in thickness from 100 mm to 300 mm.

6.4.2 Peat/Organic Soils

Peat and organic soils were generally encountered below the topsoil in the majority of testholes (BH01 to BH06, BH10, and RC02 to RC07. The soil was typically described a soft grey/brown sandy peat silt to a soft dark brown/black Peat. The thickness of peat ranged from 0.3 to 1.4 m with an average of approximately 0.7 m. The maximum thickness of peat was encountered in BH 01.

6.4.3 Alluvial Deposits

These typically comprise soft, soft to firm sandy silts s with variable gravel contents and were found underlying topsoil and peat/organic soils. These are likely relatively recent deposits by the River Abbey.

Alluvium was encountered in BH02,03,07,10, RC04,05 and TP09. The thickness encountered ranged from 0.2 to 1.1 m with an average of approximately 0.6 m.

6.4.4 Fluvio-glacial Gravels

Fluvio-glacial gravels were encountered in the following testholes:

- Boreholes: BH01,02,03,04A: typically described as medium dense fine to coarse sandy silty to slightly silty gravel with occasional to some cobbles;
- Rotary Follow on: RC02, 03,04,07: drilled using Symmetrix drilling methods which doesn't facilitate core recovery. Returns described as grey silty gravel with cobbles; and
- Trial pits: TP02,03,05,06,08,10: described as slightly clayey gravelly sand to sandy gravels.

The gravels were typically founded underlying aeat and alluvium. The thickness of the gravels ranged from about 1.1 m in TP03 to about 11.8 m in RC03. The gravels are likely coarse-grained glacial till and likely interlayered with fine-grained glacial till as shown in RC02

6.4.5 Fine Grained Glacial Till

Fine grained glacial till was encountered in the majority of the test holes with the exceptions being RC03, RC04 and TP08.

The fine-grained glacial till generally comprised a stiff to very stiff sandy gravelly silt with cobbles. The majority of boreholes refused within this layer. The maximum thickness of fine-grained glacial till was encountered in RC10 at about 11.6 m.

6.4.6 Bedrock

Bedrock was encountered at depth ranging from 9.4 to 13.2 m bgl in testholes RC02-07. The bedrock was typically described as strong to very strong fresh to locally slightly weathered limestone.

6.5 Earthworks Balance Optimisation

Excavation earthwork impacts will mainly relate to removal of topsoil and shallow subsoils, although piles for the bridge foundations will extend approximately 2 m into bedrock, while infill earthwork will mainly relate to the import and compaction of acceptable fill material for the construction of embankments to achieve the required engineering design and road grades.

To achieve the required engineering design, the Proposed Road Development will consist of approximately 21% at-grade (i.e. no cut as level with surrounding land), 6% cut and 73% formed along raised embankments created using fill.

Table 6-1 At-grade, Embankment and Cutting requirements for the Proposed Road Development

	Overall Length [m]	%
At-grade	475	21
Embankment	1,685	73
Cutting	140	6
Total	**2,300**	**100**

The Proposed Road Development will have a gross earthworks deficit (i.e. more importation of fill is required than removal), with a total general fill requirement (excluding capping and pavement) of approximately 78,000 m^3 consisting of an import volume of 77,000 m^3 required to be brought onto the Proposed Road Development site and a re-use volume of 1,000 m^3. The total fill requirement including capping material is approximately 84,000 m^3.

The balance of materials is shown in the Table 6-2. The total volume of unacceptable material (U1) as defined in the Specification for Road Works Series 600 (TII, 2015) requiring disposal is also indicated.

Table 6-2 Earthworks Approximate Volumes

Item	Earthworks Aspect	Approximate Volume (m^3)
1	Total General Cut Volume* - Underside of topsoil to base of capping	2500
2	Acceptable material for re-use bulked	1000
3	Unacceptable material bulked (U1)	2000
4	Fill requirements for embankments - underside of topsoil to base of capping	78000
5	Excavation and fill requirements to replace peat/alluvium below formation	0
6	Class 4 fill requirements (visual and noise bunds)	0
7	Total general fill required (excluding capping)	78000
8	Cut to fill (excluding capping)	77000
9	Disposal volume U1	2000
10	Import requirement including capping	84100
11	Import requirement including capping and pavement	93000
A	Total topsoil volume to be removed	18000
B	Capping volume	7100
C	Pavement volume (including sub-base)	8900
D	Total topsoil volume for re-use	4500

As indicated above, the fill required for the construction of embankments is not available in full, from the cut of existing soils present on the Proposed Road Development site and additional fill material will therefore be imported from off-site locations.

Excavation of soils (till and alluvium) will be required as part of the bridge foundation construction for the river crossing and in areas along the Proposed Road Development where levels need to be reduced. These excavations are likely to be limited in area and depth (approximately 6% of the Proposed Road Development will require soil removal).

Stockpiling of unsuitable soils will be undertaken prior to removal from site. In the absence of mitigation, this will have the potential to impact on soil and groundwater, through the leaching of contaminants.

The classification of groundwater vulnerability beneath the Proposed Road Development site varies from 'moderate' to 'rock at or near surface or karst'. Where subsoil removal is required, it will be replaced by fill material and paved road surfaces, therefore groundwater vulnerability is unlikely to change. Where soils are to be imported for embankment purposes, fill material will be used where possible and this will increase the soil cover above groundwater bodies beneath the Proposed Road Development site, reducing groundwater vulnerability in these areas.

7 Drainage

7.1 Introduction

This section covers the drainage design of the N63 Liss to Abbey Realignment Scheme. The proposed design incorporates:

- Collection and conveyance system proposed for the scheme;
- Measures to treat and attenuate the surface water run-off from the new carriageway.

This report should be read in conjunction with the drainage design drawings located in Figures N63-ACM-PH03-0500-DR-DR-0500 to N63-ACM-PH03-0500-DR-DR-0505 in Volume 2 of this Report.

7.2 Existing Environment

7.2.1 Surface Water Features

The study area is located within the Corrib catchment area (Code: 30) and the Clare [Galway] sub-catchment (Code: 30_12; area 231.8 km^2).

The Abbert River, a tributary river of Lough Corrib SAC, is the main watercourse flowing through the study area. According to the Environmental Protection Agency (EPA) map viewer, the Abbert River is not a source of drinking water that has extra protection by law. The Abbert River has not been identified as a river with significant abstraction pressures. Two tributaries of the Abbert River – labelled as 'Lindsay's Farm' and 'Derreen' on EPA mapping – join the Abbert from the south immediately to the south of the Proposed Road Development at a chainage of approximately 1+630. The Lecarrow flows from the northeast into the Abbert River approximately 250m upstream of the Proposed Road Development. The Feagh East flows from the northeast into the Abbert River approximately 500m to the west (downstream) of the Proposed Road Development.

7.2.2 Surface Water Quality

The Abbert River is considered by the EPA as being 'At Risk' of achieving and maintaining 'Good' ecological status under the EU Water Framework Directive (WFD). The WFD River Waterbody Status (2013-2018)[1] within the study area ranges from 'good' to 'moderate'.

7.2.3 Surface Water Amenity

The Abbert River is noted for its fishery potential with respect to salmon and brown trout.

7.2.4 Natural Drainage

Natural Drainage ground at flood plain level, along the Abbert River, generally comprises very poorly drained, saturated soils. The soil series north and south of the river is a sandy loam Brown Earth – Mullabane Series (Code 1100q). This free-draining soil is suited mainly to improved grassland.

There is potential for buried field drains to be present within the agricultural lands.

Springs have been identified, including a petrifying spring immediately south of the Proposed Road Development, this is listed as an Annex I habitat. In addition, an Annex I Molinia meadow is identified to the north of the study area, which is a form of species-rich grassland on poorly drained soils.

7.3 Consultation

A meeting was held with the Office for Public Works (OPW) in preparation of the Section 50/9 application on the 24th May 2021.

[1] https://gis.epa.ie/EPAMaps/

A project update was provided to Inland Fisheries Ireland (IFI) in February 2021. No feedback was received from IFI in response to this project update.

7.4 Carriageway Drainage

The preliminary design of road drainage for the Proposed Road Development is in accordance with the principles outlined below and the following TII Publications:

- DN-DNG-03022 - Drainage Systems for National Roads (including Amendment No. 1 dated June 2015) (TII, 2015);
- DN-DNG-03064 – Drainage of Runoff from Natural Catchments (including Amendment No. 1 dated June 2015) (TII, 2015);
- DN-DNG-03065 - Road Drainage and the Water Environment (including Amendment No. 1 dated June 2015) (TII, 2015); and
- DN-DNG-03066 - Design of Earthworks Drainage, Network Drainage, Attenuation & Pollution Control. (TII, 2015)

7.4.1 Principles of Design

The main parameters used in the drainage design of the N63 Liss to Abbey Realignment Scheme are as follows:

- Longitudinal sealed carrier drains designed to accommodate a one-year storm in-bore without surcharge and checked against a five-year storm intensity to ensure that surcharge levels do not exceed the levels of chamber cover;
- Minimum full bore velocity 0.75m/s to maintain self-cleansing;
- Maximum full bore velocity at outfalls 2.5m/s;
- Minimum pipe gradient 1 in 500;
- Pipe roughness, ks 0.6mm; and
- 1.2m minimum desirable cover to crown of pipe.

7.5 Cut-off Drains or Ditches

Cut-off drains, or channels will be provided at the following locations:

- Top of cutting slopes where the adjoining land slopes towards the cutting; and
- Bottom of embankment slopes where the adjoining land slopes towards the embankment.

These cut-off drains will discharge to existing watercourses where the topography permits and to the road drainage system in areas with no suitable outfall location. These locations can be seen on Figures N63-ACM-PH03-0500-DR-DR-0500 to N63-ACM-PH03-0500-DR-DR-0505 in Volume 2 of this Design Report.

7.6 Proposed Road Drainage Networks

The Proposed Road Development involves the construction of a new drainage system which includes provision of a surface water collection system, earthworks drainage, sub-surface drainage, attenuation and pollution control, and the culverting of existing streams. The Proposed Road Development has been designed such that surface water drainage and sub-surface drainage will be provided for the proposed mainline carriageway, junctions, link roads and all new sections of local roads. The drainage network will be designed to;

- Ensure the speedy removal of surface water from the road pavement in order to provide safe driving conditions;

- Mimic, in as far as is practical, the existing road drainage regime, particularly in relation to run-off rates and watercourse outfalls, while at the same time providing improved water quality treatment by means of wetland ponds prior to discharge;
- Ensure that the impact of the drainage outfalls on the receiving waters is negligible;
- Minimise the impact of runoff on the receiving environment; and
- Provide effective sub-surface drainage to maximise longevity of the road pavement and associated earthworks.

As the Proposed Road Development will cross Lough Corrib SAC, and due to the use of kerbs on the road section, it is proposed that a sealed drainage system is used. Road runoff will be collected through gullies located at regular intervals or kerb drains where necessary. Sealed pipes will convey the flows to the downstream attenuation systems.

The Proposed Road Development drainage system has been divided in to four separate networks. The road drainage will outfall at four locations into existing ditches, which eventually outfall into the Abbert River. The road drainage outfalls via a lined drainage ditch at one location and via attenuation ponds at three locations. The temporary and permanent land acquisition required to undertake these works and associated attenuation systems has been incorporated into the CPO. The outfalls and drainage requirements are shown in Figures N63-ACM_PH03-0500-DR-DR-0500-0505 inclusive, contained in Volume 2 of this Design Report.

7.7 Sub-Surface Water Drainage

A sub-surface drainage system of the road pavement will be provided in order to control groundwater levels in the vicinity of the Proposed Road Development and to drain the road foundation. This is required in areas of cutting and low embankments (<1.5 m). In general, this will be achieved using a network of filter drains or narrow filter drains.

The Proposed Road Development will cross through a regionally important aquifer, this aquifer consists of the majority of land from Castlebar, to Carrick-on-Shannon, to Athlone and Maigh Cullinn.

7.8 Structure Drainage

Drainage of the proposed bridge structure will be managed so as to achieve the requirements set out in DN-DNG-03022 – Drainage Systems for National Roads (TII, 2015). For the length of the bridge over the Abbert River, a combined kerb and drainage system will capture the runoff on the bridge deck, transport it along the length of the bridge and connect into the proposed carriageway drainage system.

7.9 Flow Attenuation Systems

Flows from the proposed road will be attenuated prior to discharge to the receiving watercourse so that the post development peak flow rate is not greater than the original greenfield runoff rate. This will be achieved using pond and tank attenuation systems with a flow restricting device such as a vortex flow control device upstream of the outlet to a receiving waterbody.

The attenuation systems have been designed to accommodate a 1 in 100-year event plus 20% for climate change without increasing the discharge rate to the receiving watercourse. This design ensures that there is no increase in the risk of flooding in the receiving watercourse due to construction of the road up to the 100-year return period.

The attenuation ponds have been designed to accommodate the first flush surface water runoff within a forebay. First flush flows are those that arrive at the outfall first after a rainfall event. The first flush is defined as 10% of the five-year storm peak flow and contains the heaviest contaminant load. The plan area of the sediment forebay should be at least 10% of the total basin area. The connection from the forebay area to the main body of the pond will be via a permeable bund. Due to the environmentally sensitive nature of the area and because the ponds will be used for spillage containment, the ponds will be lined.

The attenuation systems will be located in land adjacent to the Proposed Road Development – see Figure N63-ACM_PH03-0500-DR-DR-0500 to N63-ACM_PH03-0500-DR-DR-0505 contained in

Volume 2 of this Design Report for locations of attenuation systems. Access for future maintenance will be accommodated by provision of a gated access and connected to the public road network.

The storage volumes required for the attenuation structures proposed for each drainage network are demonstrated in Table 7-1.

Table 7-1 Storage Volumes of Attenuation Structures

Drainage Network	Volume of Max Water (m^3) (1:100 yr Pond)	Full Pond Volume (m^3) (1:100 yr Pond)	Maximum Permissible Discharge (l/s)	Attenuation Structure
Network 1	N/A	N/A	5.00	Lined Drainage Ditch
Network 2	469.8	-	5.00	Pond
Network 3	580	1010	5.00	Pond
Network 4	322.2	719.1	5.00	Pond

7.10 Spillage Risk

A preliminary risk assessment to quantify the likelihood of a serious accidental spillage has been carried out in accordance with the TII (NRA) DN-DNG-03065 (TII, 2015). When considering the risk of spillages from a road and potential pollution to the receiving environment, TII (NRA) DN-DNG-03065 (TII, 2015) recommends that the:

- Calculated spillage risk return period must not be greater than 1-in-100 years;
- Calculated spillage risk return period must not be greater than 1-in-200 years where spillage could affect: protected areas for conservation, important drinking water supplies or important commercial activities; and
- Spillage risk from existing outfalls must not be increased.

The spillage assessment carried out on the Proposed Road Development demonstrates a very low magnitude of risk for individual outfalls as shown in the Table 7-2 below. Shut-down facilities at outfalls will be provided as a precautionary measure due to the presence of the SAC.

Table 7-2 Spillage Risk

Drainage Network	Return Period before mitigation (years)	Spillage Risk
Network 1	15748	1/15748
Network 2	15336	1/15336
Network 3	17036	1/17036
Network 4	21092	1/21092

7.11 Pollution Control

Pollution control measures are proposed at each outfall/discharge point from the carriageway drainage network to reduce the risk of watercourses or groundwater being contaminated by carriageway runoff. A range of pollution control measures have been adopted as part of the Proposed Road Development which include combined filter drains, attenuation ponds, emergency spill containment areas and petrol and oil interceptors.

Oil and petrol interceptors will be provided upstream of the wetland and attenuation pond/infiltration basins to prevent any contamination from hydrocarbons, such as oil or petrol spillages, from entering the receiving water or groundwater. The interceptors will be sized for each drainage catchment according to the inflow.

A shut-down valve will be provided at the outlet to each outfall to allow any potential spillage to be accommodate within the attenuation system.

Along the mainline of the Proposed Road Development, a minimum emergency spill containment volume area equal to 25 m^3 will be provided at all outfall locations, as set out in the TII Drainage Standards.

7.12 Culverts

Streams and interceptor ditches crossed by the scheme will be culverted. Culvert size and locations are shown on Figures N63-ACM_PH03-0500-DR-DR-0500 to N63-ACM-PH03-0500-DR-DR-0505 contained in Volume 2 of this Design Report and are summarised in the Table 7-3 below.

Table 7-3 Proposed Culverts

Culvert	Chainage	Proposed Culvert Dimensions
PC01	N63 Mainline - Ch. 1+030	Piped Culvert – 525 mm Diameter
PC02	N63 Mainline - Ch. 1+415	Box Culvert – 2.0 m x 2.3 m
PC02A	N63 Mainline - Ch. 1+230	Piped Culvert – 1200 mm Diameter
FC01	N63 Mainline - Ch. 1+460	Box Culvert – 2.0 m x 2.3 m
FC02	N63 Mainline - Ch. 1+515	Box Culvert – 2.0 m x 2.3 m
FC03	N63 Mainline - Ch. 1+650	Box Culvert – 2.0 m x 1.5 m
PC03	N63 Mainline - Ch. 1+800	Box Culvert – 2.0 m x 1.6 m
PC04	L6159 North South – Ch. 70	Piped Culvert – 450 mm Diameter
PC05	N63 Mainline - Ch. 2+270	Piped Culvert – 450 mm Diameter
PC06	N63 Mainline - Ch. 2+340	Piped Culvert – 450 mm Diameter
PC07	N63 Mainline - Ch. 2+395	Piped Culvert – 450 mm Diameter
PC08	N63 Mainline - Ch. 2+530	Piped Culvert – 750 mm Diameter

All culverts have been designed to allow for the provision of natural bed material along their length.

All of the proposed structures over existing watercourses have been submitted to the OPW for approval under Section 50 of the Arterial Drainage Act and have been approved.

7.13 Watercourses Diversions

Where possible, watercourse diversions will be avoided, but some are necessary to avoid excessively long culvert crossings, and these are shown in Figures N63-ACM-PH03-0500-DR-DR-0500 to N63-ACM-PH03-0500-DR-DR-0505 contained in Volume 2 of this Design Report and are summarised in Table 7-4 below.

Table 7-4 Proposed Watercourse Diversions

Watercourse Diversion	Chainage	Proposed Dimensions
WD-01A	1+030 – 1+170	Length: 144 m
WD-01B	1+000 – 1+030	Length: 43 m
WD-02A	1+280 – 1+400	Length: 116 m

Watercourse Diversion	Chainage	Proposed Dimensions
WD-02B	1+450 – 1+530	Length: 75 m
WD-02C	1+400 – 1+500	Length: 97 m
WD-03	1+590 – 1+650	Length: 65 m
WD-04	1+800 – 1+900	Length: 95 m
WD-05	2+250	Length: 20 m
WD-06	2+530 – 2+670	Length: 145 m

All of the proposed diversions of existing watercourses have been submitted to the OPW for approval under Section 9 of the Arterial Drainage Act and have been approved.

7.14 Flood Risk Assessment

The Proposed Road Development passes through a flood plain area associated with the Abbert River. The Abbert River Bridge described in section 8 above incorporates a minimum vertical clearance of 3m above the riverbanks. to accommodate flood capacity.

7.14.1 Overview

The Stage 3 element of the FRA comprised the following tasks:

- Assessment of flow using industry standard best practice; A 1% Annual Exceedance Probability (AEP) flow estimate of 48.6 m^3/s was calculated using the FSR-6 method. A corresponding flow hydrograph was produced using the unit hydrograph method to allow unsteady hydraulic analysis to be undertaken. The resultant 0.1% AEP flow of 63.1 m^3/s was obtained through scaling.
- Baseline model development; A linked 1D-2D hydraulic model representative of the current/baseline conditions was developed in Infoworks ICM modelling software. This was developed from hydrographic survey data obtained by Murphy Surveys in May 2020. This included the existing N63 Liss Bridge and the L2128 bridge along with the substantial weir structure at the former corn mill.
- Determination of Flood Zones; Baseline model runs were undertaken for the 1% and 0.1% AEP flow events using the developed baseline model. This allowed determination of the extents of Flood Zones A, B and C.
- “Proposed without Mitigation” model development; The proposals were added to the baseline model which included the approach embankments, River Abbert bridge and other culverts based on a hydraulic and structural basis only. This model scenario was then ran using the 1% and 0.1% AEP flows which demonstrated an increase in flood level and extents upstream of the crossing and a subsequent reduction downstream.
- “Proposed with Mitigation” model development; Alterations were made to the “Proposed without Mitigation” to reduce the impact of the proposals. This included the provision of additional flood connectivity culverts (2 no. south of the bridge, 1No. north of the bridge) through the approach embankments and upsizing of 2 no. watercourse culverts. This model scenario was then run using the 1% and 0.1% AEP flows which still demonstrated an increase in flood level and extents upstream of the crossing and a subsequent reduction downstream however this was much reduced in comparison with the “Proposed without Mitigation” scenario and within acceptable limits.

7.14.2 Conclusion

Three model scenarios have been developed; Baseline, Proposed without Mitigation and Proposed with Mitigation. Hydrological estimation has been undertaken to determine the flows for the 1% AEP, 1%+CC AEP (MRFS) and 0.1% AEP events. Model output for the Proposed without Mitigation scenario indicated a significant increase (maximum of 83mm in-channel and 169mm in the floodplain for the 1% AEP) in flood level upstream of the proposed crossing. This is attributed to the impact of the approach embankments and the span of the bridge restricting the overland flow path.

The Proposed with Mitigation scenario included upsizing of two proposed ditch culverts and the addition of three flood connectivity culverts to improve the conveyance of flow through the proposed approach embankments. Model output for the Proposed with Mitigation scenario indicated a slight increase (maximum of 33mm in-channel and 33mm in the floodplain for the 1% AEP) in flood level upstream of the proposed crossing. There is no additional risk posed to nearby properties with increases only within agricultural lands.

8 Structures

There is one proposed structure as a part of the Proposed Road Development, namely the proposed River Abbert Bridge.

A preliminary design has been prepared for this individual structure in accordance with TII DN-STR-03001 Technical acceptance of Structures on Motorways and Other National Roads. The preliminary design study has addressed issues such as ground conditions, costs, structure function and aesthetics for the different potential types of structures.

8.1 River Abbert Bridge

8.1.1 Site and Function

The proposed bridge over the Abbert River is located north-east of Abbeyknockmoy at coordinates 551020, 743507 (ITM). The bridge crosses the Abbert River in a south-west to north-east orientation.

The steel bridge over the Abbert River consists of a single span of approximately 60.5 m, ensuring a clear span over the river channel and Lough Corrib SAC. The proposed underbridge alignment will cross the Abbert River at a skew of approximately 35° to the perpendicular.

8.1.2 Environmental Consideration

The location of the bridge over the Abbert River was developed through careful consideration of the biodiversity constraints within Lough Corrib SAC, which includes the Abbert River with some localised widening in areas near Liss Abbey and the existing Liss Bridge. As a result of the SAC, the bridge will be single span to minimise the impact on the SAC and Abbert River itself.

Consideration was given to flooding along the river channel in consultation with the OPW. Section 7.14 above details the flood mitigation measures proposed for the bridge design.

To protect water quality in the river, a temporary drainage system will be provided at the works areas on the riverbanks, with all water directed away from the river and into a collection system that will be fitted with suitable pollution control measures prior to discharge to the existing drainage system. These measures will protect against accidental spillages from the construction machinery and processes from entering the river channel. Further measures will be adopted during the pouring of concrete for the bridge deck above the steel beams so as to prevent accidental spillages of pollutant materials directly into the river. Details of control measures for the construction stage are outlined in the Outline Construction Environmental Management Plan and further information on the Construction Methodology is given below in Section 8.1.4.

8.1.3 Structure

The superstructure is formed of 6 no. braced weathering steel I Girders at 2.53 m centres. The total bridge width will be 15.65 m which includes the minimum required cross sectional width plus additional verge widening to account for carriageway sightlines at the south-west and north-east corners. To improve aesthetics, the girders will be fabricated with a varying arched profile soffit with a maximum structural depth at the abutments of 2.5 m and a minimum structural depth of 1.8 m at the centre of the span. Freeboard provided at the lowest soffit point of the crossing is approximately 2.88 m. The freeboard provision is greatest at the centre due to the arched shape of the bridge beams. An in-situ concrete deck 250 mm thick is provided to span between the steel girders with parapet edge beams also provided to the edge of the deck. The details of the proposed bridge can be seen in the elevation and cross-sections shown in Figure 8-1 and Figure 8-2 respectively.

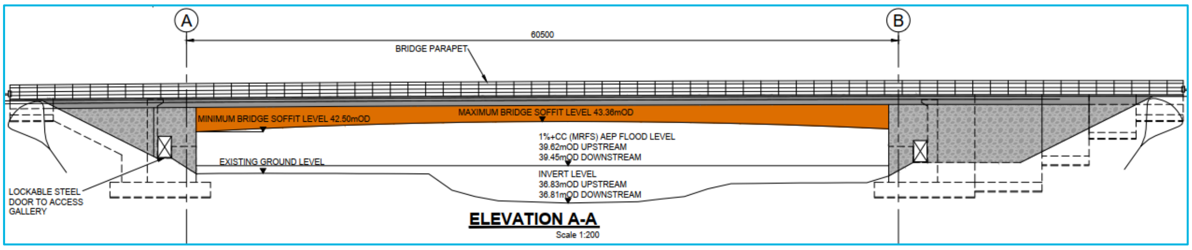


Figure 8-1 Proposed Bridge crossing of Abbert River - Elevation

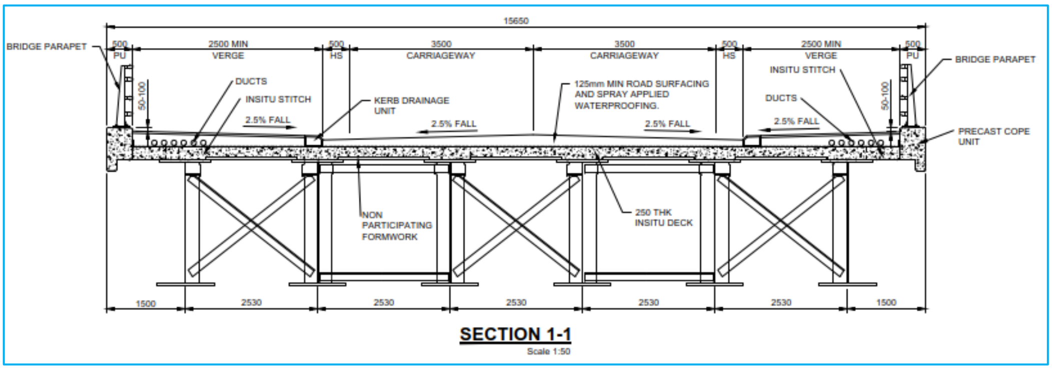


Figure 8-2 Proposed Bridge crossing of Abbert River – Cross-Section

The bridge abutments are located outside the river channel to minimise in-stream works for the construction of the bridge over the Abbert River, a tributary river of Lough Corrib SAC. The bridge abutments will be finished with a locally sourced masonry cladding. Stone cladding was chosen over concrete as it was deemed to blend with the existing environment to a greater degree than insitu concrete with a pattern profile finish.

This bridge is a key programme item for the construction, particularly in conjunction with seasonal constraints during the construction of drainage outfalls and earthworks in proximity to the river. The proposed bridge is illustrated in Figure N63-ACM-PH03-1700-DR-SE-1701 contained in Volume 2 of this Design Report.

8.1.4 Bridge Construction Methodology

The proposed construction methodology considers the temporary and permanent impact on the surrounding environment. Off-site fabrication will be maximised for the construction of the 6-no. braced weathering steel girders. The structural members will be fabricated in a controlled factory environment to ensure high precision and efficiency. This reduces material waste and limits the environmental impacts from the harmful emissions created in production. The use of offsite fabrication of the beams will limit construction time on-site, construction traffic moving to and from the site and the risks associated with working at height and near live watercourses. The superstructure will be transported to site in sections and assembled on-site. On site assembly will aim to avoid the impacts of construction in inclement weather conditions and ensure high quality welds and connections minimising maintenance requirements over the service life of the bridge. Insitu reinforced concrete abutments have been proposed for the substructure. The abutments will retain suitable backfill material up to the finished deck level.

Prior to construction commencing, temporary fencing will be erected a suitable set-back from the river embankments. This will create an exclusion zone, protecting the riverbanks during construction and maintaining a safe passage for wildlife during construction. The fences will further act as a safe working zone for construction personnel and prevent the storage of material too close to the crest of the slope, mitigating the risk of run-off and pollution to the River Abbert.

The foundation type will be finalised at detailed design stage at this stage a piled foundation is preferred to limit differential settlements, excavation dimensions and minimise the surcharge transferred to the fill slopes over the service life of the bridge. Sufficient space will be required within the lands made available boundary to ensure that delivery of the structural elements is facilitated, such as the prefabricated weathering steel girders. In addition, areas should be identified for piling platforms) and crane lifting platforms within the lands made available. These locations may require local excavation and replacement with structural fill to support the piling rig or crane. When the foundation work is complete, the abutments can be built-up to bridge soffit level including insitu cantilever wingwalls and gravity retaining walls on the approach and departure of the bridge. Bridge bearings will then be installed on each abutment and the bridge superstructure can be lifted into place with a mobile crane. To transport the girders to site it is suspected an Abnormal Load Permit will need to be granted from An Garda Síochána. Once the superstructure of the bridge has been lifted into place the abutment diaphragms and deck slab can be cast. The parapet edge beam may then be erected, and waterproofing will be applied to the deck slab and any other area of exposed concrete.

Once the superstructure and abutments are in place, the backfill to the abutments will be laid and compacted to the required road level. Finally, the finishes of the bridge will be completed including the construction of any required verged/service ducts, erecting the parapet system and applying the road surfacing.

9 Pavement

9.1 Introduction

Road pavement has two primary functions:

i. Provide a good quality surface and appropriate resistance to skidding; and

ii. Distribute applied traffic loading to road foundation.

Although the actual road pavement layer thicknesses and make-up will be determined at detailed design stage, this chapter outlines the design standards that will be used and indicates the likely road pavement make-up.

9.2 Pavement Design Standards

The pavement for the proposed Mainline shall be designed to withstand the traffic loading as detailed in the TII Publication PE-SMG-02002 - Pavement Design and Maintenance: Traffic Assessment.

The pavement will be designed as a fully flexible construction for a 40 years Design Life.

The design of capping layer, sub-base and pavement layers will follow the requirements of TII Publication DN-PAV-03021 - Pavement & Foundation Design.

The pavement materials to be used and method of construction will follow the requirements of the TII Specification for Road Works Series 700 - Road Pavements – General (CC-SPW-00700) and Series 900 - Road Pavements - Bituminous Materials (CC-SPW-00900).

9.3 Pavement Foundations

The main purpose of the foundation layers is to distribute the applied vertical loads to the underlying sub-grade providing a firm and uniform support to the pavement layers above. In particular the foundation must be adequate to prevent damage to the subgrade during construction and facilitate compaction of the pavement. The design recommendations for the foundation layers of capping and sub-base are given in the TII Publication DN-PAV-03021 and are based on the strength of the sub-grade, measured as its ‘CBR’ value.

Capping material is used to improve weak sub-grade material. It is proposed to use a capping layer using granular material which conforms with type 6F1, 6F2 or 6F3 (TII Specification for Road Works Series 600 - Earthworks (CC-SPW-00600)) in both embankments and cuttings to the thickness required by the above standard as appropriate to the CBR value of the sub-grade and selected pavement type.

A detailed ground investigation will be undertaken prior to detailed design and as such a detailed analysis of sub-grade strength has not been undertaken at this stage. Typically, assuming a 3.0% design CBR and a fully flexible pavement, two pavement foundations options will be available, as outlined in Table 9-1.

Table 9-1 Pavement Foundation

CBR	Option	Description	Design Thickness (mm)
3%	A	Sub-base on Capping	150 mm 350 mm
	B	Sub-base only (no Capping)	300 mm -

A thin regulating layer of sub-base (Clause 804) is required in lieu of the capping layer where it is anticipated that rock will be encountered.

9.4 Pavement Design

The pavement proposed is a fully flexible pavement with a design life of 40 years with a surface course of polymer modified SMA.

The design traffic loadings have been calculated in accordance with TII Publication PE-SMG-02002 - Pavement Design and Maintenance: Traffic Assessment. The future cumulative pavement traffic loading, in terms of million standard axles (msa) has been determined using the following formulae;

$$\boxed{\text{Design Traffic (T)} = \sum T_i}$$

Where;

$$\boxed{T_i = W \text{ x } P \text{ x } 10^{-6} \text{ x } 365 \text{ x } \sum_{y=0}^{y=Y} Fy \qquad \text{(msa)}}$$

and;

T = Total pavement traffic loading summed for all vehicle classes over the design period (msa)

T_i = Pavement traffic loading for each individual class of vehicle over the design period (msa)

F_y = Annual Average Daily Flow of traffic (AADF) for each traffic class for each individual year, where year 0 = year of opening. Therefore F_0 = Annual Average Daily Flow of traffic (AADF) for each traffic class in the year of opening;

Y = Design Period

W = Wear Factor for each traffic class

P = Percentage of vehicles in the heaviest loaded lane

The pavement design calculations have been developed using the following HCV growth rates abstracted from the Traffic Model as discussed in Chapter 3 of this report.

Table 9-2 HCV Growth Rates

Growth Period	Annual HCV Growth Rates
2016-2030	4.5% (OGV1 + PSV) and 4.5% (OGV2)
2030-2040	2% (OGV1 + PSV) and 2% (OGV2)
2040-2050	2.4% (OGV1 + PSV) and 2.4% (OGV2)
2050+	1% (OGV1 + PSV) and 1% (OGV2)

9.4.1 Mainline

The mainline carriageway has been divided into 3 sections described below:

- Section A: west of the proposed roundabout;
- Section B: between the proposed roundabout and the proposed junction with L6159; and
- Section C: east of the proposed junction with L6159.

The design traffic (msa) for the mainline sections of the proposed road development are listed in Table 9-3 below. For the purposes of the design, the highest loading has been assumed throughout.

Table 9-3 Design Traffic - Mainline

Section	Carriageway	AADT (Opening Year)	Commercial Vehicle (%)	Design Traffic (msa)
A	N63, west of the proposed roundabout	5500	6.0%	7
B	N63, between the proposed roundabout and the proposed junction with L6159	3500	6.7%	5
C	N63, east of the proposed junction with L6159	3900	6.9%	6

Typical pavement depths for various options of fully flexible pavement are outlined in Table 9-4 below.

Table 9-4 Pavement Depths - Mainline

Section	Surface Course	Structural Pavement Option		Design Thickness of Layers
A	SMA 14 PMB65/105-60	Fully Flexible	Asphalt Concrete using 70/100 Pen Bitumen	270mm
		Fully Flexible	Asphalt Concrete using 40/60 Pen Bitumen	240mm
B	SMA 14 PMB65/105-60	Fully Flexible	Asphalt Concrete using 70/100 Pen Bitumen	250mm
		Fully Flexible	Asphalt Concrete using 40/60 Pen Bitumen	230mm
C	SMA 14 PMB65/105-60	Fully Flexible	Asphalt Concrete using 70/100 Pen Bitumen	260mm
		Fully Flexible	Asphalt Concrete using 40/60 Pen Bitumen	230mm

9.4.2 Side Roads

The side roads intersected by the proposed road development, including the existing N63 and other Local Roads, experience varying levels of traffic. Some of these flows are relatively low (<1.5 msa). As such the opening year traffic flows on the existing N63 (which will be reclassified) will be used for the calculation of pavement thicknesses.

Where the traffic flows are greater than 5msa, the pavement of the proposed N63 mainline will be extended along the realigned side road. The design traffic for each side road is indicated in Table 9-5 below.

Table 9-5 Design Traffic – Side Roads

Section	Carriageway	AADT (Opening Year)	Commercial Vehicle (%)	Design Traffic (msa)
D	Existing N63, between the proposed roundabout and the junction with L3110	2000	5.0%	3.0
E	L3110 Monivea Road	2000	5.0%	3.0
F	Other Local Roads: • L21821; • L7138; • L6159; • L6234.	N/A	N/A	< 1.5

Typical pavement depths for various options of fully flexible pavement are outlined in Table 9-6.

Table 9-6 Pavement Depth – Side Roads

Section	Surface Course	Structural Pavement Option		Design Thickness of Layers
D	SMA 14 PMB65/105-60	Fully Flexible	Asphalt Concrete using 70/100 Pen Bitumen	230mm
		Fully Flexible	Asphalt Concrete using 40/60 Pen Bitumen	210mm
E	SMA 14 PMB65/105-60	Fully Flexible	Asphalt Concrete using 70/100 Pen Bitumen	230mm
		Fully Flexible	Asphalt Concrete using 40/60 Pen Bitumen	210mm
F	SMA 14 PMB65/105-60	Fully Flexible	Asphalt Concrete using 70/100 Pen Bitumen	200mm
		Fully Flexible	Asphalt Concrete using 40/60 Pen Bitumen	200mm

9.4.3 Access Roads

The access tracks serving the severed lands from the farm accesses shall be designed in accordance with the TII Standard Construction Detail CC-SCD-00706.

9.5 Detail Design Stage

The pavement options outlined above are indicative only. The choice of pavement type will be determined during the detail design of the Proposed Road Development to achieve an optimal design.

A pavement condition survey will be carried out on all permitted access routes to the site before, during and after construction to determine if any deterioration of the existing road network has occurred as a result of the construction works. If deterioration of the existing road network as a result of construction works is observed, this will be rectified as part of the works.

10 Road Signage & Public Lighting

10.1 Introduction

This chapter describes the signing and lighting proposed as part of the Proposed Road Development. The general principles of the provisions are defined and the exact detail of signing and lighting provisions will be finalised during the detailed design of the project. This will occur through consultation with the relevant bodies and in conformance with the statutory requirements.

10.2 Road Signage

Directional Signs and Regulatory Signs will be provided in accordance with the ‘Traffic Sign Manual’ as published by the Department of Transport (2019) (DTTAS, 2019). The Proposed Road Development will be provided with Advanced Direction Signs (ADS) at the approaches to each junction, to advise drivers on directions to regional and local destinations. Text on signage will be in both Irish and English in accordance with the Traffic Signs Manual.

White-on-brown tourist signage panels will be provided, where appropriate, in the standard form, with the name of the town/village and symbols to highlight facilities and features likely to be of interest to tourists. The design of tourist signage and the confirmation of destinations to be included along the Proposed Road Development shall be agreed in conjunction with GCC and in accordance with the TII ‘Policy on the Provision of Tourist and Leisure Signage on National Roads’ (2011)(TII, 2011).

Road Markings, Reflective Markings and Road Studs shall be provided in accordance with the ‘Traffic Signs Manual’ (DDTAS, 2019) and in accordance with TII Specification for Road Works - Series 1200 (CC-SPW-01200) (TII, 2019). Temporary traffic signs during construction will comply with Chapter 08 of the Traffic Signs Manual, and the TII Specification for Road Works - Series 1200 (CC-SPW-01200). Brown tourist signs will be included to advertise Liss Abbey and the proposed Liss Abbey Viewing Area.

10.3 Public Lighting

The rural sections of the Proposed Road Development will not be lit, and road lighting shall be confined to:

- N63 roundabout (Junction 1) and immediate approaches, including tie-ins with existing road lighting in the village of Abbeyknockmoy;
- The existing road lighting in proximity to Newtown National School and Abbeyknockmoy Community Centre, between Junction 5 (L7138) and Junction 6 (L3110); and
- The proposed pedestrian and cycle facility along the existing N63 between the village of Abbeyknockmoy and Newtown National School/Abbeyknockmoy Community Centre.

The Public Lighting plan is presented in Figure N63-ACM-PH03-1300-DR-PL-1300 in Volume 2 of this Design Report.

11 Services, Land Use & Accommodation Works

11.1 Services

The Proposed Road Development intercepts various utility services along the mainline and side roads. Locations where potential conflicts with significant trunk and distribution services occur along the route have been identified, and preliminary designs and budget costs for the necessary service diversions have been developed following discussions with the utility providers. Effects on local domestic connections will be addressed at the detailed design stage. The locations of significant existing utility services are shown in Figures N63-ACM-PH03-2700-DR-UT-2700 to N63-ACM-PH03-2700-DR-UT-2705 contained in Volume 2 of this Design Report.

As part of the constraints study, a desktop study was carried out in order to identify all utility constraints located within the study area for the realignment scheme. As part of the desktop study, a number of utility providers were contacted to obtain up-to-date information on the location and type of services that are situated within the defined study area. Table 11-1 provides a summary of all the utility providers which were contacted as well as the response received (if any).

Table 11-1 Utility Providers Contacted

Utility Provider	Response Received	Response
Brighter Networks	Yes	No Infrastructure within Study Area
BT Ireland	Yes	No Infrastructure within Study Area
Clear Channel	Yes	No Infrastructure within Study Area
Colt	Yes	No Infrastructure within Study Area
Cuillagh Group Water Scheme	Yes	Infrastructure Confirmed within Study Area
EIR	Yes	Infrastructure Confirmed within Study Area
Enet	Yes	No Infrastructure within Study Area
ESB	Yes	Infrastructure Confirmed within Study Area
EU Networks	Yes	No Infrastructure within Study Area
Gas Networks Ireland	Yes	No Infrastructure within Study Area
Industria	No	-
Irish Water	Yes	Infrastructure Confirmed within Study Area
Magnet	Yes	No Infrastructure within Study Area
Siro	Yes	No Infrastructure within Study Area
Verizon	No	-
Viatel	No	-
Virgin Media	Yes	No Infrastructure within Study Area
Vodafone	Yes	No Infrastructure within Study Area

An assessment of the utilities crossing and surrounding the current N63 between Liss and Abbeyknockmoy reveals potential conflicts at the locations noted below.

11.1.1 Telecommunications

11.1.1.1 Eir

As of the date of this Design Report Eir was the only telecommunications provider which confirmed that it had infrastructure within the study area. Details of the seven relevant telecommunications infrastructure is provided below.

- Two underground Eir cables are located on westernmost extents of the N63 with one running parallel to the carriageway and another running underneath;
- Two over-head cables are located at the western extents and central portion of the existing N63;
- There is one overhead cable at the eastern extents of the development; and
- There are two cables run perpendicular to the carriageway which intersect at the southern portion of the Proposed Road Development.

Further information is given in **Error! Reference source not found.** Table 11-2 below.

11.1.2 Electricity

11.1.2.1 ESB

At the time of prepareation of this this document ESB was the only utility provider which confirmed that it had infrastructure within the study area. The ESB distribution network comprises medium voltage (MV) (10kV/20kV) and low voltage (LV) (230V/400V) electricity lines which are managed by ESB Networks area offices. An assessment of the proposed route and the MV and LV ESB network has revealed the following conflicts. Details of the ten relevant telecommunications infrastructure is provided below.

- There are three separate medium voltage cables which run overhead perpendicular to the existing N63 carriageway;
- Two low voltage overhead cables run parallel with the N63, beginning at the far western portion of the existing N63 carriageway and the eastern portion of the carriageway. Additionally, two other low voltage over-head cables run perpendicular to the carriageway at the far western and central portion of the road; and
- There are also of two these Medium Voltage Electricity Lines are located at the north eastern-most extents of the development.

Further information is given in **Error! Reference source not found.** Table 11-2 below.

11.1.3 Water

Both Irish Water and the Cuillagh Group Water Scheme have indicated that they have water infrastructure within the area. An assessment of the proposed route network has revealed the following potential conflicts. Details of the relevant water infrastructure is provided below.

11.1.3.1 Cuillagh Group Water Scheme

- There is one underground pipe belonging to the Cuillagh Group Water Scheme which runs parallel to the road at the western-most extents of the existing N63 and another pipe which intersects the road perpendicularly at the centre of the development;
- There is one underground pipe belonging to the Cuillagh Group Water Scheme located at the beginning of the southern arm of the proposed carriageway which runs perpendicular to the scheme; and
- There is one underground pipe owned by the Cuillagh Group Water Scheme which runs perpendicular to the proposed development.

11.1.3.2 Irish Water

- There are three pipes belonging to Irish Water in the existing N63; one which runs parallel to the scheme at the western-most extents and another two which run perpendicular to the carriageway at the north eastern extents;
- There is also one underground pipe belonging to Irish Water along the southern extents of the proposed carriageway;
- One pipe owned by Irish Water runs perpendicular to the scheme at the north-eastern most extents of the proposed development; and
- One other pipe managed by Irish Water which runs perpendicular to the Proposed Road Development at its western extents.

Further information is given in Table 11-2 below.

Table 11-2 Relevant Utility Infrastructure in Study Area

Type of Utility	Company	Mainline Chainage (Ch.)	Collision Type	Description	Proposed Works
Electricity	ESB	0+070	Perpendicular crossing (mainline)	MV Three Phase Underground Line	No Division Needed
Electricity	ESB	2+250 (L6159 South: Ch. 0+050)	Perpendicular crossing (L6159 South)	MV Three Phase Overhead Line	Diversion and/or protection where required.
Electricity	ESB	2+340	Skew crossing (mainline)	MV Three Phase Overhead Line	Diversion and/or protection where required.
Electricity	ESB	2+340	Skew crossing (mainline)	MV Three Phase Overhead Line	Diversion and/or protection where required.
Electricity	ESB	3+050	Skew crossing (mainline)	HV 220V Overhead Wire	No Division Needed
Electricity	ESB	11+170	Skew crossing (existing N63)	MV Three Phase Overhead Line	No Division Needed
Electricity	ESB	11+310 (L7138: Ch. 0+020)	Parallel (east side)	LV Single Phase Overhead Line	Diversion and/or protection where required.
Electricity	ESB	11+800	Perpendicular crossing (existing N63)	MV Three Phase Overhead Line	No Division Needed
Water	Cuillagh GWS	10+070 – 10+300	Skew crossings (mainline and existing N63) Parallel to existing N63 (north side)	Underground Pipes	Diversion and/or protection where required.
Water	Cuillagh GWS	10+470 – 10+670	Parallel to proposed swale Parallel to existing N63 (north side)	Underground Pipes	Diversion and/or protection where required.
Water	Cuillagh GWS	10+930	Skew crossing (existing N63)	Underground Pipes	Diversion and/or protection where required.
Water	Irish Water	10+070 – 10+300	Skew crossings (mainline and existing N63) Parallel to existing N63 (north side)	Water main	Diversion and/or protection where required.
Water	Irish Water	10+470 – 10+670	Parallel to proposed swale Parallel to existing N63 (north side)	Water main	Diversion and/or protection where required.
Water	Irish Water	11+270 – 11+320	Parallel to proposed footpath Parallel to existing N63 (north side)	Water main	No Division Needed
Water	Irish Water	11+320	Perpendicular crossing (existing N63)	Water main	No Division Needed

Type of Utility	Company	Mainline Chainage (Ch.)	Collision Type	Description	Proposed Works
Water	Irish Water	11+320 – 11+650	Parallel to proposed footpath & skew crossing at Junction 6 Parallel to existing N63 (both sides)	Water main	Diversion and/or protection where required.
Water	Irish Water	2+275 (L6159 South: Ch. 0+080 – 0+150)	Parallel to existing L6159 (west side)	Water main	Diversion and/or protection where required.
Water	Irish Water	2+275	Perpendicular crossing (mainline)	Water main	Diversion and/or protection where required.
Water	Irish Water	2+275 (L6159 North: Ch. 0+000 – 0+070)	Parallel to existing L6159 (west side)	Water main	Diversion and/or protection where required.
Water	Irish Water	11+650 – 12+000	Parallel to existing N63 (north sides)	Water main	No Division Needed
Water	Irish Water	2+600 – 3+120	Parallel to existing N63 (north sides)	Water main	Diversion and/or protection where required.
Water	Irish Water	3+000 (L6234: Ch. 0+000 – 0+070)	Parallel to existing L6234 (south sides)	Water main	Diversion and/or protection where required.
Telecommunications	Eir	10+070 – 10+225	Parallel to existing N63 (north side)	Underground Cable	Diversion and/or protection where required.
Telecommunications	Eir	10+225	Perpendicular crossing	Underground Cable	Diversion and/or protection where required.
Telecommunications	Eir	10+225 – 11+450	Parallel to existing N63 (south side)	Underground Cable	Diversion and/or protection where required.
Telecommunications	Eir	11+310 (L7138: Ch. 0+020)	Parallel and Perpendicular crossing	Overhead Line and Underground Cable	Diversion and/or protection where required.
Telecommunications	Eir	11+665	Perpendicular crossing	Overhead Line	No Division Needed
Telecommunications	Eir	11+665 – 11+970	Parallel to existing N63 (north side)	Overhead Line	No Division Needed
Telecommunications	Eir	11+970 – 12+530 (Mainline: 2+550 – 3+120)	Parallel to existing N63 (north side)	Overhead Line	Diversion and/or protection where required.
Telecommunications	Eir	2+275	Perpendicular crossing	Overhead Cable	Diversion and/or protection where required.

Type of Utility	Company	Mainline Chainage (Ch.)	Collision Type	Description	Proposed Works
Telecommunications	Eir	2+275 (L6159 North: Ch. 0+000 – 0+070) (L6159 South: Ch 0+080 – 0+150)	Parallel to existing L6234 (south sides)	Overhead Cable	Diversion and/or protection where required.
Telecommunications	Eir	3+000 (L6234: Ch. 0+000 – 0070)	Parallel to existing L6234 (south sides)	Overhead Cable	Diversion and/or protection where required.

11.2 Land Use

11.2.1 Land Acquisition

Provision of the Proposed Road Development requires the acquisition of land for construction and operation of the development. The area of land acquisition is required for a number of different purposes, including:

- Construction of the road;
- Landscaping and boundary treatments;
- Temporary road realignments and diversions;
- Working space to facilitate the safe construction;
- Accommodation works and access roads;
- Acquisition of severed plots; and
- Other road engineering, safety, and environmental considerations.

The land acquisition has been sub-divided into temporary acquisition and permanent acquisition. Temporary acquisition has been sought where the lands are required temporarily to facilitate the construction/demolition of discreet elements of the works. Permanent land acquisition has been sought where the lands are required permanently to enable the operation of the Proposed Road Development through its lifetime.

The total land take including both permanent and temporary acquisition comprises approximately 15.404 ha of land. The permanent acquisition for the scheme totalling 15.161 ha is categorised below (areas are approximate):

- 2.942 ha classified as public road;
- 12.184 ha classified as agricultural land; and
- 0.035 ha classified as residential land.

In addition to the permanent acquisition, 0.243 ha of land is being temporarily acquired for the duration of the works to facilitate construction of pedestrian and cycle facilities on the existing N63 and construction of the new boundary walls and fences.

The proposed land acquisition is necessary for the construction, operation, and maintenance of the Proposed Road Development.

11.3 Accommodation Works

11.3.1 Boundary Treatment

Where boundaries at residential properties are removed as part of the works, they will generally be replaced on a like-for-like basis, subject to final agreement on accommodation works with individual property owners.

At the beginning of the construction phase, the land to be acquired as per the Proposed Road Development boundary will be fenced and access restricted. Temporary fencing or hoarding may be required during construction prior to the installation of permanent fencing to secure the site and prevent unauthorised access.

Fence types will vary across the Proposed Road Development depending on the different requirements. Fence types include timber post and tension mesh fencing, masonry walls, steel palisade fencing, noise barriers, parapets etc. Fencing, safety barriers and parapets on the Proposed Road Development will be provided to meet the requirements of the current TII Publications and guidance documents.

Standard detailed fencing typically used on schemes of this nature will be used. Where the Proposed Road Development traverses' agricultural lands, the road boundary fencing will typically be timber post and tension mesh fencing, in accordance with TII CC-SCD-00320 – Fencing: Timber Post and Tension Mesh Fence (TII, 2018).

12 Cost Estimation

12.1 Scheme Cost

The Total Scheme Budget was determined in accordance with the TII Cost Management Manual under the following seven expenditure headings.

- Main Contract Construction;
- Main Contract Supervision;
- Archaeology;
- Advance Works & Other Contracts;
- Residual Network;
- Land & Property; and
- Planning & Design.

The Total Scheme Budget is prepared based on the Target Cost plus a TII Programme Risk and Total Inflation contingency. The Total Scheme Budget (inclusive of VAT) is outlined in Table 12-1.

Table 12-1 Total Scheme Budget (2021 Prices inclusive of VAT)

Cost Expenditure Heading	Base Cost	Contingency	Budget
Main Construction Contract	€12.57m	€1.04m	€13.61m
Main Contract Supervision	€0.41m	€0.08m	€0.49m
Archaeology	€0.33m	€0.05m	€0.38m
Advance Works & Other Contracts	€0.19m	€0.06m	€0.25m
Walking/Cycling/Asset Renewal	€0.98m	€0.06m	€1.04m
Land & Property	€2.54m	€0.21m	€2.76m
Planning & Design	€0.68m	€0.16m	€0.84m
Sub-Total	**€17.69m**	**€1.66m**	**€19.36m**
Total Inflation Allowance		**€1.22m**	
TII Programme Risk		**€0.97m**	
Total Scheme Budget		**€21.46m**	

12.2 Risk Assessment

The cost estimate for the N63 Liss to Abbey Realignment Scheme was based on the application of the risk contingencies to each element of the base costs. The risk contingency values varied relative to the level of risk associated with each element.

Risks were identified within the following risk identification categories:

- Highways;
- Geotechnics;
- Structures;
- Technology;
- Environment;
- 3rd Parties;
- Land and Compensation;
- Resources/Market;
- Pre-Construction Programme/Procurement;
- Buildability & Construction Programme;
- Finance; and
- Other-General.

These risks were assessed by assigning a probability to each risk along with cost and time impacts (1-5 scale). The cost and time rank values were calculated by multiplying the cost/time impacts by the probability. Mitigation measures and the owner for each risk were identified. The minimum, most likely and maximum value (€) of each risk were calculated and these figures were multiplied by the risk probability to find the contingency for each risk. The "most likely" value was used for each risk and these values were assigned to the appropriate Scheme Cost heading. The sum of each these values under each heading were used for the contingency in the Total Scheme Budget.

The top 12 risks and the overall impact for Main Contract Construction can be seen below in Table 12-2.

Table 12-2 Top Risks under Main Contract Construction

Risk #	Risk Description	Overall Impact (€)
1	Unforeseen ground conditions encountered during Construction.	240,000
2	Increased construction cost for the river bridge compared to preliminary design bridge layout.	180,000
3	Utility providers, private and public. Known and unknown utility routes.	120,000
4	Changes to design during Construction may be necessary	96,000
5	Geophysics Survey has identified there is a 50m wide feature interpreted as either weathered/karstified bedrock or a north south trending fault structure. Geophysics Survey has raised concern over the ground conditions in the area north of the river, where the bridge is proposed to land. Additional cost for piling (bridge foundations)	96,000
6	Increased cost for the Bridge design/construction due to the Abutment Stone Cladding	81,000
7	Risk of errors in the Tender Docs	48,000
8	Increased complexity and cost for the bridge design (skew structure, increased span, etc.)	63,000
9	Changes required due to inaccuracy of Topographical Survey.	48,000

10	Noise Barrier, Screening, Mammal crossings etc. Number of houses may require environmental screening from the road	48,000
11	Proximity to Knockmoy Abbey Ruins	48,000
12	Severed Farmland	48,000
Total		**1,116,000**

13 Economic Assessment

13.1 Introduction

A detailed appraisal of the preferred scheme was conducted in accordance with the TII PAG and DTTaS Common Appraisal Framework. A Preliminary Business Case was undertaken in accordance with the TII Project Management Guidelines 2019 (PE-PMG-02041). The Business Case document is the primary deliverable summarising the project appraisal process and is developed and updated as the project progresses through its project lifecycle. The Business Case also includes a summary of many other important aspects of the project management and delivery process, alongside the appraisal process.

More detail on the Economic Assessment of the scheme is given in the Preliminary Business Case which can be found in Appendix D.

13.2 Assessment Overview

The complexity of Minor Projects (€5m to €20m) varies considerably. To aid the appraisal process, TII Minor Projects can be classified into three broad categories as follows:

1. Online or offline improvements – economic appraisal supported by 'TII Simple Appraisal Tool' and COBALT;
2. Bypasses – economic appraisal supported by a traffic assignment model; and
3. Junction upgrades (including the optimisation of existing merge/diverge layouts) – economic appraisal supported by modelling proportionate to the upgrade.

The section of existing N63 under consideration is approximately 2.3km in length and consists of online and offline realignment. For this reason, the first approach described above has been considered.

13.3 TII Simple Appraisal Tool

TII PAG Unit 12: Minor Projects (€5m to €20m) provides a spreadsheet-based tool to assesses the economic case for online or offline minor improvement to the National Roads network. This tool requires the following information to be detailed:

- Scheme Information;
- Existing Annual Average Daily Traffic (AADT);
- Scheme Costs; and
- Target Performance.

All general parameters such as value of time, value of time growth rates, discount rates, fuel cost changes, fuel consumption, vehicle operating costs fuel/non-fuel, trip purpose distribution, tax rates, change in tax rates, vehicle occupancy rates and vehicle proportions were taken from the TII *PAG Unit 6.11 - National Parameters Value Sheet*.

The Cost Benefit Analysis (CBA) assessment assumes a Discount Rate of 4% (years 1-30) and 3.5% (years 31-60), with all costs and benefits discounted back to a common base year of 2011.

13.3.1 Scheme Information

The following information was used for the Scheme Information section of the Simple Appraisal Tool:

- County – Galway;
- Existing Route Length – 2.34 km;
- New Route Length – 2.17 km;
- Scheme Opening Year – 2023;
- Existing Route Standard – 2 Lane Single Carriageway;

- New Route Standard – 2 Lane Single Carriageway;
- Appraisal Period – 30 years;
- Residual Period – 30 years;
- Observed AADT – 3,065;
- HGV% – 6.2%; and
- Year of Observed AADT – 2019.

13.3.2 Target Performance

An existing average speed of 62 kph and a forecast average speed of 92 kph were used for the Target Performance section of the Simple Appraisal Tool. The existing average speed was calculated from data obtained from Google API data (GPS data taken anonymously from mobile phones), and the forecast average speed was obtained from a speed survey conducted by the Road Safety Authority in 2018.

The end-to-end average speed will be 92 kph, which comprises of a short section with a 50 kph speed limit and the remainder a 100 kph speed limit, where vehicles are assumed to travel at an average speed of 96 kph. This 96 kph value was obtained from the RSA Free Speed Study in 2018 for National Secondary Roads.[3]

13.4 Key Results

The benefit cost ratio (BCR) is a function of the monetised benefits, Present Value of Benefits (PVB) versus the Present Value of Costs (PVC), and has been calculated using the TII Simple Appraisal Tool. In accordance with the Department of Transport guidelines, a discount rate of 4% for the design life of the scheme (30 years), and falling to 3.5% after that, has been applied to the benefits. A shadow pricing for labour factor of 1.0, with a factor of 1.3 for public funds has been applied to the costs, with all costs and benefits discounted back to a common base year of 2011.

Table 13-1 below highlights the PVB and PVC and the associated BCR of the scheme.

Table 13-1 Preferred Option – Net Present Value and Benefit Cost Ratio (discounted to 2011)

Present Value Benefits (PVB) (€ Million)	Present Value Costs (PVC) (€ Million)	Net Present Value (NPV) (€ Million)	Benefit Cost Ratio (BCR)
€ 18.13	€ 16.00	€ 2.13	**1.13**

[3] https://www.rsa.ie/Documents/Road%20Safety/Speed/RRD_Res_20190204_FreeSpeedSurvey2018FINAL.pdf

14 Conclusions & Recommendations

This Phase 3 Design Report was developed for the proposed N63 Liss to Abbey Realignment Scheme, the Proposed Road Development. The project aims to divert a section of the existing N63 that has poor horizontal and vertical alignment along with a narrow bridge crossing the Abbert River and to increase the safety for pedestrians and cyclists in the area

The Proposed Road Development involves the construction of approximately 2.3km of predominantly offline new road to replace the existing N63 mainline. The proposed upgrade for this section of the N63 will use a Type 2 Single carriageway cross-section to improve route consistency along the National Roads network and is consistent with local and regional and national policy and guidance. This includes National Planning Framework (NPF), Strategic Investment Framework for Land Transport, West Regional Planning Guidelines (2010-2022) and the Galway County Development Plan (2015-2021). The Proposed Road Development will support the objectives of the TEN-T network in broad terms by improving the connectivity to Junction 19 on the M17 TEN-T network.

Other key improvements to the N63 and surrounding road network include the provision of a new roundabout at the western end of the scheme which will provide connection to the existing N63 mainline, the provision of two new priority junctions to provide connection to the L6159 and L7234, and new pedestrian and cycling facilities along the existing N63. The construction of a new N63 alignment, along with these improvements, will greatly increase the safety of the local road network and will reduce the frequency and severity of accidents in the region.

All aspects of the scheme have been designed in accordance with the TII Publications (Standards), the TII Environmental Assessment and Construction Guidelines and other best practice guidelines. This includes DN-GEO-03031 Rural Road Link Design (TII, 2017), DN-GEO-03036 Cross Sections and Headroom (TII, 2017), DN-GEO-03060 Geometric Design of Junctions (priority junctions, direct accesses, roundabouts, grade separated, and compact grade separated junctions) (TII, 2019), DMURS - Design Manual for Urban Roads and Streets (DTTAS,2019), and NCM – National Cycle Manual (NTA, 2011).

A detailed appraisal of the preferred scheme was conducted in accordance with the TII PAG and DTTaS Common Appraisal Framework. A Cost Benefit Analysis (CBA) was conducted using the TII Simple Appraisal Tool and the CBA presented a Benefit to Cost Ratio of 1.13, generating a positive return on the required investment.

The N63 Liss to Abbey Design Team recommend that the scheme be progressed to Phase 4 (Statutory Processes) of the TII Project Management Guidelines 2020.

Appendix A - Junction Strategy Report

AECOM Imagine it. Delivered.

AECOM Ireland Limited
4th Floor
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin A96 T927
Ireland

T: +353 1 238 3100
aecom.com

To:
Galway County Council

CC:
AECOM Project Team

Date:
14 June 2021

Revision:
1

Prepared By:
Luca Bellini, Consultant Engineer

Checked By:
Patrick Craig, Highways Engineer

Verified By:
Donald MacKenzie, Principal Engineer

Approved By:
Eoin Greene, Technical Director

Project name:
N63 Liss To Abbey Realignment Scheme

Project ref:
60571547 - GC\16\13416

Memo 0008

Subject: N63 Liss To Abbey Realignment Scheme - Junction Strategy

1. Introduction

1.1 Overview

The following memo outlines the junction options considered as part of the junction strategy review for the N63 Liss To Abbey Realignment Scheme. The junction strategy has been developed considering the finding of the Option Selection Report, which has identified Option B, and the associated route corridor, as the Emerging Preferred Route. The exact location of these junctions will be defined at Phase 3 – Preliminary Design.

In order to facilitate discussion, the junction strategy has been divided into five main areas described as follows and illustrated in Figure 1-1 below (see also attached drawing *N63-ACM-ZZ-ZZ-SK-HW-000016* for more details):

- Area 1: Western Tie-In
- Area 2: Central Tie-In
- Area 3: Eastern Tie-In
- Area 4: L3110 Tie-In
- Area 5: Liss Bridge

It is noted that the numbering of options within each area does not necessarily correlate with other options for a different area, although it has made clear through the text that the combination of some options will be unfeasible or, conversely, provide a better result.

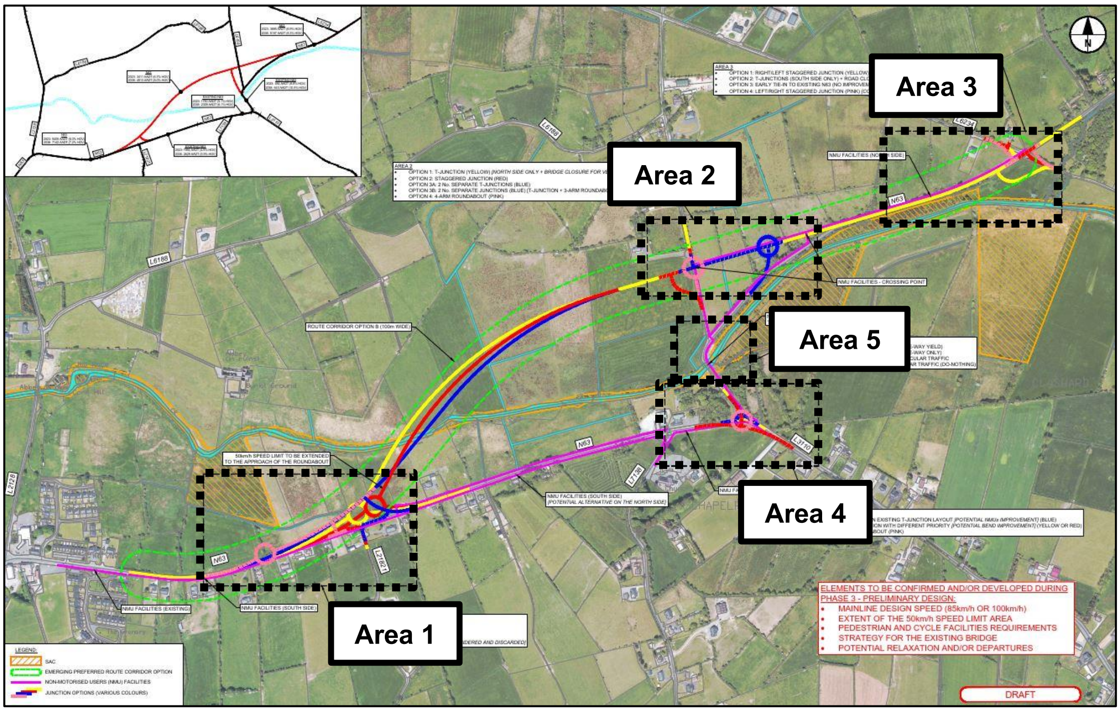


Figure 1-1 Junction Areas

1.2 Assumptions

The main assumptions adopted in the development of the junction options are described below:

- The preliminary layout of the junctions has been designed in accordance with TII Standards DN-GEO-03060.
- Full 3D analysis of each option for SSD, swept paths, cross-sections, vertical alignment and horizontal alignment will be undertaken at Phase 3 – Preliminary Design on the preferred option.
- Traffic analysis of each junction will be reviewed at Phase 3 – Preliminary Design to ensure the junction options are operating at an acceptable Level of Service (LoS).
- For all options, the existing N63 (between Area 1 and Area 4) will be downgraded to a local road.
- For all options, Non-Motorised Users (NMU) facilities will be provided along the downgraded section of N63 and across the existing Liss Bridge to tie into the proposed alignment, which will be designed at Phase 3 – Preliminary Design.
- Accesses to dwellings along the downgraded section of the N63 will be connected directly onto this section of the N63, where required, which will be designed at Phase 3 – Preliminary Design.
- All options are designed based on a 100km/h design speed, but it may be beneficial to reduce this design speed to 85km/h to tie the scheme into the surrounding network better. This could be considered at Phase 3 – Preliminary Design.

1.3 Initial Traffic Review

An initial review of the forecasted traffic volumes in the Opening Year and Design Year was undertaken. The traffic volumes on the main link roads were extracted from the relevant section of the Option Selection Report (Option B - Emerging Preferred Route) and are shown in Figure 1-2 below.

The traffic review highlighted that, from a traffic capacity perspective, a priority junction would provide sufficient traffic capacity at any of the junctions upgraded as part of this scheme (see Figure 1-3 below). Nevertheless, alternative junction options including roundabout design have been developed to investigate the relative advantage or disadvantages associated with these options.

It is also noted other junction options, as traffic signals and grade separated junctions have been discounted for this project, due to the rural nature of the area and the low traffic volumes respectively.

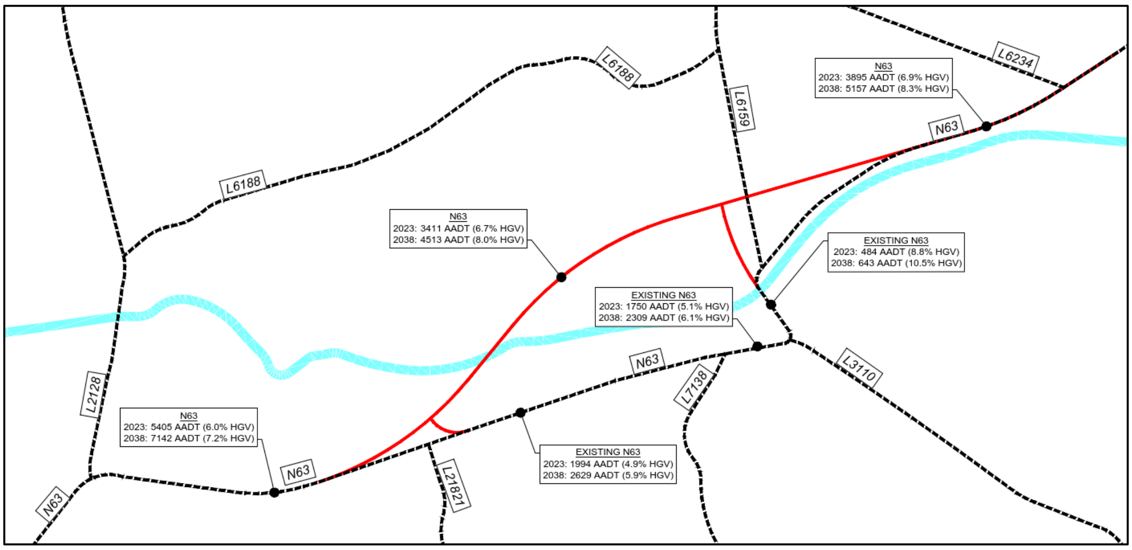


Figure 1-2 Traffic Volumes

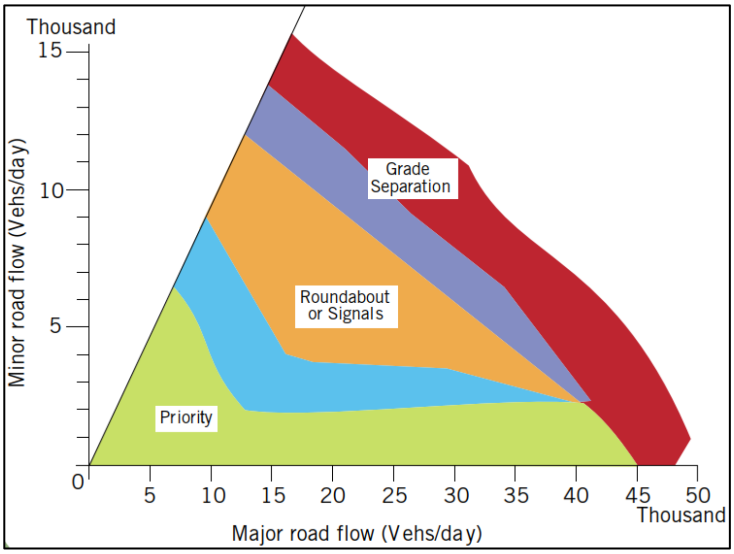


Figure 1-3 Type of junction based on traffic flow levels (Traffic Management Guidelines 2003)

2. Area 1: Western Tie-In Options

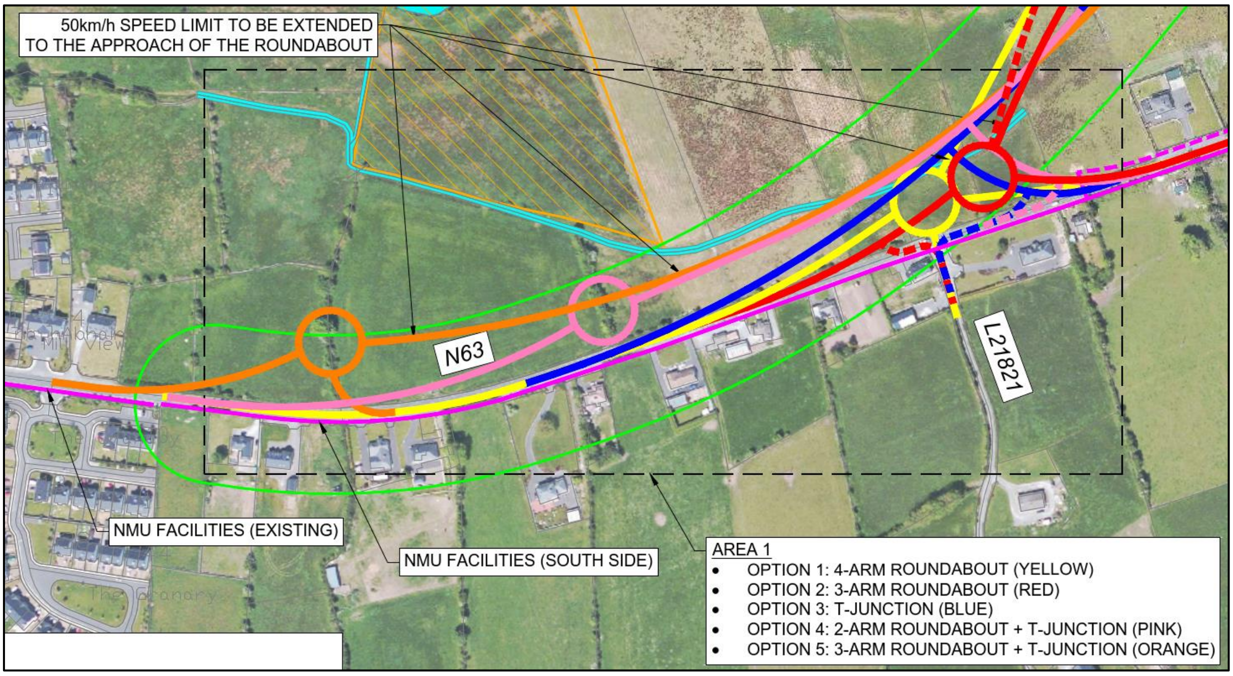


Figure 2-1: Junction Options for Area 1

2.1 Option 1 – 4 Arm Roundabout (Yellow)

This option includes a 4-arm roundabout to the north of the existing N63, in proximity of the exiting T-junction between N63 and L21821. The roundabout would connect the existing N63 (west arm), the proposed re-aligned section of the N63 (north-east arm), down-graded section of the N63 (east arm) and the local road L21821 (south arm).

The roundabout would be designed as a single lane roundabout (ICD between 28-36m). This would be a similar size to other roundabouts on the N63 corridor.

This ICD means that it would not be able to facilitate NMU crossing points on traffic islands, but as the roundabout is proposed to the north of the existing N63 it is the intention to use the existing N63 as an NMU route. This would improve NMU safety as it would introduce a clear segregation between the vehicular traffic on the National Road and the NMU route.

2.2 Option 2 – 3 Arm Roundabout (Red)

This option includes a 3-arm roundabout to the north-east of the existing T-junction between N63 and L21821. This roundabout would connect the existing N63 (west arm), the proposed re-aligned section of the N63 (north-east arm), and the down-graded section of the N63 (east arm).

A three-armed roundabout would mean the local road (L21821) would require a Priority Junction connection to the network. A simple T-Junction is envisaged for this connection due to low speeds and low traffic volumes, the final location of this junction would have to be reviewed. Currently the clearance between the roundabout and the T-Junction is shown as approximately 50m, and a relaxation/departure would be required if the acceptable clearance (90m) cannot be achieved. Depending on the final location of the proposed roundabout, design speeds, traffic volumes and clearance from the roundabout, it may be safer to install this connection to the east of the proposed roundabout, on the downgraded section of N63, or to the west of the roundabout, on the realigned N63.

The roundabout would be designed as a single lane roundabout (ICD between 28-36m). This would be a similar size to other roundabouts on the N63 corridor.

This ICD means that it would not be able to facilitate NMU crossing points on traffic islands, but as the roundabout is proposed to the north of the existing N63 it is the intention to use the existing N63 as an NMU route. This would improve NMU safety as it would introduce a clear segregation between the vehicular traffic on the National Road and the NMU route.

2.3 Option 3 – T-Junction (Blue)

This option includes a T-junction between the realigned N63 and the down-graded section of the N63 (east arm).

The T-junction would be located on the outside of a bend, so no departure is required, but the full SSD along the mainline would have to be achievable along the paved surface or a departure would be required for this. This section of the proposed route is not deemed an overtaking section as it is on a horizontal curve.

The T-junction layout (simple T-junction or ghost island) would depend on traffic analysis, and this would be dependent on what facilities are provided at Areas 2 and 3. If queuing is anticipated along the mainline due to vehicles turning right into the junction a nearside passing bay may be provided, but this would still cause vehicles to slow down.

The tie-in point of the T-junction to the mainline would be negotiable but would be dependent on the curvature of the local road.

A T-junction would mean the local road (L21821) would require a second T-Junction connection to the network. A simple T-Junction is envisaged for this connection due to low speeds and low traffic volumes, the final location of this junction would have to be reviewed. Currently the clearance between the two T-junctions is shown as approximately 50m, and a relaxation/departure would be required if the acceptable clearance (90m) could not be achieved. Depending on the final location of the proposed mainline T-junction, design speeds, traffic volumes and clearance between the two T-Junctions, it may be safer to install this connection to the east, on the downgraded section of N63, or to the west, on the realigned N63.

The junction is proposed to the north of the existing N63, it is the intention to use the existing N63 as an NMU route. This would improve NMU safety as it would introduce a clear segregation between the vehicular traffic on the National Road and the NMU route.

2.4 Option 4 – 2 Arm Roundabout and T-Junction (Pink)

This option includes a 2-arm roundabout along the re-aligned N63, just outside of the Abbeyknockmoy village. This roundabout would connect the existing N63 (west arm), the proposed re-aligned section of the N63 (east arm).

A T-junction along the re-aligned N63 is also included to connect the western section of the existing N63 (which would be downgraded to a local road).

The connection of the local road to the south (L21821) through a second T-junction along the down-graded section of the N63. A simple T-Junction is envisaged for this connection due to low speeds and low traffic volumes, the final location of this junction would have to be reviewed. The clearance between the two T-junctions would be less than 90m so a departure would be required.

The roundabout would be designed as a single lane roundabout (ICD between 28-36m). This would be a similar size to other roundabouts on the N63 corridor.

This ICD means that it would not be able to facilitate NMU crossing points on traffic islands, but as the roundabout is proposed to the north of the existing N63 it is the intention to use the existing N63 as an NMU route. This would improve NMU safety as it would introduce a clear segregation between the vehicular traffic on the National Road and the NMU route.

2.5 Option 5 – 3 Arm Roundabout (Orange)

This option includes a 3-arm roundabout along the existing N63, just outside of the Abbeyknockmoy village. This roundabout would connect the existing N63 (west arm), the proposed re-aligned section of the N63 (east arm) and a connection to the down-graded section of the N63 (south-east arm).

The connection of the local road to the south (L21821) could be maintained at the current location without major improvement required.

The roundabout would be designed a single lane roundabout (ICD between 28-36m). This would be a similar size to other roundabouts on the N63 corridor.

This ICD means that it would not be able to facilitate NMU crossing points on traffic islands, but as the roundabout is proposed to the north of the existing N63 it is the intention to use the existing N63 as an NMU route. This would improve NMU safety as it would introduce a clear segregation between the vehicular traffic on the National Road and the NMU route.

3. Area 2: Central Tie-In

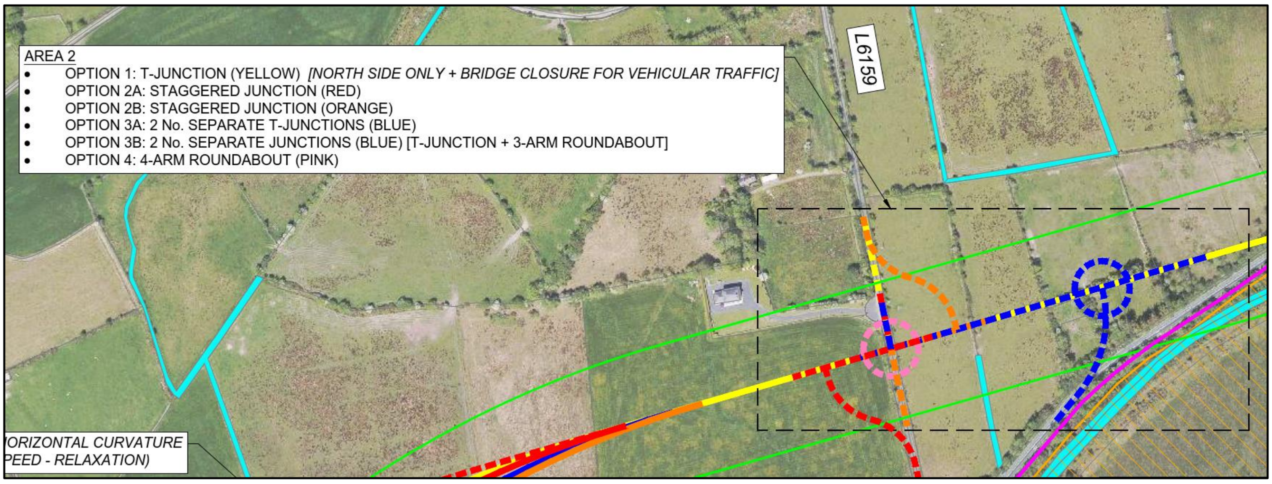


Figure 3-1: Junction Options for Area 2

3.1 Option 1 – T-Junction (northern side only) (Yellow)

A single T-junction is proposed at the connection between the northern section of the local road L6159 and the proposed N63.

The T-junction is located along a straight which is beneficial for SSD (no departure required) but may raise safety concerns if the mainline section is an overtaking section due to vehicles turning out onto the mainline.

It is not envisaged that any ghost islands or passing bays would be required on the mainline due to traffic volumes.

The proximity of the private access to the mainline junction would require a departure as it should be 90m.

3.2 Options 2A and 2B – Right/Left Staggered Junction (Red or Orange)

A staggered junction is proposed at the connection between the local road L6159 and the proposed N63. Two alternative layouts are envisaged:

- Option 2A (Red): southern arm of the local road L6159 to be re-aligned to the west
- Option 2B (Orange): northern arm of the local road L6159 to be re-aligned to the east

In both cases, the distance between the staggered junctions is shown as 50m which is within the minimum allowable distance.

It is not envisaged that any ghost islands or passing bays would be required on the mainline due to traffic volumes.

The proximity of the private access to the mainline junction would require a departure as it is less than the required 90m clearance.

The southern connection may be located on the inside of a bend (final design would have to be reviewed) which would be a safety concern and a departure.

The northern T-junction is located along a straight which is beneficial for SSD (no departure required) but may raise safety concerns if the mainline section is an overtaking section due to vehicles turning out onto the mainline.

3.3 Options 3A and 3B – 2 Separate T-Junctions (Blue)

Two separate junctions are proposed at the connection between the proposed N63 and the local road L6159 to the north and the existing N63 to the south. Two alternative layouts are envisaged:

- Option 3A (Blue): two separate T-junctions
- Option 3B (Blue): a T-junction for the northern connection (L6159) and a three-arm roundabout with the southern connection (existing N63).

If the design speed is 100km/h then the minimum distance between 2 junctions, in order to be considered separate junctions, is 200m (DN-GEO-03060 – Table 5.2). Currently the junctions are shown at 160m apart (1 step below – 85km/h design speed) and due to the location of the river, it might not be feasible to move the southern junction any further east. This would likely result in a departure.

The northern T-junction is located along a straight which is beneficial for SSD (no departure required) but may raise safety concerns if the mainline section is an overtaking section due to vehicles turning out onto the mainline.

The southern connection is located along a straight which is beneficial for SSD (no departure required) but may raise safety concerns if the mainline section is an overtaking section due to vehicles turning out onto the mainline.

It is not envisaged that any ghost islands or passing bays would be required on the mainline due to traffic volumes.

The proximity of the private access to the mainline junction would require a departure as it is below the minimum distance of 90m.

3.4 Option 4 – 4 Arm Roundabout (Pink)

A four-arm roundabout would be introduced at the cross road between the proposed N63 and the existing L6159.

The roundabout would be designed a single lane roundabout (ICD between 28-36m). This would be a similar size to other roundabouts on the N63 corridor.

The proximity of the private access to the mainline junction would require a departure as it is below the minimum distance of 90m.

3.5 Other Discarded Options

The following options have been considered and discontinued due to the reason noted below:

- Option 5 – Crossroad: Departure from Standards
- Option 6 – Left/Right Staggered Junction: Departure from Standards

4. Area 3: Eastern Tie-In Options

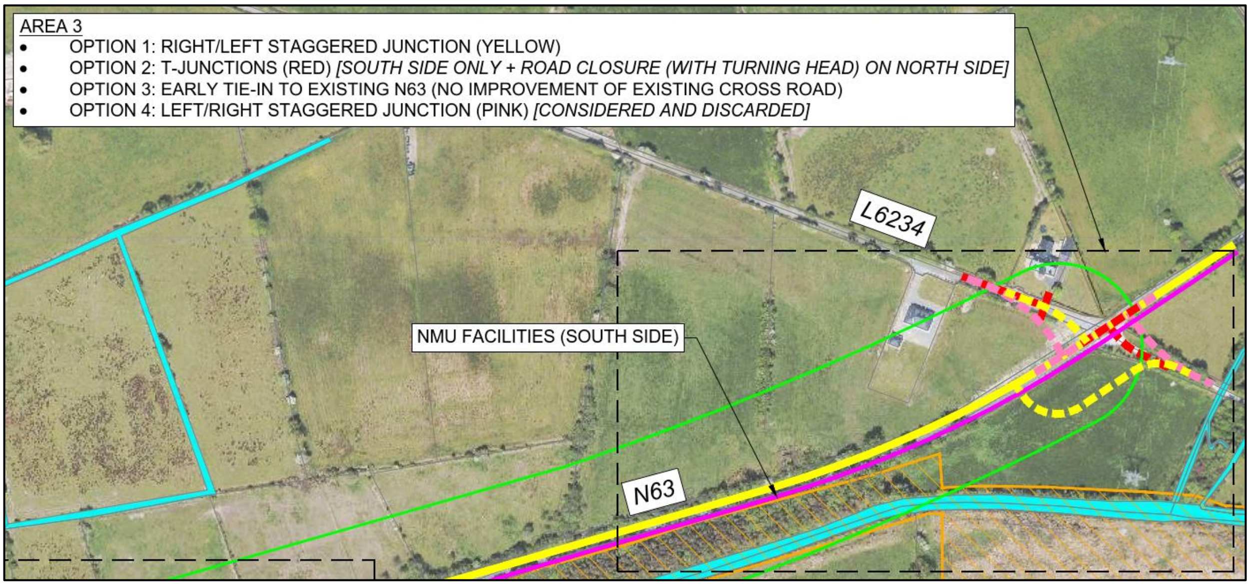


Figure 4-1: Junction Options for Area 3

4.1 Option 1 – Right/Left Staggered Junctions (Yellow)

The layout of the stagger is the correct orientation (right/left) and the distance between the staggered junctions is shown as 50m which is within the minimum allowable distance.

The southern junction location would be limited due to the watercourse crossing so horizontal alignment may be sub-standard in this area.

It is not anticipated that any ghost islands would be required on the mainline for this staggered junction due to low traffic flows.

4.2 Option 2 – Southern T-Junction (L6234) closed (Red)

[Note: the requirement for a northern connection here will be dependent on what facilities are provided at Area 2. If no connection is provided at Area 3, a connection will require to be provided at Area 2].

It is proposed to close the existing T-junction between the N63 and L6234. A turning head would be provided to end of the closed L6234. Vehicular connectivity to the main road network could be provided through a detour along the L6234 and L6159. NMUs connection would be maintained.

The southern connection would remain unchanged (or include minor modification of the existing layout).

If the northern connection was to remain open (due to Area 2 provisions) then a left/right staggered junction could be introduced. Due to the nature of the southern alignment (private access) it was deemed that crossing traffic would be minimal and safety implications would be reduced.

This junction orientation would minimise land take and offline construction.

It is not anticipated that any ghost islands would be required on the mainline for this junction.

4.3 Option 3 – Leave as is (Early Tie-In)

Early tie-in to the west of the bend along the existing N63. No improvement to the existing crossroad along the N63 between the L6234 to the north and the private access to the south.

4.4 Option 4 – Left/Right Staggered Junction (Pink) [DISCARDED]

This staggered junction is the wrong arrangement (left/right) which would require a departure. Moreover, the location of the northern junction may be on the inside of a curve and this would be deemed another departure.

Although the southern junction being a private access and crossing traffic is not deemed as an issue, this option has been considered and discarded due to the reason noted above.

5. Area 4: L3110 Tie-In Options

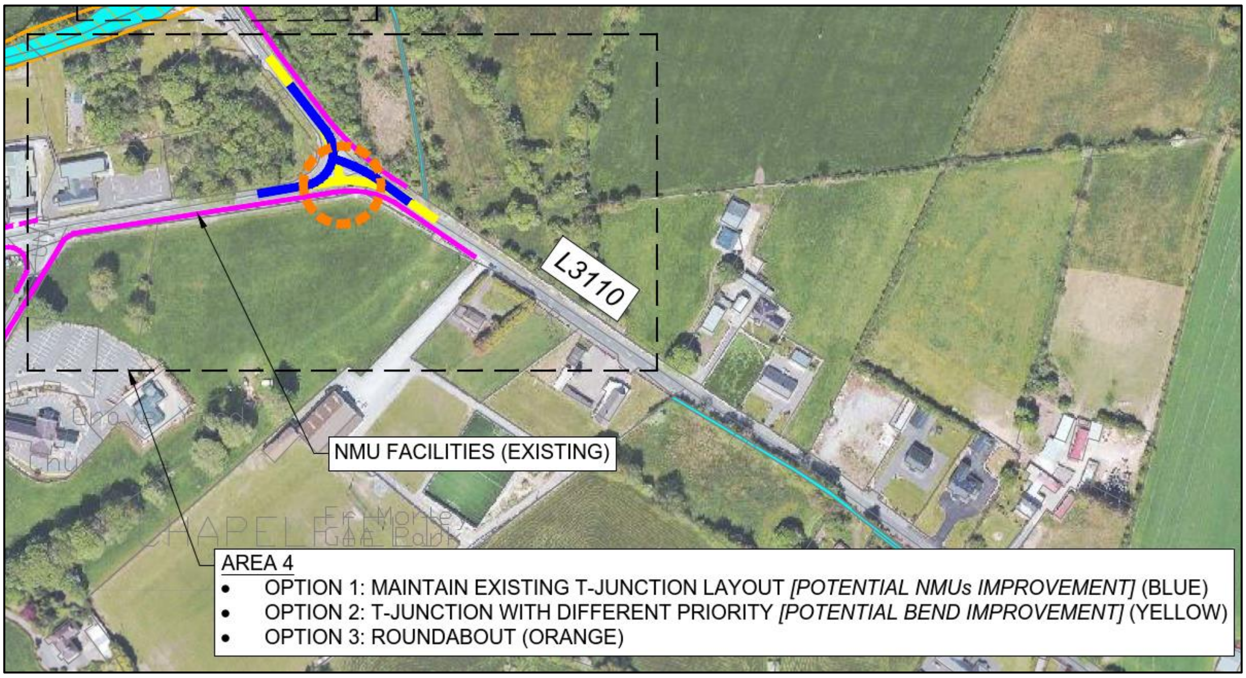


Figure 5-1: Junction Options for Area 4

5.1 Option 1 – Existing T-Junction Layout (Blue)

Maintain the existing T-Junction layout, with improvement for NMUs. Additional improvements may be required to keep the junction compact, reduce the traffic speed (also in light of the reduced volume of traffic through this junction compared to the existing situation).

The existing problems; bridge crossing, S bends, horizontal and vertical curvature would remain.

5.2 Option 2 – Realignment of priority at T-Junction (Yellow)

Improves connectivity as the L3110 would have a direct access on to the N63 and this may alleviate any stress on junction at Area 1, although it is not envisaged that Area 1 would be operating at a poor LoS. Change in priority might help traffic flows but keeping this open may be used as a rat-run and encourage L3110 traffic to use Liss Bridge to get to N63 and lead to queuing.

Improvements for NMUs within the existing road boundaries would be required, although it is noted that a second sub-option could include a more substantial realignment of the bend between existing N63 east and L3110. These improvements could be carried out to realign the bend to help safety if required, although it is envisaged that the Desirable Minimum horizontal curvature may not be achievable at this location.

5.3 Option 3 – 3 Arm Roundabout (Orange)

A three-arm roundabout is proposed at this location and would connect the down-graded N63 (west arm), the existing L3110 (south-east arm) and the existing N63 (north arm) connecting to the existing Liss Bridge.

This option may not be viable due to land take issues and sightlines on approach, the introduction a roundabout at this area could lead to queuing across the existing Liss Bridge.

6. Liss Bridge Options

6.1 Option B1 – Traffic Management (One-Way Yield)

Introduction of a One-Way yield across the bridge for vehicular traffic.

This option would alleviate any conflicts between opposing traffic flows and allow for formal NMU routes to be introduced across the bridge.

6.2 Option B2 – Traffic Management (One-Way Only)

Introduction of One-Way traffic across the bridge for vehicular traffic (northbound or southbound direction to be confirmed).

The introduction of the realigned section of the N63 would offer a by-pass for the bridge and allow for vehicles to loop back where required.

6.3 Option B3 – Bridge Closure

Full closure of the Liss Bridge for vehicular traffic.

This removes Liss Bridge vehicle issues and allows for pedestrian access to the new N63 and residential properties to the north of the River.

Redistribution of traffic from the L3110 along the downgraded N63 would have to be considered as this increased traffic could be considered a safety issue (although initial traffic figures show a very relatively low AADT). This option would increase traffic volumes through Area 1 so this would have to be considered during traffic modelling.

There would be a negative impact on connectivity as the northern connection is removed.

It would improve safety in the immediate vicinity of the area as it removes junction turning movements.

Local access and turning head can be provided for fisheries or whoever needs access.

6.4 Option B4 – Bridge Open

Bridge fully open for vehicular traffic with no traffic management measures in place.

With the implementation of this option it would not be possible to provide dedicated NMUs facilities along the bridge.

7. Non-Motorised User Facilities

It is the intention to include NMU facilities for whatever junction options are chosen. Currently there are NMU facilities on both sides of the road through Abbeyknockmoy town (to the west of the scheme). These facilities are footpaths adjacent to the carriageway and both terminate in the vicinity of the current eastbound 100km/h speed limit signs, as seen in Figure 7-1 below.

Figure 7-1 Extents of Existing NMU Facilities (Westbound)

The intention is to continue NMU facilities on the south of the existing N63 carriageway until the new junction at ‘Area 1.’ The area to the south is reasonably flat so extending the paved area should be easier to construct, as seen in Figure 7-2 below. There would be a requirement for land take to the south of the road as some property boundaries are quite close to the current carriageway, as seen in Figure 7-3.

Figure 7-2 NMU Facilities Opportunities

Figure 7-3 Land Take Issues

Beyond this first boundary wall issue in Figure 7-3 the property boundary set back is greater so land take would not be as much an issue as seen in Figure 7-4 to Figure 7-6 below.

Figure 7-4 Available Land

Figure 7-5 Available Land

Figure 7-6 Available Land

To the east of 'Area 1,' along the downgraded section of the N63,NMU facilities would be developed to include cycle facilities as detailed in a typical Type 2 Carriageway Cross-section. These are envisaged to remain adjacent to the south side of the existing N63 carriageway but there would be the option to put them on the north if desired. As this section of road has been downgraded it may be possible to reduce the carriageway width and use some of this paved area for NMU facilities. The available lands are shown in Figure 7-7 to Figure 7-9 below.

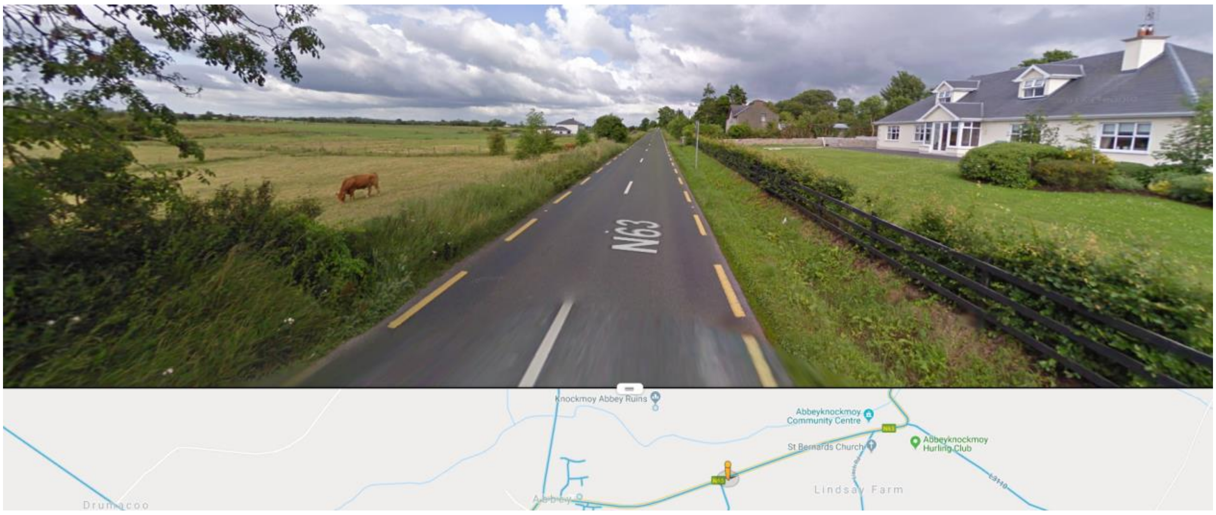


Figure 7-7 NMU Facilities to incorporate segregated cycle facilities along section

Figure 7-8 NMU Facilities to incorporate segregated cycle facilities along section

Figure 7-9 NMU Facilities to incorporate segregated cycle facilities along section

Closer to the Abbeyknockmoy Community Centre facilities road verges narrow, so an option would be to reduce the carriageway cross-section along the entire section of the downgraded section of the N63 to incorporate NMU facilities. This reduced verge can be seen in Figure 7-10 below.

Figure 7-10 Reduced Verge width on approach to Community Facilities

There are already NMU facilities in the immediate vicinity of the Community Facilities. Depending on the junction options selected, the existing Liss Bridge could be reconfigured to incorporate NMU facilities across the bridge.

North of Liss bridge, the NMU route could take advantage of the existing N63 alignment and use the existing carriageway to travel north-east before joining the new alignment. Further east, the NMU facilities would be continued along the south side of the proposed N63 realignment until the eastern termination point.

No uncontrolled crossing points would be required as the main NMU facilities would be maintained along the south side of the N63. The NMU facilities would also allow to separate further the proposed N63 realignment from the River Abbert SAC.

These NMU options can be seen in Drawing *N63-ACM-ZZ-ZZ-SK-HW-000016.*

8. Junction Options Assessment

The junction's options presented in the previous section have been assessed in order to identify the main Advantages and Disadvantages, which are listed in the tables below. The junction's options have been assessed against various criteria including, but not limited to: network/traffic operation, safety performance, environmental constraints, design standards.

8.1 Area 1: Western Tie-In

Option	Assessment	Overall Ranking
1	Advantages: • The roundabout could be used as gateway into Abbeyknockmoy village. • This option provides good connectivity for all approach roads as it retains the existing connections and introduces the bypass connection. • The introduction of a roundabout rather than a T-Junction would help facilitate right turning movements in and out of the community facilities. • The land take is to the north of the existing N63 where the land is mostly agricultural, rather than to the south where there are a number of residential properties. Disadvantages: • If the existing 50km/h speed limit is extended to the roundabout, this would reduce the length of high-speed section on the N63 main corridor compared to Options 4 and 5. • The final location of the roundabout would have to be confirmed but the connection of the southern arm (L21821) limits the number of location options compared to the three-arm roundabout (Option 2). • There is a watercourse that runs underneath the proposed roundabout, but it is noted that this watercourse would have to be diverted for all tie in options in this area, so its impact is insignificant to the junction option assessment in this area.	2
2	Advantages: • The roundabout could be used as gateway into Abbeyknockmoy village. • This option provides good connectivity for the three major approach roads, as it retains two of the existing connections and introduces the realigned connection. • The introduction of a roundabout rather than a T-Junction would help facilitate right turning movements in and out of the community facilities. • The land take is to the north of the existing N63 where the land is mostly agricultural, rather than to the south where there are a number of residential properties. • The final location of the roundabout would have to be confirmed and there is more flexibility with this option compared to the four-arm roundabout (Option 1). Disadvantages: • If the existing 50km/h speed limit is extended to the roundabout, this would reduce the length of high-speed section on the N63 main corridor compared to Options 4 and 5. • There is a watercourse that runs underneath the proposed roundabout, but it is noted that this watercourse would have to be diverted for all tie in options in this area, so its impact is insignificant to the junction option assessment in this area.	1
3	Advantages: • The land take is to the north of the existing N63 where the land is mostly agricultural, rather than to the south where there are a number of residential properties. • The land take associated with a T-junction would be reduced compared to other roundabout options. • The final location of the junction would have to be confirmed and there is more flexibility with this option compared to other roundabout options. • The T-junction option it would be more similar to current junction along this stretch of the N63 corridor. Disadvantages: • The T-junction option would not offer any significant gateway opportunities or highway feature. • The introduction of a T-junction rather than a roundabout would not help facilitate right turning movements in and out of the community facilities.	3

	• There is a watercourse that runs underneath the proposed T-junction, but it is noted that this watercourse would have to be diverted for all tie in options in this area, so its impact is insignificant to the junction option assessment in this area.	
4	Advantages: • The roundabout could be used as gateway into Abbeyknockmoy village. • If the existing 50km/h speed limit is extended to the roundabout, this option would increase the length of the 'high speed' section compared to Options 1 and 2. • The final location of the roundabout and the T-junction would have to be confirmed and there is more flexibility with this option compared to other roundabout options. Disadvantages: • Proximity of the roundabout to the SAC • The position of the roundabout does not allow for a connection to the downgraded section of the N63, because of horizontal curvature. This means there would still be a requirement for a second junction (T-Junction) to be installed connecting the mainline to the downgraded section of road. • This option provides poor connectivity for the downgraded section of the N63, as this would have to be connected via a T-Junctions. A T-junction rather than a roundabout would not help facilitate right turning movements in and out of the community facilities.	5
5	<u>Advantages:</u> • The roundabout could be used as gateway into Abbeyknockmoy village. • If the existing 50km/h speed limit is extended to the roundabout, this option would increase the length of the 'high speed' section compared to Options 1 and 2. • The final location of the roundabout would have to be confirmed and there is more flexibility with this option compared to other roundabout options. • Maintains existing junctions at L21821 and downgraded N63 and majority of frontages remain unaffected <u>Disadvantages:</u> • The position of the roundabout allows for a connection to the downgraded section of the N63, however the horizontal curvature would be substantially sub-standard. • If a sub-standard connection was deemed not acceptable, there would still be a requirement for a second junction (T-Junction) to be installed connecting the mainline to the downgraded section of road, which would incorporate the disadvantages noted for Option 3.	4

8.2 Area 2: Central Tie-In

Option	Assessment	Overall Ranking
1	<u>Advantages:</u> • Minimal land take. Land take is not an issue for this connection as it can be completed mostly online. • The T-junction is located along a straight which is beneficial for SSD (no departure required) but may raise safety concerns if the mainline section is an overtaking section due to vehicles turning out onto the mainline. • The T-junction would not affect the overall travel time along the proposed N63, as it does not reduce the length of the 'high-speed' section. <u>Disadvantages:</u> • Vehicles wanting to travel to the community facilities would not be able to cross the mainline and would have to travel to Area 1 to gain access, although this is a longer route it reduces safety concerns of vehicles crossing the mainline. This option is slightly negative for connectivity as it retains one of the existing connections along the network and loses the southern connection. • The proximity of the private access to the mainline junction would require a departure as it should be 90m	2
2A and 2B	<u>Advantages:</u> • This option is positive for connectivity as it retains all the existing connections along the network.	1

	• The staggered junction is located along a straight which is beneficial for SSD (no departure required) but may raise safety concerns if the mainline section is an overtaking section due to vehicles turning out onto the mainline. • Minimal land take. Land take is not an issue for this connection as the one arm can be completed mostly online while the other arm would be through agricultural land. • The staggered junction would not affect the overall travel time along the proposed N63, as it does not reduce the length of the 'high-speed' section. Disadvantages: • Vehicles wanting to travel to the community facilities would be able to cross the mainline and although the staggered junction is the correct arrangement, this could lead to some safety concerns on a national road. • One issue with connecting to the existing Liss Bridge is that the existing limitations regarding the bridge would still exist. This connection could also be used as a 'rat-run' for vehicles wanting to travel south.	
3A and 3B	Advantages: • This option is positive for connectivity as it retains all the existing connections along the network, although a slightly longer route is required compare to Options 2A, 2B and 4. Disadvantages: • This arrangement could result in a departure from standard if sufficient separation between the two T-junction is achieved (resulting in a Left/Right Staggered Junction). • One issue with connecting to the existing Liss Bridge is that the existing limitations regarding the bridge would still exist. This connection could also be used as a 'rat-run' for vehicles wanting to travel south. • If the southern connection would be upgraded to a roundabout, the benefits of this roundabout include providing easy right turn movements to travel south, but the majority of eastbound traffic that wants to access the community facilities would use the junction to the west of the by-pass. • The roundabout would also increase the overall travel time along the proposed N63, reducing the length of the 'high-speed' section. • Increased land take for the roundabout option compared to other options including T-junctions only.	4
4	Advantages: • This option could provide optimal connectivity for vehicles ensuring all turning movement. Disadvantages: • Traffic volumes on the north and south arms of this junction would be extremely low and not sufficient to justify a roundabout. • The roundabout would also increase the overall travel time along the proposed N63, reducing the length of the 'high-speed' section. • Increased land take compared to other option including T-junctions only.	3
5	*CONSIDERED AND DISCARDED (Departure from Standards)*	N/A
6	*CONSIDERED AND DISCARDED (Departure from Standards)*	N/A

8.3 Area 3: Eastern Tie-In

Option	Assessment	Overall Ranking
1	Advantages: • An advantage of this arrangement is that the sightlines for both junctions could be addressed and these were raised as an issue at the first Public Consultation. • The layout with have neutral impacts on connectivity as it is matching what is there at the moment. • The arrangement could have a positive influence on safety as it removes a crossroads scenario, but due to the nature of the accesses it is not anticipated that there would be many crossing manoeuvres. Disadvantages: • This arrangement would require a departure for the junction on the inside of the curve (northern junction).	2

	• There may be a landowner issue with the positioning of the new aligned access.	
2	Advantages: • An advantage of this arrangement is that the sightlines for both junctions could be addressed and these were raised as an issue at the first Public Consultation. • This arrangement improves safety at this location due to a junction on the inside of a curve being removed • Minimum land take require Disadvantages: • This arrangement would have negative connectivity issues as one connection is being removed (Area 2 dependant), but homeowners may benefit of the closure due to less traffic on the road.	1
3	Advantages: • The main advantage of this option would be the reduced construction costs. Disadvantages: • The existing safety issue of the crossroads arrangement is not addressed, but as discussed there may not be many vehicles making this movement so it may not be an issue. • The sightlines issue that was raised at first Public Consultation would not be addressed and there would still be the issue of a junction on the inside of a bend.	3
4	*CONSIDERED AND DISCARDED (Departure from Standards)*	N/A

8.4 Area 4: L3110 Tie-In

Option	Assessment	Overall Ranking
1	Advantages: • Limited amount of work required. • No additional land take would be required (work within existing road boundaries). • The existing T-junction could be used as gateway to reduce vehicles' speed approaching the community centre. Disadvantages: • Junction orientation not reflecting the future turning movement at this junction.	2
2	Advantages: • Junction orientation would reflect the future turning movement at this junction. Disadvantages: • Although improvements could be carried out to realign the bend to help safety if required, it is envisaged that the Desirable Minimum horizontal curvature may not be achievable at this location. • Land take may increase if improvements would be carried out to realign the bend. • The realigned T-junction could not be used as gateway to reduce vehicles' speed approaching the community centre.	1
3	Advantages: • All turning movement would be fully accommodated. • The roundabout could be used as gateway and reduce vehicles' speed approaching the community centre. Disadvantages: • Traffic volumes at this junction would be extremely low and not sufficient to justify a roundabout. • Increased land take compared to other option including T-junctions only.	3

8.5 Liss Bridge

Option	Assessment	Overall Ranking
B1	Advantages: • All traffic movement and full connectivity are maintained	1

	• NMU facilities could be accommodated on the existing bridge Disadvantages: • Existing limitations and safety issue regarding the bridge structure and the roads approaching the bridge would be mitigated but not fully removed.	
B2	Advantages: • NMU facilities could be accommodated on the existing bridge Disadvantages: • Traffic connectivity is maintained in one direction only • Existing limitations and safety issue regarding the bridge structure and the roads approaching the bridge would be mitigated but not fully removed.	2
B3	Advantages: • NMU facilities could be accommodated on the existing bridge • Existing limitations and safety issue regarding the bridge structure and the roads approaching the bridge would be fully removed. Disadvantages: • Reduced connectivity, substantial de-tour required through Area 1	3
B4	Advantages: • All traffic movement and full connectivity are maintained Disadvantages: • NMU facilities could not be accommodated on the existing bridge • Existing traffic limitations and safety issue regarding the bridge structure and the roads approaching the bridge would still remain.	4

9. Conclusions and Recommendations

This short note identified the preferred junction option for each area, which are noted below:

- Area 1 – Western Tie-In: 3 Arm Roundabout (Red Option)
- Area 2 – Central Tie-In: Right/Left Staggered Junction (Orange Option)
- Area 3 – Eastern Tie-In: Left/Right Staggered Junctions (Yellow Option)
- Area 4 – L3110 Tie-In: Realignment of priority at T-Junction (Yellow Option)
- Liss Bridge Options: Traffic Management (One-Way Yield) – (Option B1)

Appendix B - RSA Stage 1 Report

N63 Liss to Abbey Realignment Scheme

Stage 1 Road Safety Audit
FINAL Report

Galway County Council

60571547-RSA 2

18 June 2021

Quality information

Prepared by	Checked by	Approved by
Rowan Lyons Principal Engineer	Brian McMahon Associate Director	Rowan Lyons Principal Engineer

Revision History

Revision	Revision date	Details	Authorised	Name	Position
01	18.06.2021	Draft issue to client	RL	Rowan Lyons	Principal Engineer
02	29.07.2021	Final	RL	Rowan Lyons	Principal Engineer

Distribution List

# Hard Copies	PDF Required	Association / Company Name
	1	Galway County Council

Prepared for:

Galway County Council
Áras an Chontae,
Prospect Hill,
Galway

Prepared by:

AECOM Infrastructure & Environment UK Limited
The Clarence West Building
2 Clarence Street west
Belfast BT2 7GP
United Kingdom

T: +44(28)9060 7200
AECOM.com

© 2021 AECOM Infrastructure & Environment UK Limited. All Rights Reserved.

This document has been prepared by AECOM Limited ("AECOM") for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM.

Table of Contents

1. Introduction

1.1 AECOM was commissioned to undertake a Stage 1 Road Safety Audit on the proposed development of the N63 Liss to Abbey Realignment Scheme located at the eastern side of Abbeyknockmoy, County Galway. The Proposed Road Development would comprise of a rural all-purpose Type 2 Single Carriageway road, including a new river crossing over the Abbert River. This Road Safety Audit concerns works for the proposed realignment.

1.2 The Road Safety Audit Team membership, approved by (TII) Road Safety Audit Approvals System for Transport Infrastructure Ireland, and Galway County Council, the Overseeing Organisation Project Sponsor, was as follows:

Team Leader: R Lyons BEng (Hons) CEng, MIEI MSoRSA
Principal Engineer, AECOM
(Certificate of Competency in Road Safety Audit)

Team Member: B McMahon BE MSc CEng MIEI
Associate Director, AECOM
(Certificate of Competence in Road Safety Audit)

1.3 This Safety Audit represents the response of an independent Audit Team to various aspects of the scheme. The recommendations contained therein are the opinions of the Audit Team and are intended as a guide to the designers on how the scheme as designed can be improved to address issues of road safety.

1.4 The terms of reference of the Road Safety Audit are as described in TII GE-STY-01024. The Road Safety Audit Team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the design to any other criteria.

1.5 The scheme has not been examined or verified for compliance with any other standards. However, in order to clearly explain a safety problem or the recommendation to resolve a problem, the Audit Team may on occasion have referred to a design standard for information only. Any Audit comments should not be construed as implying that a technical audit has been undertaken in any respect.

2. Scheme Description

Received Information

2.1 A summary of the drawings and documentation information received to carry out the audit is included in Appendix A.

A formal Stage 1 Audit Brief was not provided. Only details as provided have been considered as part of this Stage 1 Audit.

Traffic Flow Information

2.2 A Traffic Survey dated May 2019 and details of 2 no. automatic traffic counters (ATC) on the N63, east of Abbeyknockmoy, has been provided.

The ATC on the N63 to the east of the L3110 junction determined an AADT of 3500. This correlated with a permanent TII traffic counter on the N63furtehr east which identified AADT flows of 3,598 in 2019 and 3,349 in 2018 along this section of the N63. The 85% speeds in this section were 90.7km/h eastbound and 93.5km/h westbound at this location.

The ATC on the N63, east of Abbeyknockmoy and west of the L3110 junction determined an AADT of 4,859. The 85% speeds in this section were 87.0km/h eastbound and 95.0km/h westbound at this location.

12-hour classified junction turning count surveys were undertaken at 5 no. locations along the scheme route in May 2019. These surveys determined AM peak hour (9:00-10:00) and PM peak hour (17:00-18:00) flows at the junctions of the L3110 and the L7138 Lisch Road in the vicinity of the local schools.

A total of 4,859 vehicles, along the existing N63 between the eastern end of Abbeyknockmoy and L7138, were recorded as the AADT of which 5.9% were HGVs. An AADT of 3,764 was determined on the existing N63 between L7138 and the L3110, of which 6.8% were HGVs. An AADT of 3,499 was determined on the existing N63 between the L3110 and the L6159 (at Liss bridge), of which 6.5% were HGVs. To the east of the scheme, an AADT of 4,859 was determined on the existing N63 between the L6159 and L6234, of which 5.9% were HGVs.

Collision Information

2.3 Collision data from 2005 – 2016 obtained from the Road Safety Authority (RSA) has identified 6 no. collisions along the scheme length of road. These 6 no. collisions occurred between the years 2005 and 2012.

There were 2 no. serious collisions which were a head on collision and a single vehicle collision on the straight section of the N63 between the village and the community facilities, church, schools and GAA pitch, to the east.

There were 4 no. minor collisions, 2 of which occurred in the vicinity of the stone bridge over the River Abbert and the other 2 no. occurred on the straight section of the N63 between the village and the community facilities to the east.

Departures from Standard

2.4 It is indicated that up to 3 no. Departures from Standard will be formally submitted which may include for a sub-standard overtaking value, a direct access located on the inside of a bend and a staggered junction.

Scheme Details

2.5 The N63 Liss to Abbey Realignment Scheme, is located in the north-east of County Galway along the N63 route, a national secondary route, and includes the realignment of approximately 2.3km of the N63 to the eastern edge of Abbeyknockmoy. The scheme crosses the Abbert River. The scheme is also located in close proximity to Abbeyknockmoy Abbey, a National Monument. A speed limit of 100km/h will be imposed on the realigned mainline section of the Proposed Road Development. The N63 / L3110 junction is to be reconfigured, with the L3110-N63 becoming the major road with the N63 section which crosses over the Abbert River becoming the minor road.

The proposed road development includes the following;

- Approximately 2.3km of new Type 2 Single Carriageway road (predominantly offline);
- One new roundabout at the western end of the scheme to provide connection with the existing N63;
- Two new priority junctions to provide connection to the existing L6159 and L6234, including some minor local road realignments;
- One new clear span bridge crossing of the Abbert River;
- New pedestrian and cycle facilities, predominantly located along the existing N63;
- Associated earthworks including excavation of unacceptable material, excavation and processing of rock and other material, provision of material deposition areas and deposition and recovery of unacceptable material for reuse in the works;
- Accommodation works, including the provision of access roads and accesses;
- Drainage works, including the construction of attenuation ponds;
- Utilities and services diversion works;
- Safety Barrier, Public Lighting, Fencing;
- Landscaping works; and
- Environmental measures and other ancillary works

Site Inspection

2.6 The audit team visited the site on the afternoon of Wednesday 12th May 2021 between 12.30 and 14.30. The weather conditions during the site visit were clear and the road surface was dry. Traffic on the N63 was light and free flowing.

2.7 Photographs and videos were taken, and notes were written in order to document impressions of the scheme prior to the writing of this report.

2.8 All comments and recommendations are referenced to the design drawings and where applicable, the locations of problems are shown in conjunction with the scheme proposals in Appendix B where the reference numbers relate to the problems identified in this report.

2.9 The Audit Team has examined and reported only on the road safety implications of the measures as presented and has not specifically examined or verified the compliance of the designs to any other criteria.

3. Items Raised at Previous Road Safety Audits

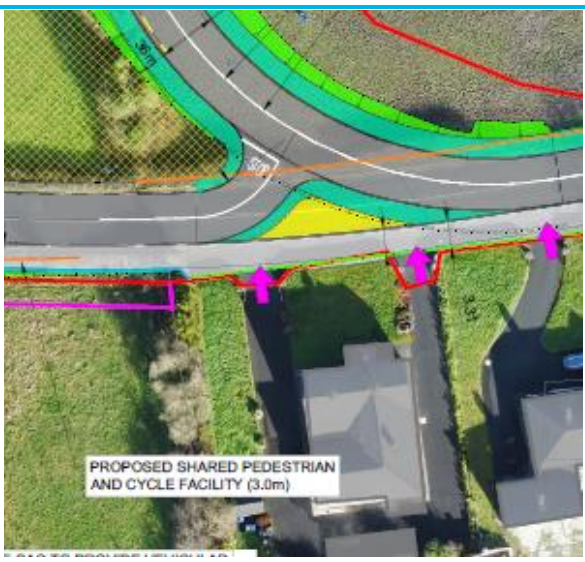
3.1 The Audit team are not aware of any previous Road Safety Audits being carried out on the N63 Liss to Abbey Realignment scheme.

4. Items Raised at this Stage 1 Road Safety Audit

4.1 General

Problem: 4.1.1

Location(s):	Residential shared access road
Drawing(s):	N63-ACM-PH03-0100-DR-HW-0131 D1
Summary:	NMUs at risk of collision with vehicles



Description:

The houses to the east of the new tie-in point are accommodated by retaining a section of the existing carriageway and forming a minor shared access road junction off the eastern section of existing N63 road by installation of a build-out. This build-out is surfaced by a grass verge and a landscaped area. There is no clear vehicular access identified for the residential unit, addressed as Abbey View' onto either the minor shared access road or the existing N63.
This may lead to vehicles overriding kerb lines which can result in collisions with pedestrians or cyclists on this section of shared pedestrian and cycle facility.

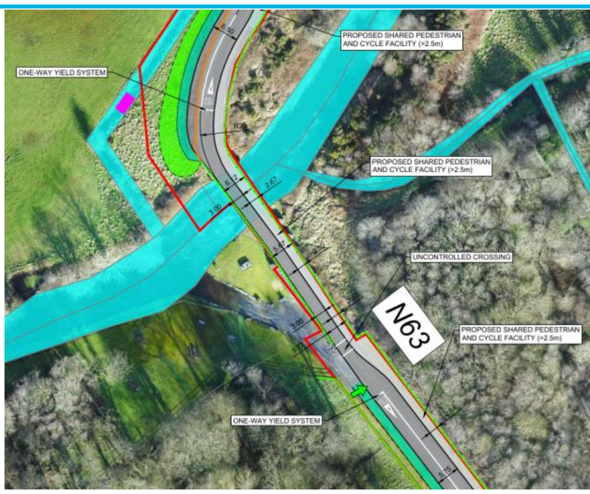
Recommendation:

Provide a safe vehicular access with dropped kerbs to all residential units and field accesses.

4.2 Local Alignment

Problem: 4.2.1

Location(s):	Existing N63 at Abbert River bridge crossing
Drawing(s):	N63-ACM-PH03-0100-DR-HW-0134 D1
Summary:	Inadequate road width at Yield lines can lead to vehicular collisions



Description:

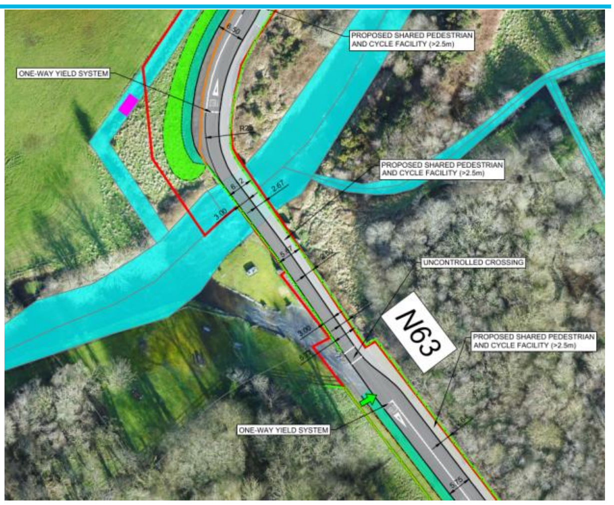
On the northern side of the one-way yield system the Yield line is located on the sharp bend before the bridge. It is unclear if there is sufficient road width to accommodate large vehicles travelling northbound past a vehicle stopped at this northern Yield line.
If there is insufficient road width provided in this area, this can lead to vehicular impact collisions with stationary vehicles, or erratic vehicular manoeuvres at this location causing collisions with NMU users on the shared pedestrian facility.

Recommendation:

Ensure adequate carriageway width is provided within the vicinity of the Yield lines and undertake an Autotracking analysis ensure safe manoeuvrability is achievable.

Problem: 4.2.2

Location(s):	Existing N63 at Abbert River bridge crossing
Drawing(s):	N63-ACM-PH03-0100-DR-HW-0134 D1
Summary:	Insufficient forward visibility to Yield Lines may lead to vehicles hard braking or reversing causing collisions



Description:

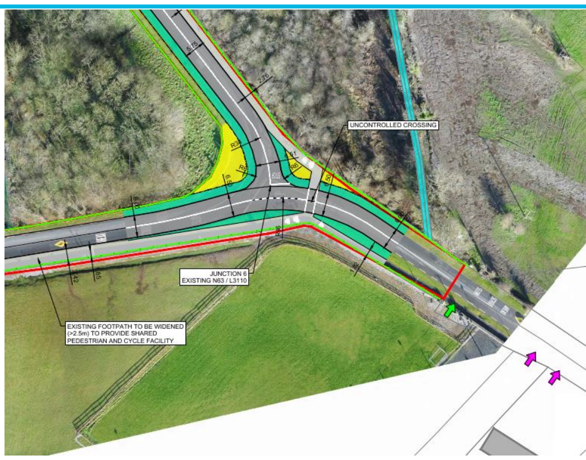
It is unclear if there is sufficient forward visibility to/from vehicles travelling southbound and northbound on the N63 approaching the bridge over the Abbert River to see each other so as to give sufficient warning to stop at the proposed Yield line. Insufficient forward visibility inhibits drivers from seeing approaching vehicles resulting in inadequate time to react in a safe manner.
This may lead to vehicles travelling beyond the Yield line and having to reverse to accommodate priority to an oncoming vehicle or vehicles undertaking hard braking, which can result in rear end collisions.

Recommendation:

Ensure adequate forward visibility is provided to opposing vehicles beyond the one-way yield system, to enable vehicles adequate time to stop safely at the proposed Yield lines.

Problem: 4.2.3

Location(s):	N63 / L3110 junction
Drawing(s):	N63-ACM-PH03-0100-DR-HW-0134 D1
Summary:	Insufficient forward visibility to objects on the roadway may lead to collisions



Description:

It is unclear if there is sufficient forward visibility around the realigned junction of the N63 and L3110. There may not be the required forward visibility to/from vehicles travelling eastbound on the N63 and northbound on the L3110 approaching the revised junction configuration. Insufficient forward visibility inhibits drivers from seeing objects on the roadway resulting in inadequate time to react in a safe manner.

This can lead to vehicles travelling around the bend at inappropriate speeds which may result in head on or side swipe collisions.

Recommendation:

Ensure adequate forward visibility is provided to objects on the roadway to enable vehicles adequate time to identify hazards ahead and to react in a safe manner.

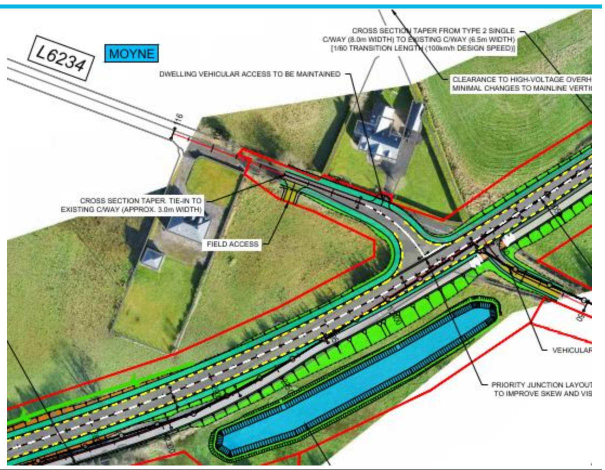
4.3 Junctions

Problem: 4.3.1

Location(s): N63 / L6234 Junction

Drawing(s): N63-ACM-PH03-0100-DR-HW-0137 D1

Summary: Insufficient visibility at junction can lead to side impact collisions



Description:

Due to the location of the junction and the existing curvature of the N63 to the west of the L6234 minor road, the visibility to the right from L6234 onto the N63 appears insufficient for the posted speed limit. Visibility to the right appears to be impaired by high vegetation. Visibility to the left should be checked to ensure that it is satisfactory for the speed limit. A lack of sufficient visibility may lead to vehicles encroaching into the major road and taking undue risks which may result in side impact collisions with eastbound vehicles on the N63.

Recommendation:

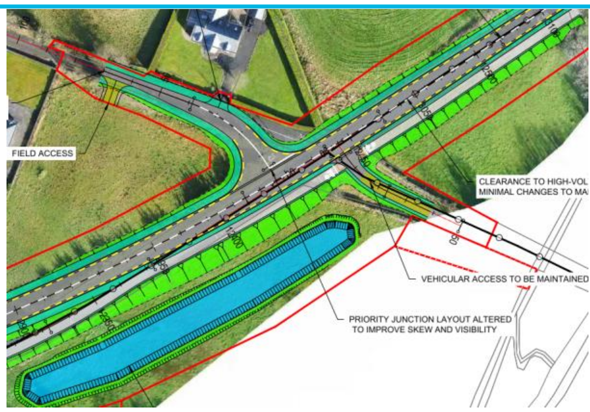
Ensure adequate sight lines are provided in both directions measured in accordance with TII DN-GEO-03060. These should be measured both horizontally and vertically and kept clear of obstructions.

Problem: 4.3.2

Location(s): L6234 Junction

Drawing(s): N63-ACM-PH03-0100-DR-HW-0137 D1

Summary: Direct see-through line of sight may lead to rear end shunt type collisions



Description:

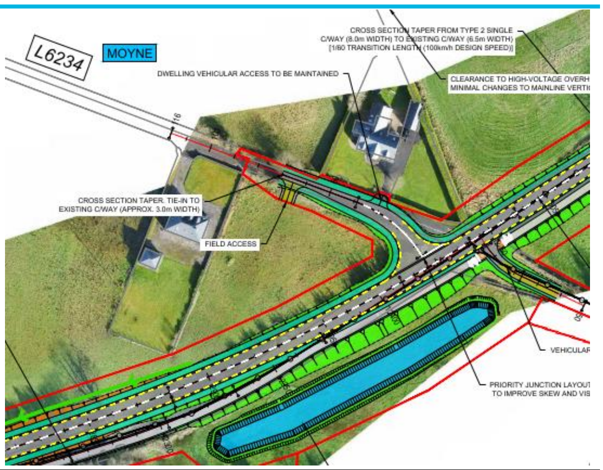
The L6234 and the access to Dereen are on long approach straights directly opposite each other. The proposed realignment of the L6234 approach onto the N63, diverts the L6234 to a greater approach angle to the existing junction, thus removing the directly opposing junctions. Although the edge of carriageway of the L6234 junction is realigned, there is still a direct line of sight on the approach from the L6234 to the Dureen access. As the junction will not be lit, this will be a greater issue during the hours of darkness. This can lead to drivers not being fully aware of the junction alignment ahead and could lead to sudden braking on the approach to the junction which may result in vehicles mounting the realigned verge resulting in loss of control incidents.

Recommendation:

Ensure that adequate screening is provided on the realigned verge, and advanced warning signage, road markings and surfacing is provided to ensure that vehicles are fully aware of the junction layout.

Problem: 4.3.3

Location(s):	L6234 Junction
Drawing(s):	N63-ACM-PH03-0100-DR-HW-0137 D1
Summary:	Vehicles at risk of entering pond



Description:

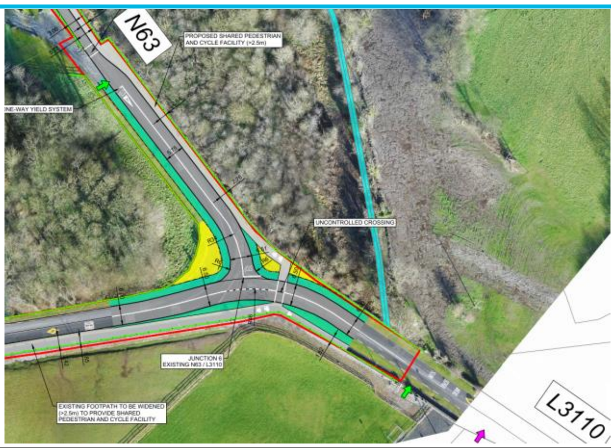
A proposed drainage pond is located opposite the newly realigned N63 and L6234 junction. The road levels at the location of the junction appear to be at a height above the proposed pond. The pond is located close to the base of the N63 road embankment earthworks.
This may lead to vehicles travelling at speed on the L6234 approach to the N63, if involved in loss of control incidents may cross the N63 and travel down the road embankment resulting in a collision into the proposed pond.

Recommendation:

Provide appropriate vehicle restraint along the top of the N63 road embankment to minimise the potential for vehicles entering the drainage pond.

Problem: 4.3.4

Location(s):	N63 / L3110 Junction
Drawing(s):	N63-ACM-PH03-0100-DR-HW-0134 D1
Summary:	Revised junction may lead to vehicles overshooting the Stop line



Description:

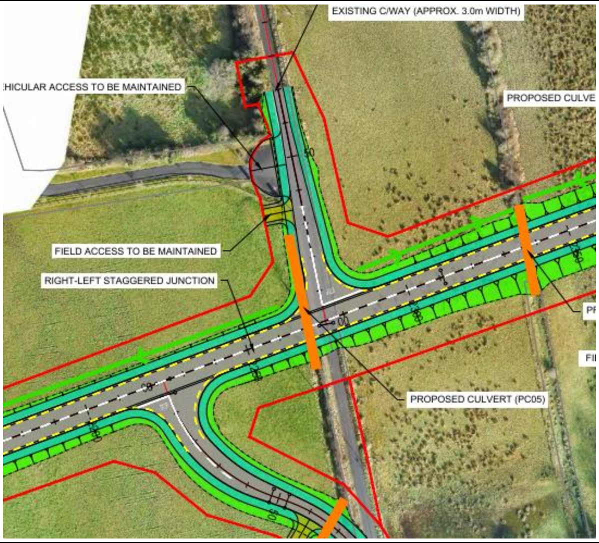
This N63 / L3110 junction is to be reconfigured, with the L3110-N63 becoming the major road and the N63 section which crosses over the Abbert River becoming the minor road. This new arrangement configuration produces an obtuse change in direction south to west and vice versa. The L3110 is on a downhill approach to this bend which is currently within an 80kn/h speed limit zone. It is unclear as to the type and extent of advanced warning signage or speed limit signage to be provided at this reconfigured junction.
Without adequate and appropriate signage drivers may not be fully aware of the junction configuration, particularly during the hours of darkness, which may lead to vehicles overshooting the Stop Line or sudden braking and loss of control collisions.

Recommendation:

Ensure that adequate screening is provided on the realigned landscaped build-out, and advanced warning signage, road markings and surfacing is provided to ensure that vehicles are fully aware of the junction layout.

Problem: 4.3.5

Location(s):	L6234 Junction
Drawing(s):	N63-ACM-PH03-0100-DR-HW-0135 D1
Summary:	Direct see-through line of sight may lead to rear end shunt type collisions



Description:

The L6159 will be severed by the new realigned road. The severed section of the L6159 is on long straight to the existing N63. The L6159 will join the new road on its existing alignment. As a result of this, there is still a direct line of sight onto the southern alignment of the existing road. As the junction will not be lit, this will be a greater issue during the hours of darkness.

This can lead to drivers not being fully aware of the junction ahead and could lead to sudden braking on the approach to the junction or vehicles overshooting the junction which may result in side impact or loss of control incidents.

Recommendation:

Ensure that adequate visual screening is provided to the severed road section, and advanced warning signage, road markings and surfacing is provided to ensure that vehicles are fully aware of the junction ahead.

Problem: 4.3.6

Location(s):	Realigned L6234
Drawing(s):	N63-ACM-PH03-0100-DR-HW-0135 D1
Summary:	Inadequate visibility can lead to side impact collisions

Description:

There is field access located on the inside of a bend on the new realigned section of the L6159. Due to the curvature of the new road, it is unclear if there is sufficient visibility provided in each direction for vehicles accessing onto the realigned local road.

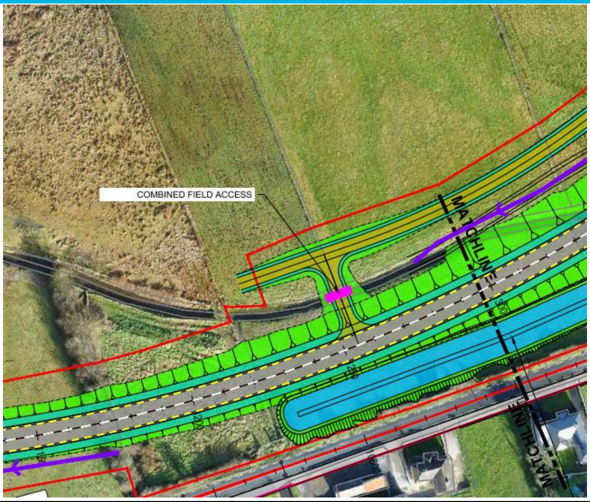
A lack of sufficient visibility may lead to vehicles encroaching into the major road and taking undue risks which may result in side impact collisions with vehicles on the realigned L6159.

Recommendation:

Ensure adequate sight lines are provided in both directions. These should be measured both horizontally and vertically and kept clear of obstructions.

Problem: 4.3.7

Location(s):	East of proposed roundabout
Drawing(s):	N63-ACM-PH03-0100-DR-HW-0132 D1
Summary:	Inadequate visibility can lead to side impact collisions



Description:

There is field access located on the inside of a bend on the new realignment section, located approximately 250m east of the proposed roundabout and another field access located at chainage 2000. Due to the curvature of the new road, it is unclear if there is sufficient visibility provided in each direction for vehicles accessing onto the new N63 realignment from these sites.
A lack of sufficient visibility may lead to vehicles encroaching into the major road and taking undue risks which may result in side impact collisions with vehicles on the realigned N63.

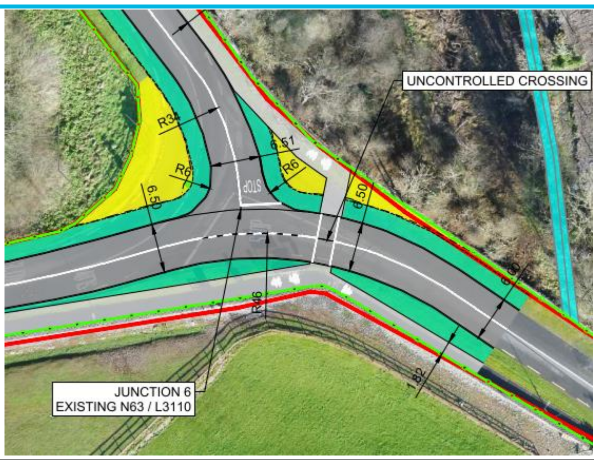
Recommendation:

Ensure adequate sight lines are provided in both directions measured in accordance with TII DN-GEO-03060. These should be measured both horizontally and vertically and kept clear of obstructions.

4.4 Non-Motorised Users (NMUs)

Problem: 4.4.1

Location(s):	Shared Pedestrian & Cycle Facility – Scheme wide
Drawing(s):	N63-ACM-PH03-0100-DR-HW-0134 D1
Summary:	Lack of pedestrian facilities can lead to collisions with vehicles



Description:

There is a shared pedestrian and cycle facility provided along the length of the section of the N63 which is being bypassed. Uncontrolled crossing locations have been identified.
The proposal does not indicate any dropped kerbs or tactile paving provided along this shared use NMU facility. Inappropriate or lack of crossing facilities could lead to vulnerable road users taking risks by entering the carriageway at unsafe locations and coming into conflict with traffic on the main carriageway.

Recommendation:

Provide adequate dropped kerb and tactile paving crossing facilities along the shared pedestrian and cyclist facility to accommodate all footpath users.

Problem: 4.4.2

Location(s):	Shared Pedestrian & Cycle Facility
Drawing(s):	N63-ACM-PH03-0100-DR-HW-0133 D1
Summary:	Inadequate separation of NMUs and vehicles can lead to NMU/vehicular collisions

Description:

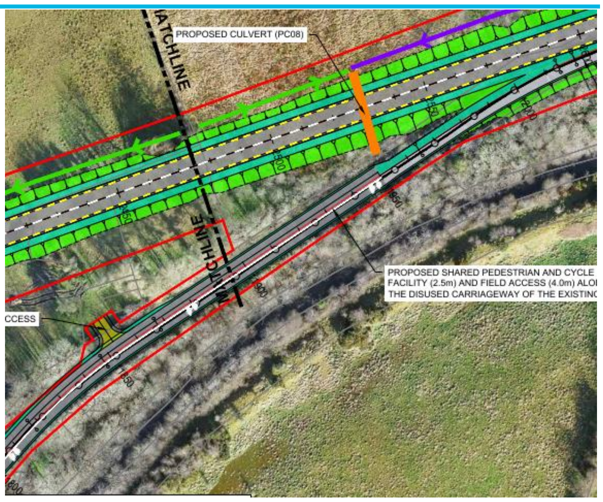
It is unclear as to the form of separation provided between the existing N63 carriageway and the proposed shared pedestrian and cycle facility. It is not identified if there is a level difference between the carriageway and the NMU facility.
Without a physical separator and level difference, errant vehicles can easily access into the shared pedestrian and cycle facility. This can lead to NMUs becoming isolated on the existing bridge over the Abbert River if southbound vehicles encroach into the shared NMU facility or large vehicles overrunning this facility on bends. This can also lead to faster moving vehicles on the straight sections of the existing N63 coming into conflict with users on the NMU shared facility and result in NMU collisions.

Recommendation:

Ensure adequate and appropriate separation is provided for NMUs on the shared pedestrian and cycle facility.

Problem: 4.4.3

Location(s):	Severed Eastern section of N63
Drawing(s):	N63-ACM-PH03-0100-DR-HW-0136 D1
Summary:	NMUs at risk of collision with vehicles



Description:

The severed section of the eastern length of the N63 will provide single lane access to 2 no. fields as the existing westbound lane is to be developed into a shared pedestrian and cycle facility, 2.5m wide. There are no turning facilities provided on this section of road for vehicles that access this section of severed road. There are also no barriers to vehicles from accessing to/from the N63 via this section. This may lead to vehicles undertaking multiple point turning manoeuvres or reversing along this road section back to the junction of the Old Road, east of the bridge which can result in collisions with pedestrians or cyclists on this section of shared pedestrian and cycle way.

Recommendation:

Provide adequate signage or entrance gates to ensure restricted use of this access or provide a suitable turning facility for errant vehicles, also ensure vehicular access to/from the proposed N63 realignment cannot be achieved.

5. Audit Team Statement

5.1 We certify that this Road Safety Audit has been carried out in the accordance with Transport Infrastructure Ireland Road Safety Audit Guidelines GE-STY-01027 (Dec 2017) and Standard GE-STY-01024 (Dec 2017)

5.2 The Road Safety Audit has been carried out with the sole purpose of identifying any features of the design that could be removed or modified in order to improve the safety of the scheme.

5.3 No one on the audit team has been involved with scheme design.

ROAD SAFETY AUDIT TEAM LEADER:

Rowan Lyons Signed

BEng (Hons) CEng, MIEI MSoRSA (Certificate of Competency)

Principal Engineer

AECOM Date 18 June 2021

9th Floor, 2 Clarence Street West

Belfast

BT2 7GP

ROAD SAFETY AUDIT TEAM MEMBER:

Brian McMahon Signed Brian McMahon

BE MSc CEng MIEI (Certificate of Competency)

Associate Director

AECOM Date 18 June 2021

4th Floor, Adelphi Plaza

Georges Street Upper

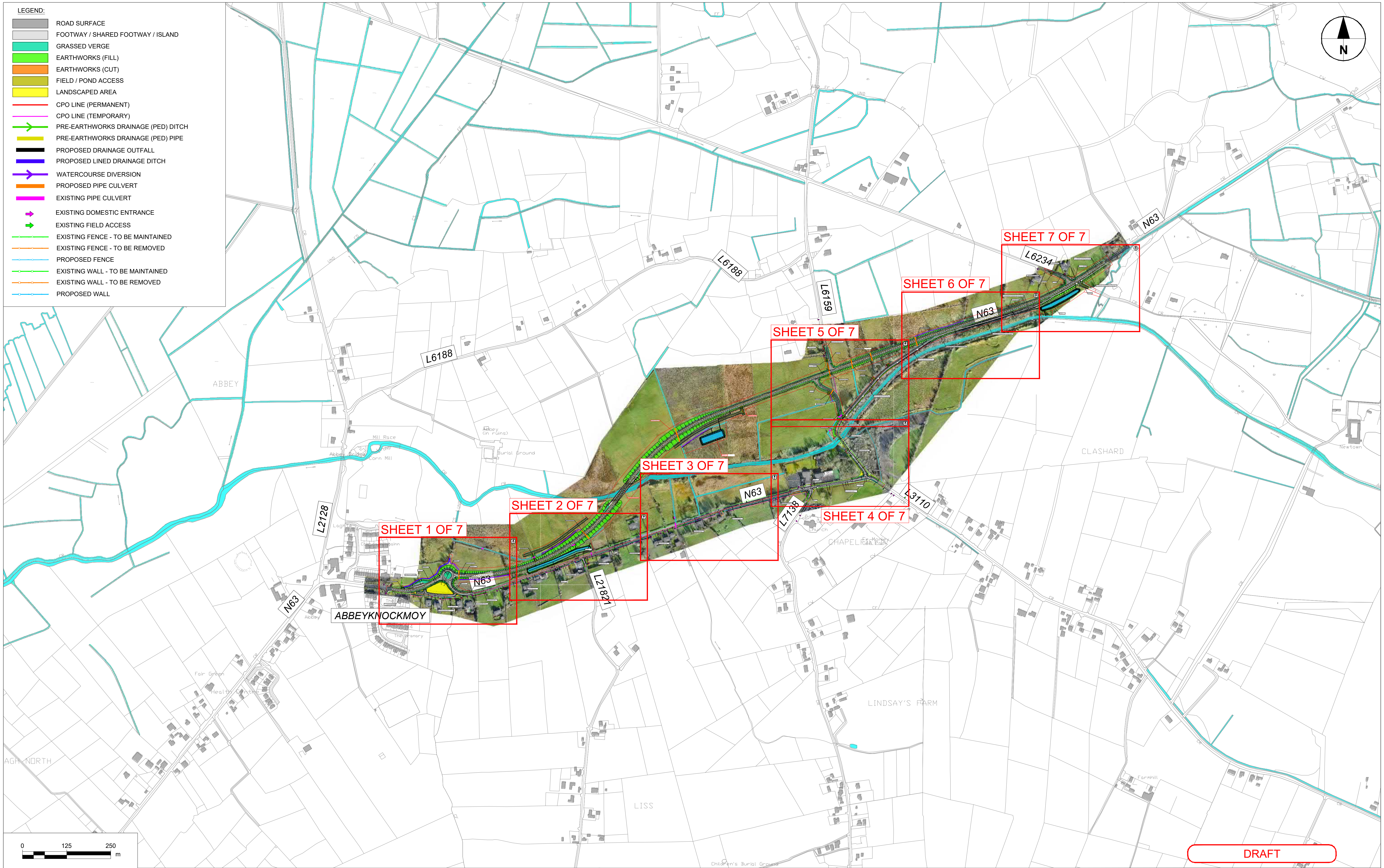
Dun Laoghaire

Co. Dublin A96 T927

Appendix A Schedule of Documents Used

List of included documents and drawings			
Documents			
Reference		Title	Date
Automatic Traffic Count – N63		N63_Liss to Abbey Traffic Survey (May 2019)	May 2019
N63_Liss to Abbey_Departures & Relaxations_Rev0.1		Schedule of Road Design Departures & Relaxations	17/07/2020
Drawings			
Drawing Nos.			
N63-ACM-PH03-0100-DR-HW-0001	D1	Location Plan	15.12.2020
N63-ACM-PH03-0000-DR-HW-0010-0015	D1	GA Plan on Aerial Photography	14.12.2020
N63-ACM-PH03-0100-DR-HW-0101	D1	Typical Road Cross Section	15.12.2020
N63-ACM-PH03-0100-DR-HW-0111-0112	D1	Mainline – Plan & Profile	15.12.2020
N63-ACM-PH03-0100-DR-HW-0130-0137	D1	Junctions, Side Road, Pedestrian & Cycle Facilities	15.12.2020
N63-ACM-PH03-0200-DR-HW-0200-D1_	D1	Proposed Site Compounds	15.12.2020
N63-ACM-PH03-0500-DR-DR-0500-0505	D1	Drainage	15.12.2020
N63-ACM-PH03-2700-DR-UT-2700-2705	D1	Utilities	15.12.2020

Appendix B Location of Problems Plans



No.	Revision	Date	By	Chk'd	App'd

Roughan & O'Donovan-AECOM Alliance

AECOM
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin
Ireland
T +353 (0)1 238 3100
www.aecom.com

Roughan & O'Donovan
Arena House
Arena Road
Sandyford
Dublin 18
Ireland
T +353 (0)1 294 0800
www.rod.ie

Drawn	Designed	Checked	Approved	Suitability Code - Description
AC	LB	LB	EG	S0 - Work In Progress

Project Title: N63 LISS TO ABBEY REALIGNMENT SCHEME

Drawing Title: JUNCTIONS, SIDE ROAD, PEDESTRIAN & CYCLE FACILITIES SHEET LAYOUT

Drawing Number	Project	Originator	Phase	Series	Type	Dept.	Number
	N63	ACM	PH03	0100	DR	HW	0130

Scale: 1:5000 @A1 / 1:10000 @A3 | Date: 15.12.2020 | Job No: 60597858 | Rev: D1

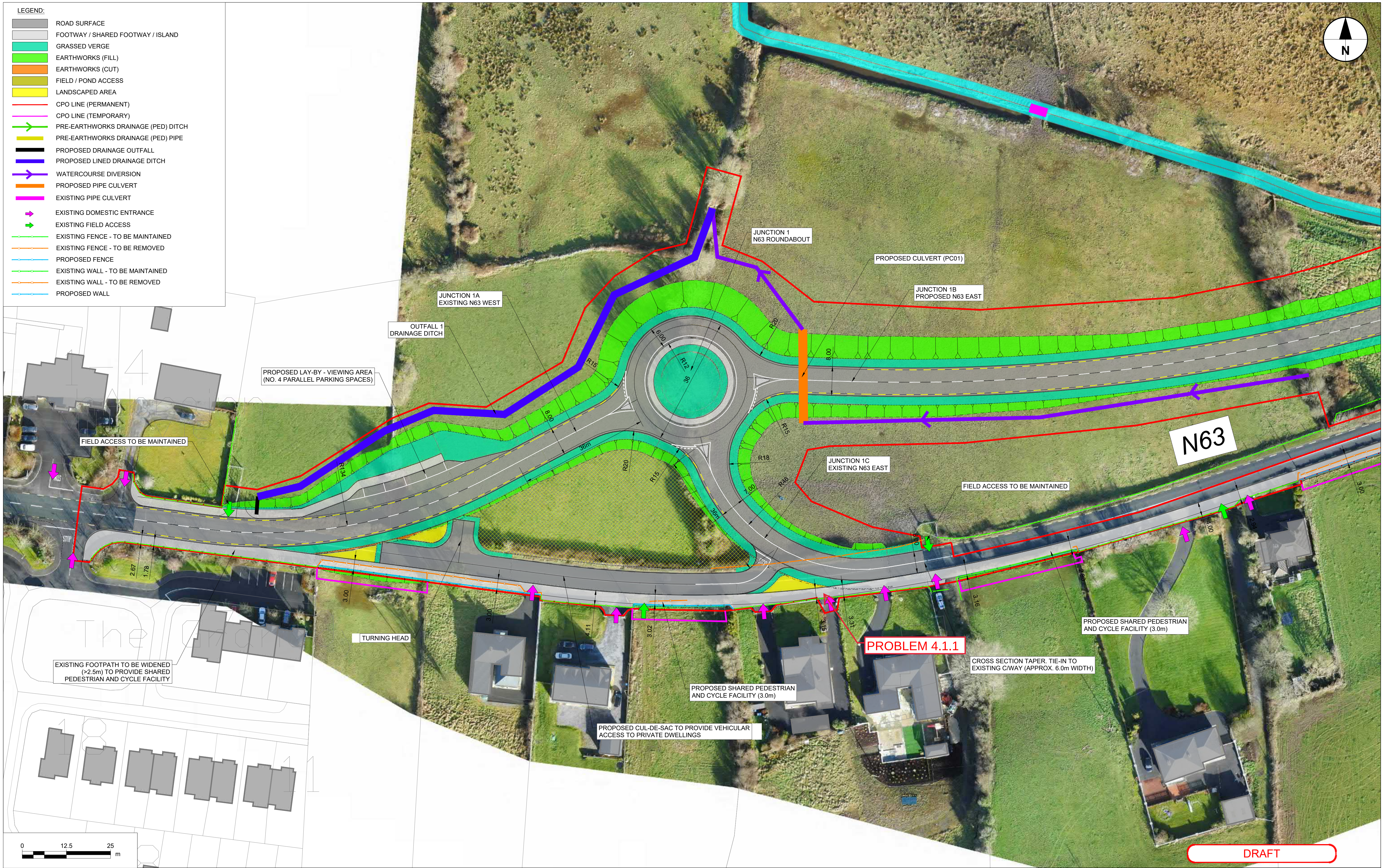
DO NOT SCALE USE FIGURED DIMENSIONS ONLY

GALWAY COUNTY COUNCIL 2020/OSI_NMA_090
© ORDINANCE SURVEY IRELAND, 2020
© 2020 Microsoft Corporation © 2019 DigitalGlobe
© CNES (2019) Distribution Airbus DS

21 December 2020 13:04:58 \\EU.AECOMNET.COM\EMIA\UKI\IEDBL2\JOBS\PR-395964_N63_PH1-4\900_CAD_GIS\910_CAD\20-SHEETS\01-WIP\N63-AEC-PH03-0100-DR-HW-0130-0135_JUNCTIONS.DWG

LEGEND:

- ROAD SURFACE
- FOOTWAY / SHARED FOOTWAY / ISLAND
- GRASSED VERGE
- EARTHWORKS (FILL)
- EARTHWORKS (CUT)
- FIELD / POND ACCESS
- LANDSCAPED AREA
- CPO LINE (PERMANENT)
- CPO LINE (TEMPORARY)
- PRE-EARTHWORKS DRAINAGE (PED) DITCH
- PRE-EARTHWORKS DRAINAGE (PED) PIPE
- PROPOSED DRAINAGE OUTFALL
- PROPOSED LINED DRAINAGE DITCH
- WATERCOURSE DIVERSION
- PROPOSED PIPE CULVERT
- EXISTING PIPE CULVERT
- EXISTING DOMESTIC ENTRANCE
- EXISTING FIELD ACCESS
- EXISTING FENCE - TO BE MAINTAINED
- EXISTING FENCE - TO BE REMOVED
- PROPOSED FENCE
- EXISTING WALL - TO BE MAINTAINED
- EXISTING WALL - TO BE REMOVED
- PROPOSED WALL



No.	Revision	Date	By	Chk'd	App'd

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

GALWAY NATIONAL ROADS PROJECT OFFICE

Comhairle Chontae na Gaillimhe
Galway County Council

Project Ireland 2040
Building Ireland's Future

Roughan & O'Donovan-AECOM Alliance

AECOM
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin
Ireland
T +353 (0)1 238 3100
www.aecom.com

Roughan & O'Donovan
Arena House
Arena Road
Sandyford
Dublin 18
Ireland
T +353 (0)1 294 0800
www.rod.ie

Drawn	Designed	Checked	Approved	Suitability Code - Description
AC	LB	LB	EG	S0 - Work In Progress

Project Title: N63 LISS TO ABBEY REALIGNMENT SCHEME

Drawing Title: JUNCTIONS, SIDE ROAD, PEDESTRIAN & CYCLE FACILITIES SHEET 1 OF 7

Drawing Number	Project	Originator	Phase	Series	Type	Dept.	Number
	N63	ACM	PH03	0100	DR	HW	0131

Scale: 1:500 @A1 / 1:1000 @A3 | Date: 15.12.2020 | Job No: 60597858 | Rev: D1

GALWAY COUNTY COUNCIL 2020/OSI_NMA_090
© ORDINANCE SURVEY IRELAND, 2020

© 2020 Microsoft Corporation © 2019 DigitalGlobe
© CNES (2019) Distribution Airbus DS

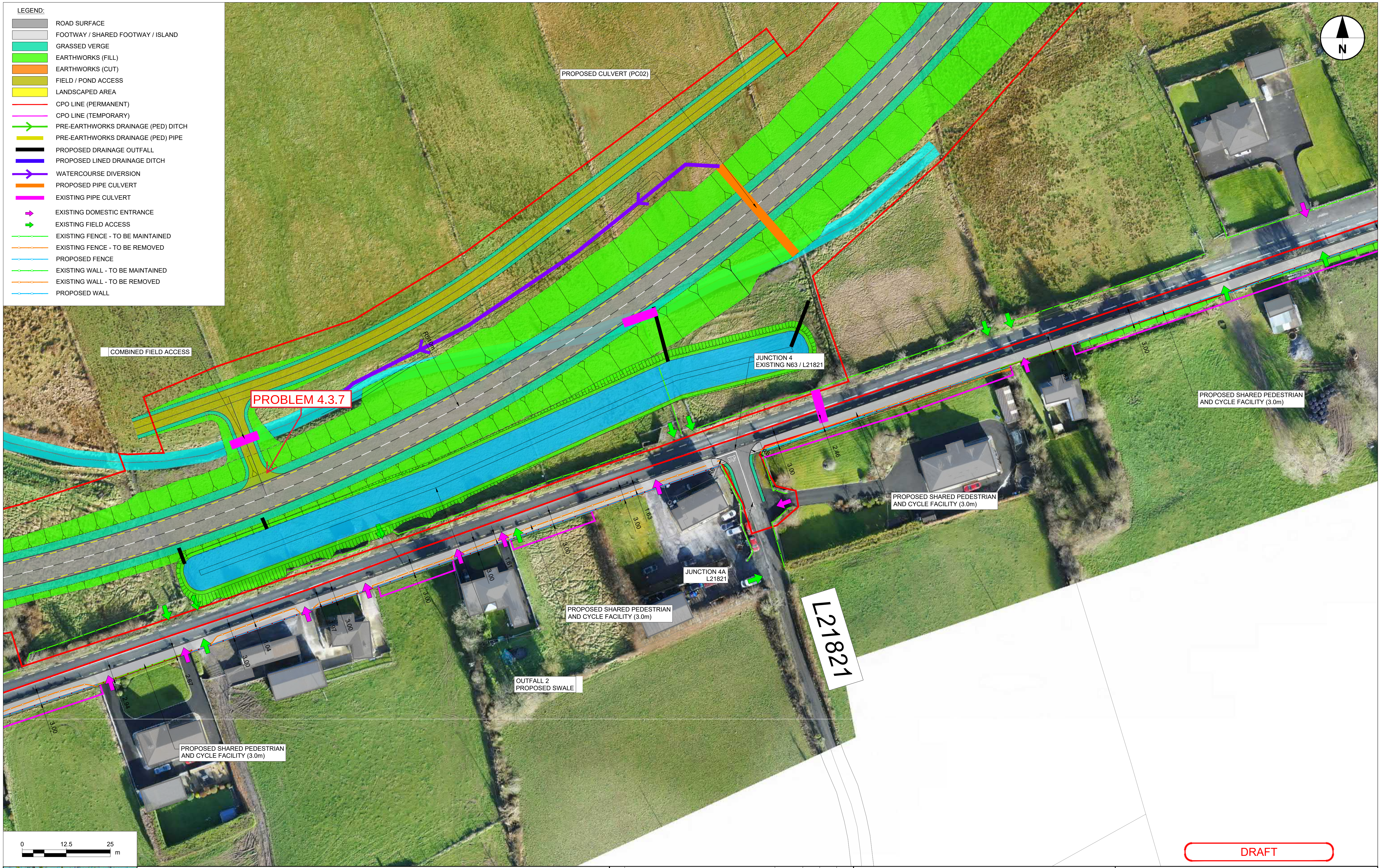
21 December 2020 13:07:46

\\EU.AECOMNET.COM\EMIA\UKI\EDBL2\JOBS\PR-395964_N63_PH1-4\900_CAD_GIS\910_CAD\20-SHEETS\01-WIP\N63-AEC-PH03-0100-DR-HW-0130-0135_JUNCTIONS.DWG

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

LEGEND:

- ROAD SURFACE
- FOOTWAY / SHARED FOOTWAY / ISLAND
- GRASSED VERGE
- EARTHWORKS (FILL)
- EARTHWORKS (CUT)
- FIELD / POND ACCESS
- LANDSCAPED AREA
- CPO LINE (PERMANENT)
- CPO LINE (TEMPORARY)
- PRE-EARTHWORKS DRAINAGE (PED) DITCH
- PRE-EARTHWORKS DRAINAGE (PED) PIPE
- PROPOSED DRAINAGE OUTFALL
- PROPOSED LINED DRAINAGE DITCH
- WATERCOURSE DIVERSION
- PROPOSED PIPE CULVERT
- EXISTING PIPE CULVERT
- EXISTING DOMESTIC ENTRANCE
- EXISTING FIELD ACCESS
- EXISTING FENCE - TO BE MAINTAINED
- EXISTING FENCE - TO BE REMOVED
- PROPOSED FENCE
- EXISTING WALL - TO BE MAINTAINED
- EXISTING WALL - TO BE REMOVED
- PROPOSED WALL



No.	Revision	Date	By	Chk'd	App'd

Roughan & O'Donovan-AECOM Alliance

AECOM
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin
Ireland
T +353 (0)1 238 3100
www.aecom.com

Roughan & O'Donovan
Arena House
Arena Road
Sandyford
Dublin 18
Ireland
T +353 (0)1 294 0800
www.rod.ie

Drawn	Designed	Checked	Approved	Suitability Code - Description
AC	LB	LB	EG	S0 - Work In Progress

Project Title: N63 LISS TO ABBEY REALIGNMENT SCHEME

Drawing Title: JUNCTIONS, SIDE ROAD, PEDESTRIAN & CYCLE FACILITIES SHEET 2 OF 7

Drawing Number	Project	Originator	Phase	Series	Type	Dept.	Number
	N63	ACM	PH03	0100	DR	HW	0132

Scale: 1:500 @A1 / 1:1000 @A3 | Date: 15.12.2020 | Job No: 60597858 | Rev: D1

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

GALWAY COUNTY COUNCIL 2020/OSI_NMA_090
© ORDNANCE SURVEY IRELAND, 2020
© 2020 Microsoft Corporation © 2019 DigitalGlobe
© CNES (2019) Distribution Airbus DS

21 December 2020 13:10:49 \\EU.AECOMNET.COM\EMIA\UKI\EDBL2\JOBS\PR-395964_N63_PH1-4\900_CAD_GIS\910_CAD\20-SHEETS\01-WIP\N63-AEC-PH03-0100-DR-HW-0130-0135_JUNCTIONS.DWG

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

GALWAY NATIONAL ROADS PROJECT OFFICE

Comhairle Chontae na Gaillimhe
Galway County Council

Project Ireland 2040
Building Ireland's Future

No.	Revision	Date	By	Chk'd	App'd

Roughan & O'Donovan-AECOM Alliance

ROD ROUGHAN & O'DONOVAN
AECOM

AECOM
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin
Ireland
T +353 (0)1 238 3100
www.aecom.com

Roughan & O'Donovan
Arena House
Arena Road
Sandyford
Dublin 18
Ireland
T +353 (0)1 294 0800
www.rod.ie

Drawn	Designed	Checked	Approved	Suitability Code - Description
AC	LB	LB	EG	S0 - Work In Progress

Project Title: N63 LISS TO ABBEY REALIGNMENT SCHEME

Drawing Title: JUNCTIONS, SIDE ROAD, PEDESTRIAN & CYCLE FACILITIES SHEET 3 OF 7

Drawing Number	Project	Originator	Phase	Series	Type	Dept.	Number
	N63	- ACM	- PH03 -	0100	- DR	- DR	- 0133

Scale: 1:500 @A1 / 1:1000 @A3 | Date: 15.12.2020 | Job No: 60597858 | Rev: D1

GALWAY COUNTY COUNCIL 2020/OSI_NMA_090
© ORDNANCE SURVEY IRELAND, 2020
© 2020 Microsoft Corporation © 2019 DigitalGlobe
© CNES (2019) Distribution Airbus DS

21 December 2020 13:13:33 \\EU.AECOMNET.COM\EMIA\UKI\IEDBL2\JOBS\PR-395964_N63_PH1-4\900_CAD_GIS\910_CAD\20-SHEETS\01-WIP\N63-AEC-PH03-0100-DR-HW-0130-0135_JUNCTIONS.DWG

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

LEGEND:

- ROAD SURFACE
- FOOTWAY / SHARED FOOTWAY / ISLAND
- GRASSED VERGE
- EARTHWORKS (FILL)
- EARTHWORKS (CUT)
- FIELD / POND ACCESS
- LANDSCAPED AREA
- CPO LINE (PERMANENT)
- CPO LINE (TEMPORARY)
- PRE-EARTHWORKS DRAINAGE (PED) DITCH
- PRE-EARTHWORKS DRAINAGE (PED) PIPE
- PROPOSED DRAINAGE OUTFALL
- PROPOSED LINED DRAINAGE DITCH
- WATERCOURSE DIVERSION
- PROPOSED PIPE CULVERT
- EXISTING PIPE CULVERT
- EXISTING DOMESTIC ENTRANCE
- EXISTING FIELD ACCESS
- EXISTING FENCE - TO BE MAINTAINED
- EXISTING FENCE - TO BE REMOVED
- PROPOSED FENCE
- EXISTING WALL - TO BE MAINTAINED
- EXISTING WALL - TO BE REMOVED
- PROPOSED WALL

No.	Revision	Date	By	Chk'd	App'd

Roughan & O'Donovan-AECOM Alliance

ROD ROUGHAN & O'DONOVAN

AECOM

AECOM
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin
Ireland
T +353 (0)1 238 3100
www.aecom.com

Roughan & O'Donovan
Arena House
Arena Road
Sandyford
Dublin 18
Ireland
T +353 (0)1 294 0800
www.rod.ie

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

GALWAY NATIONAL ROADS PROJECT OFFICE

Comhairle Chontae na Gaillimhe
Galway County Council

Project Ireland 2040
Building Ireland's Future

Drawn	Designed	Checked	Approved	Suitability Code - Description
LB	LB	PC	EG	S0 - Work In Progress

Project Title: N63 LISS TO ABBEY REALIGNMENT SCHEME

Drawing Title: JUNCTIONS, SIDE ROAD, PEDESTRIAN & CYCLE FACILITIES SHEET 4 OF 7

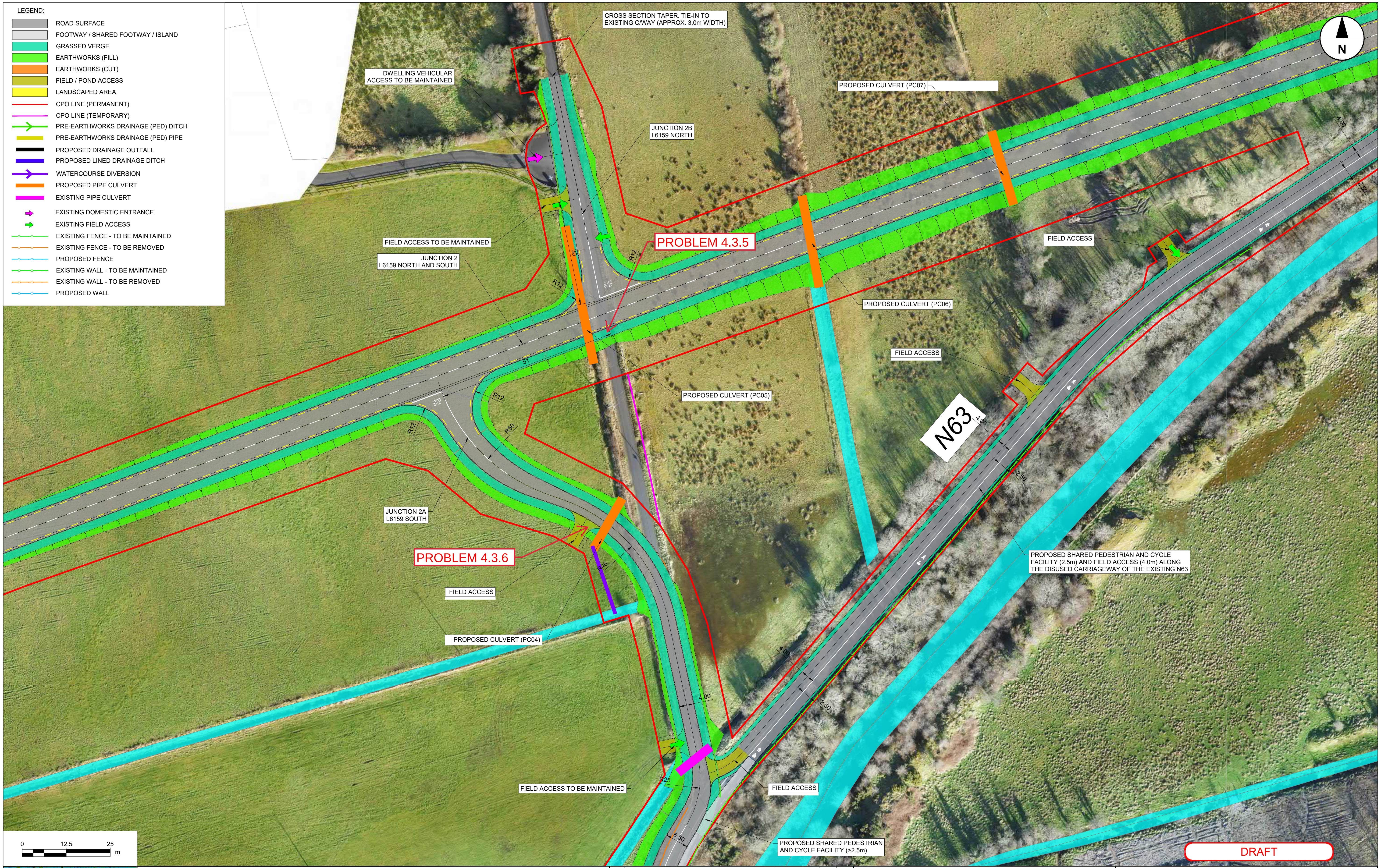
Drawing Number	Project	Originator	Phase	Series	Type	Dept.	Number
	N63	ACM	PH03	0100	DR	HW	0134

Scale: 1:500 @A1 / 1:1000 @A3 | Date: 15.12.2020 | Job No: 60597858 | Rev: D1

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

GALWAY COUNTY COUNCIL 2020/OSI_NMA_090
© ORDNANCE SURVEY IRELAND, 2020
© 2020 Microsoft Corporation © 2019 DigitalGlobe
© CNES (2019) Distribution Airbus DS

21 December 2020 13:17:02 \\EU.AECOMNET.COM\EMIA\UKIEDBL2\JOBS\PR-395964_N63_PH1-4\900_CAD_GIS\910_CAD\20-SHEETS\01-WIP\N63-AEC-PH03-0100-DR-HW-0130-0135_JUNCTIONS.DWG



GALWAY COUNTY COUNCIL 2020/OSI_NMA_090
© ORDNANCE SURVEY IRELAND, 2020

© 2020 Microsoft Corporation © 2019 DigitalGlobe
© CNES (2019) Distribution Airbus DS

Bonneagar Iompair Éireann Transport Infrastructure Ireland

GALWAY NATIONAL ROADS PROJECT OFFICE

Comhairle Chontae na Gaillimhe Galway County Council

Project Ireland 2040 Building Ireland's Future

No.	Revision	Date	By	Chk'd	App'd

Roughan & O'Donovan-AECOM Alliance

ROD ROUGHAN & O'DONOVAN
AECOM

AECOM
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin
Ireland
T +353 (0)1 238 3100
www.aecom.com

Roughan & O'Donovan
Arena House
Arena Road
Sandyford
Dublin 18
Ireland
T +353 (0)1 294 0800
www.rod.ie

Drawn	Designed	Checked	Approved	Suitability Code - Description
AC	LB	PC	EG	S0 - Work In Progress

Project Title: N63 LISS TO ABBEY REALIGNMENT SCHEME

Drawing Title: JUNCTIONS, SIDE ROAD, PEDESTRIAN & CYCLE FACILITIES SHEET 5 OF 7

Drawing Number	Project	Originator	Phase	Series	Type	Dept.	Number
	N63	ACM	PH03	0100	DR	HW	0135

Scale: 1:500 @A1 / 1:1000 @A3 | Date: 15.12.2020 | Job No: 60597858 | Rev: D1

21 December 2020 13:20:15 \\EU.AECOMNET.COM\EMIA\UKIE\DBL2\JOBS\PR-395964_N63_PH1-4\900_CAD_GIS\910_CAD\20-SHEETS\01-WIP\N63-AEC-PH03-0100-DR-HW-0130-0135_JUNCTIONS.DWG

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

LEGEND:

- ROAD SURFACE
- FOOTWAY / SHARED FOOTWAY / ISLAND
- GRASSED VERGE
- EARTHWORKS (FILL)
- EARTHWORKS (CUT)
- FIELD / POND ACCESS
- LANDSCAPED AREA
- CPO LINE (PERMANENT)
- CPO LINE (TEMPORARY)
- PRE-EARTHWORKS DRAINAGE (PED) DITCH
- PRE-EARTHWORKS DRAINAGE (PED) PIPE
- PROPOSED DRAINAGE OUTFALL
- PROPOSED LINED DRAINAGE DITCH
- WATERCOURSE DIVERSION
- PROPOSED PIPE CULVERT
- EXISTING PIPE CULVERT
- EXISTING DOMESTIC ENTRANCE
- EXISTING FIELD ACCESS
- EXISTING FENCE - TO BE MAINTAINED
- EXISTING FENCE - TO BE REMOVED
- PROPOSED FENCE
- EXISTING WALL - TO BE MAINTAINED
- EXISTING WALL - TO BE REMOVED
- PROPOSED WALL

No.	Revision	Date	By	Chk'd	App'd

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

GALWAY NATIONAL ROADS PROJECT OFFICE

Comhairle Chontae na Gaillimhe
Galway County Council

Project Ireland 2040
Building Ireland's Future

Roughan & O'Donovan-AECOM Alliance

AECOM
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin
Ireland
T +353 (0)1 238 3100
www.aecom.com

Roughan & O'Donovan
Arena House
Arena Road
Sandyford
Dublin 18
Ireland
T +353 (0)1 294 0800
www.rod.ie

Drawn	Designed	Checked	Approved	Suitability Code - Description
AC	LB	PC	EG	S0 - Work In Progress

Project Title: N63 LISS TO ABBEY REALIGNMENT SCHEME

Drawing Title: JUNCTIONS, SIDE ROAD, PEDESTRIAN & CYCLE FACILITIES SHEET 6 OF 7

Project	Originator	Phase	Series	Type	Dept.	Number
N63	ACM	PH03	0100	DR	HW	0136

Drawing Number: N63 - ACM - PH03 - 0100 - DR - HW - 0136

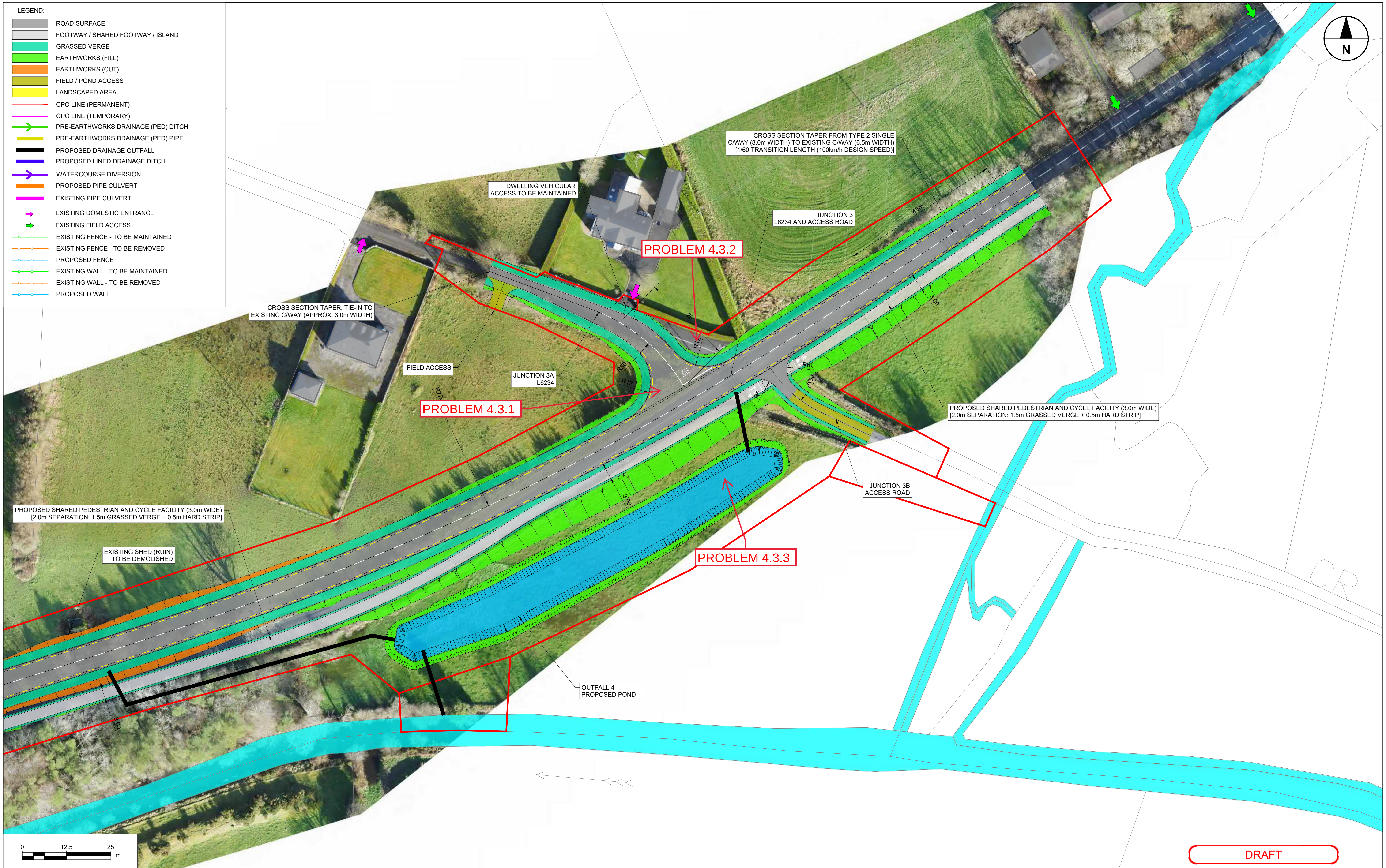
Scale: 1:500 @A1 / 1:1000 @A3 | Date: 15.12.2020 | Job No: 60597858 | Rev: D1

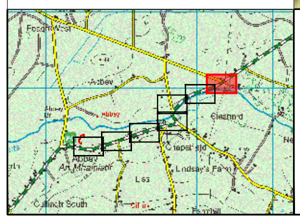
GALWAY COUNTY COUNCIL 2020/OSI_NMA_090
© ORDNANCE SURVEY IRELAND, 2020

© 2020 Microsoft Corporation © 2019 DigitalGlobe
© CNES (2019) Distribution Airbus DS

21 December 2020 13:23:06 \\EU.AECOMNET.COM\EMIA\UKI\EDBL2\JOBS\PR-395964_N63_PH1-4\900_CAD_GIS\910_CAD\20-SHEETS\01-WIP\N63-AEC-PH03-0100-DR-HW-0130-0135_JUNCTIONS.DWG

DO NOT SCALE USE FIGURED DIMENSIONS ONLY





Bonneagar Iompair Éireann
Transport Infrastructure Ireland

GALWAY NATIONAL ROADS PROJECT OFFICE

Comhairle Chontae na Gaillimhe
Galway County Council

Project Ireland 2040
Building Ireland's Future

No.	Revision	Date	By	Chk'd	App'd

Roughan & O'Donovan-AECOM Alliance

ROD ROUGHAN & O'DONOVAN
AECOM

AECOM	Roughan & O'Donovan
Adelphi Plaza	Arena House
Georges Street Upper	Arena Road
Dun Laoghaire	Sandyford
Co. Dublin	Dublin 18
Ireland	Ireland
T +353 (0)1 238 3100	T +353 (0)1 294 0800
www.aecom.com	www.rod.ie

Drawn	Designed	Checked	Approved	Suitability Code - Description
AC	LB	PC	EG	S0 - Work In Progress

Project Title: N63 LISS TO ABBEY REALIGNMENT SCHEME

Drawing Title: JUNCTIONS, SIDE ROAD, PEDESTRIAN & CYCLE FACILITIES SHEET 7 OF 7

Drawing Number	Project	Originator	Phase	Series	Type	Dept.	Number
	N63	- ACM	- PH03 -	0100	- DR	- HW -	0137

Scale: 1:500 @A1 / 1:1000 @A3 | Date: 15.12.2020 | Job No: 60597858 | Rev: D1

GALWAY COUNTY COUNCIL 2020/OSI_NMA_090
© ORDNANCE SURVEY IRELAND, 2020

© 2020 Microsoft Corporation © 2019 DigitalGlobe
© CNES (2019) Distribution Airbus DS

21 December 2020 13:25:54 \\EU.AECOMNET.COM\EMIA\UKI\IEDBL2\JOBS\PR-395964_N63_PH1-4\900_CAD_GIS\910_CAD\20-SHEETS\01-WIP\N63-AEC-PH03-0100-DR-HW-0130-0135_JUNCTIONS.DWG

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

Appendix C RSA Feedback Form

Road Safety Audit Feedback Form

Scheme: N63 Liss to Abbey Realignment Scheme		
Audit Stage: Stage 1	**Route no.: N63**	**Date of Audit: 18/06/21**

To Be Completed By Designer				**To Be Completed by Audit Team Leader**
Paragraph No. in Safety Audit Report	Problem accepted (Yes/No)	Recommended Measure Accepted (Yes/No)	Describe alternative measure(s). Give reasons for not accepting recommended measure. Only complete if recommended measure is not accepted.	Alternative Measures accepted by Auditors (Yes/No)
4.1.1	Yes	Yes	N/A	
4.2.1	Yes	Yes	N/A	
4.2.2	Yes	Yes	N/A	
4.2.3	Yes	Yes	N/A	
4.3.1	Yes	Yes	N/A	
4.3.2	Yes	Yes	N/A	
4.3.3	Yes	Yes	N/A	
4.3.4	Yes	Yes	N/A	
4.3.5	Yes	Yes	N/A	
4.3.6	Yes	Yes	N/A	
4.3.7	Yes	Yes	N/A	
4.4.1	Yes	Yes	N/A	
4.4.2	Yes	Yes	N/A	
4.4.3	Yes	Yes	N/A	

Signed Eoin Greene. Designer Eoin Greene Date 29/07/2021

Signed Audit Team Leader Rowan Lyons Date 29/07/2021

Signed ____________________ Employer ______________________________ Date __________

Appendix C - Structures Options Report

N63 Liss to Abbey Realignment Scheme

Phase 3 - River Abbert Bridge Structures Options Report

Galway County Council

AECOM Project Number: 60571547
GCC Project Number: GC\16\13416

Document Reference: N63-ACM-ZZ-ZZ-RP-SE-000001

14th June 2021

Quality information

Prepared by	Checked by	Verified by	Approved by
Rionach Murphy Graduate Engineer	Arthur Costello Principal Engineer	Niamh Rodgers Associate Director	Eoin Greene Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
0	22/03/2021	1st Issue	EG	Eoin Greene	Technical Director
1	14/06/2021	Issue for Approval	EG	Eoin Greene	Technical Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name
0	1	GCC

Prepared for:
Galway County Council
Áras an Chontae,
Prospect Hill,
Galway
H91 H6KX

Prepared by:
AECOM - ROD Alliance

AECOM Ireland Limited
4th Floor
Adelphi Plaza
Georges Street Upper
Co. Dublin
Ireland

T: +353 1 238 3100
aecom.com

Prepared by:

All Rights Reserved.
This document has been prepared by AECOM Ireland Ltd and Roughan & O'Donovan Ltd ("AECOM/ROD) for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM - ROD and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM - ROD, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM - ROD.

Structures Options Report - Consultation STA-1a

Categories 1, 2 & 3

Scheme

Name and Location: N63 Liss to Abbey Realignment Scheme

Structure(s)

Name and nature of the Structure(s): River Abbert Bridge

Structures Options Report

Reference N63-ACM-ZZ-ZZ-RP-ZZ-000001

Revision 01

Date 14/06/2021

Submitted by

Signature: Niamh Rodgers

Name Niamh Rodgers

Position Associate Director (Team Leader)

Organisation AECOM

Date 14/06/2021

Structures Section confirmation of consultation:

Name ____________________

Position ____________________

Organisation ____________________

Date ____________________

Table of Contents

Figures

Tables

1. Introduction

The N63 Liss to Abbey Realignment Scheme is a proposed road scheme near Abbeyknockmoy Co. Galway. The aim of the scheme is to facilitate a number of key objectives in the Galway County Development Plan (2015-2021), including the provision of higher-quality national roads and the separation of regional and local traffic. The scheme will also meet a number of objectives of the Road Safety Authority's Road Safety Strategy.

The purpose of the scheme is to provide an improved link for regional traffic to the M17 motorway and reduce traffic congestion at the existing Liss Bridge. The scheme will also allow for the existing section of N63 to be downgraded and pedestrian/cyclist facilities introduced to improve connectivity between the community facilities and residential properties.

In May 2019 Galway County Council commissioned AECOM-ROD to deliver the scheme under the TII Project Management Guidelines 2019 as outlined in PE-PMG-02041. The scheme has since progressed through Phase 1 Feasibility Studies (August 2019) and Phase 2 Options selection (April 2020). The project is currently proceeding through the Phase 3 Design and Environmental Evaluation.

As part of the scope AECOM-ROD have agreed to take all structures through the Technical Acceptance of Road Structures on Motorways and Other National Roads procedure as outlined in DN-STR-03001. At Phase 3 the key deliverable of the Technical Acceptance process is the Structures Options Report (SOR).

The SOR will focus on a new bridge crossing the River Abbert and its associated Special Area of Conservation (SAC). The bridge will carry the main alignment of the proposed N63 and be located in close proximity to Abbeyknockmoy Abbey, a National Monument.

2. Site and Location

2.1 Introduction

The proposed scheme is located in the north east of County Galway, directly to the east of Abbeyknockmoy Village. The proposed road alignment extends in a north easterly direction from Abbeyknockmoy, spanning the River Abbert towards the townland of Derreen and the junction of the N63 and L6234. The location is characterised by the presence of open greenfield agricultural land.

The coordinates of the proposed bridge are 551010.001(E), 743507.846 (N) (ITM).

© 2020 CNES/Airbus Maxar Technologies

Figure 2-1: Location Plan

2.2 Existing Infrastructure

The proposed N63 route is located mainly in existing agricultural farmland. The route is bounded by a number of existing features such as the existing N63, residential properties and several community facilities. In addition, the Knockmoy Cistercian Abbey and the River Abbert provide constraints to the route development.

2.2.1 Existing N63

The existing N63 commences at Junction 19 with the M17 motorway to the south of Tuam and travels for a distance of 112km to Longford Town. Large sections of the route are substandard single carriageway with limited verges and pedestrian & cycle facilities. As the route passes through Abbeyknockmoy it passes a number of sharp and dangerous bends particularly near the existing Liss Bridge. The cross section in this area is typically composed of 2.7m wide carriageways in each direction with no verges. Numerous residential property entrances are also present and community facilities along the route.

2.2.2 Liss Bridge

The Liss Bridge spans the River Abbert and is located along the existing N63 in the townland of Liss, east of Abbeyknockmoy. The bridge is a seven-span masonry arch structure, built in circa 1800. Three of the seven arches carry the River Abbert while the remaining four arches act as flood relief arches in times of river flood. The bridge is approximately 27m long and 6.6m wide from edge of parapet to edge of parapet. The bridge is composed of two 2.5m wide carriageway lanes, with minimal rubbing strips and 0.5m thick masonry parapet walls. The bridge is recorded as a protected structure (reg no. 30405811) by the National Inventory of Architectural Heritage (NIAH). The NIAH records the description and appraisal of the structure as follows:

"Seven-arch limestone road bridge, built c.1800, over Abbert River. Round arches with rubble voussoirs to arch rings, random rubble to spandrels. Single triangular and semi-circular cutwaters to north-east face with cement coping with pipe inlaid. Random rubble parapet with flat rubble coping. Area of repair to north-west face, cut-stone voussoirs to northern two arches, squared and snecked limestone infill to spandrel panels and parapet, flat cut-stone coping. Set on N63 with random rubble walls to adjacent fields. This early nineteenth-century road bridge forms an imposing feature of the N63 road spanning the River Abbert near Abbeyknockmoy. There is evidence of early repairs and extensions as the road network throughout the county was improved. It's simple detailing exhibits evidence of local craftsmanship and materials and exhibits good quality traditional stone masonry."

Figure 2-2: Liss Bridge

2.2.3 Knockmoy Abbey Ruins

Knockmoy Abbey is located directly to the north of the proposed bridge location. The abbey is recorded on Record of National Monuments (RMP) and is protected under the National Monuments Acts 1930–2004. Numerous locations within the grounds of the abbey have been designated with National Monument status including the abbey structure, outbuilding, mill, graveyard, field systems and holy wells. The RMP describes the monuments as follows:

"On a gentle south facing slope in pastureland, near Abbeyknockmoy village, it overlooks the Abbert River to the south. A Cistercian monastery founded in 1189-90 by Cathal Crobderg O'Conor, King of Connnacht. A National Monument, the remain comprise a large conserved Transitional style church (east to west; length 60m) of early 13th century date consisting of an aisled nave, a chancel and two transepts. The chancel has a find ribbed vault and eastern windows, which the transepts both contain two barrel-vaulted chapels at their east ends. Three of the arches of the crossing are walled up, possibly 15th century work coeval with the insertion of the now largely ruined central tower. The north wall of the chancel bears 15th century mural painting depicting the Holy Trinity, the martyrdom of St. Sebastian and the Three Dead and Three Live Kings. The claustral buildings and ruined cloister lie to the south but only the east wing, including the sacristy, chapter house and a later graderobe, is well preserved. The ruins of a rectangular building (east-west, length 11.35m, width 5m) (GA058-004002), probably of post-medieval date, lie immediately to north. A modern mill, 325m to west is said to occupy the site of the original abbey mill (GA058-004005). A field system (GA058-004004) and three holy wells (GA058-004007) are also associated.

The monument was taken into Ownership under the National Monuments Acts 1930 to 2014 – National Monument 166."

Figure 2-3: Knockmoy Abbey

2.2.4 River Abbert

The River Abbert is a tributary of the Clare River and forms part of the Lough Corrib SAC (site code:000297). The SAC boundary extends to include adjacent wet grassland to the south of the river. Full evaluation of the Lough Corrib SAC (site code:000297) will be discussed in the subsequent chapters of this report. The river flows in an east west direction and is approximately 15m wide at the proposed bridge location.

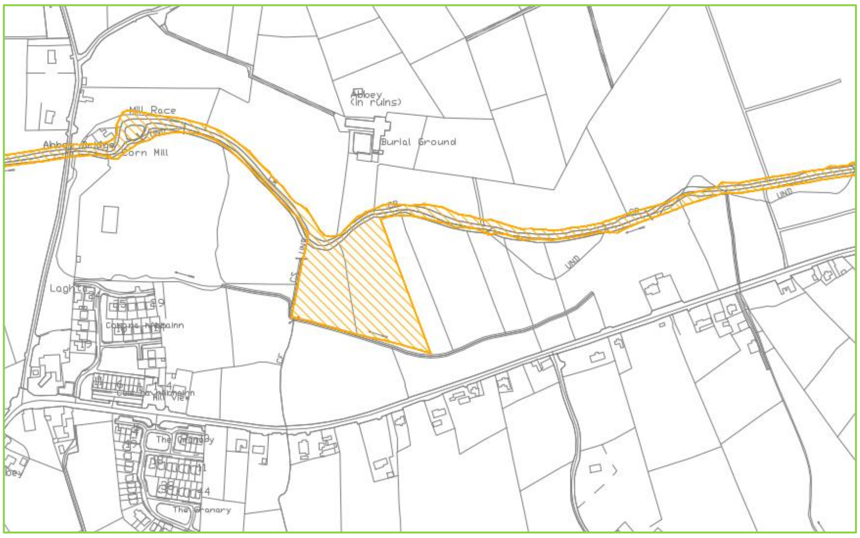


Figure 2-4: Abbert River and SAC (orange)

2.3 Proposed Infrastructure

2.3.1 N63 Proposed Alignment

The proposed N63 alignment will commence to the east of Abbeyknockmoy and proceed in a north eastly direction crossing over the River Abbert towards its tie in point east of the L3110. The proposed cross section is a Type 2 Single Carriageway including 3.5m carriageways, 0.5m hard strips and 2.5m wide verges. This proposed cross section has been determined to match the previous road improvement scheme completed to the west of Abbeyknockmoy. The proposed speed limit for the alignment will be 100 km/h. The horizontal curvature of the proposed alignment will require considerable sightlines particularly at the proposed bridge location. The proposed alignment will allow for the existing section of N63 to be downgraded and pedestrian/cyclist facilities introduced. The introduction of these facilities will require a reduction in the existing carriageway widths coinciding with the downgrade of the road.

Figure 2-5: Map of proposed N63 Alignment

3. Description of Structure and Options Considered

3.1 Introduction

The bridge will be designed in line with the standards set out in the Design Manual for Roads and Bridges (DMRB) as published by Transport Infrastructure Ireland (TII). The DRMB provides guidance for the requirements of the design of new bridge structures on the TII road network.

3.2 Geometry

3.2.1 Cross-section

The three bridge options detailed below assume a Type 2 Single Carriageway as the minimum desirable cross section at the bridge crossing location. The minimum bridge cross section will be 14m wide, composed as follows:

0.5m Parapet Edge Beam
2.5m Raised Verge
0.5m Hard Strip
3.5m Traffic Lane
3.5m Traffic Lane
0.5m Hard Strip
2.5m Raised Verge
0.5m Parapet Edge Beam

Where required the minimum cross-sectional width of the bridge shall be increased to accommodate sightlines and any requirements of the structural form.

At the bridge location the highway alignment assumes a standard cross fall of 2.5% falling from the centre of the carriageway.

3.2.2 Vertical Alignment

The vertical alignment of the bridge has been determined based on a minimum required clearance envelope of 3m above the riverbank of the River Abbert. For all options the alignment spans the River Abbert on a vertical curve with a K value of 100 over a length of 392m.

3.2.3 Horizontal Alignment

The proposed bridge is located in the transition zone between two horizontal curves. The alignment crosses the River Abbert at a skew of 57 degrees. This skew creates a difficult bridge arrangement and may not be technically feasible. All options presented below have been developed with a reduced skew of 45 degrees max. In addition, a minimum 5m offset has been provided to the bridge abutments from the top of riverbank reducing the risk of impacting on the river during construction. In addition the 5m offset provides a maintains a pathway along the edge of the river for wildlife and river users.

3.3 Options Considered

Three options have been considered as part of this report which focuses on different structural forms based on material capabilities.

The following assumptions have been made:

- The bridge will be a single span structure over the River Abbert and the SAC;
- The minimum cross-sectional width of the bridge shall be 14m;
- Where required the bridge width will be widened for sightlines and any structural form requirements;
- Minimum headroom of 3m shall be provided beneath the bridge span;
- The maximum allowable skew angle shall be 45 degrees or less;
- The minimum offset for abutments from the top of riverbank shall be 5m.

3.3.1 Option 1 – Precast Portal Frame

Option 1 is a buried precast portal frame solution. The frame will span perpendicular to the River Abbert with an internal span of 20.5m. The bridge will consist of 33 precast units each 2m wide with a total structure width of 66m. The structural depth of each unit will be a minimum of 500mm, increasing to 750mm at the chamfers provided at the supports. The bridge will be designed as buried structure with a minimum of 600mm 6N fill to the top of the portal frame, this fill material will act to disperse the vertical loading helping to reduce the load concentration and reinforcement requirements.

Spanning perpendicular to the river results in large dead zone areas on either side of the carriageway, it is assumed that no vehicular access will be provided to these dead zones with a vehicle restraint system provided parallel to the carriageway to retain accidental vehicles. A timber post and rail fence will also be provided at the edge of the structure to prevent falls from height in the event of pedestrian access.

Precast gravity retaining wingwalls will be provided to retain the earthworks on approach and departure to the structure. These earthworks will be significant and protrude outwards from the highway alignment due to the large width of the bridge Large areas of exposed concrete at the wingwalls will be finished with a pattern profile finish to improve aesthetics and avoid large areas of plain concrete.

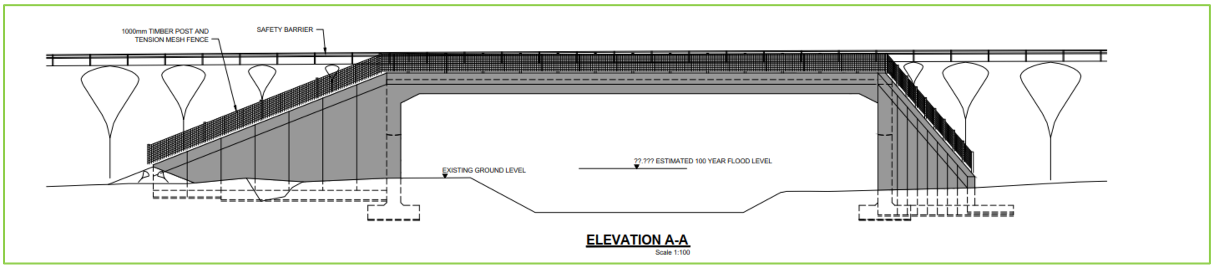


Figure 3-1: Precast Portal Frame Elevation

3.3.2 Option 2 – Steel Girder

Option 2 shall be a composite steel bridge spanning the River Abbert. The superstructure shall be formed of 6 no. braced weathering steel I Girders at 2.53m centres. The option has been developed with a skew angle of 35 degrees and a maximum span length of 60.5m from centre of bearing to centre of bearing. The total bridge width shall be 15.65m which includes the minimum required cross sectional width plus additional verge widening to account for carriageway sightlines at the south west and north east corners. To improve aesthetics the girders shall be fabricated with a varying arched profile soffit with a maximum structural depth at the abutments of 2.5m and a minimum structural depth of 1.8m at the centre of the span. An insitu concrete deck 250mm thick shall be provided to span between the steel girders with parapet edge beams also be provided to the edge of the deck. The use of a single span structure will minimise the need for temporary falsework and formwork over the river during construction. Instead permanent nonparticipating formwork will be utilised between the beams to form the insitu concrete deck. This will help minimise the construction time on site and reduce the risks of working over water.

Weathering steel while uncommon in Ireland provides significant advantages and reduced maintenance costs over the design life of the bridge when compared to the painted steel equivalent. DN-STR-03002 Weathering Steel for Highway Structures highlights the limitations on the use of weathering steel based on the bridge location and geometry. Option 2 has been developed to ensure that these limitations do not apply, and that weathering steel can be utilised.

A span length of 60.5m will result in significant thermal expansions and contractions of the bridge. To this end bridge bearings will be provided at both abutments to accommodate movement. The articulation of the structure will need to consider the most appropriate locations for the expansion bearings to allow longitudinal and transverse movement to occur, in addition the locations of fixed bearings will also need to be considered. The expansion bearings will permit both translational and rotational movements while fixed bearings only allow rotational movements. The types of bearings and the articulation will be determined at detailed design.

The substructure shall be formed using full height concrete abutments supported on insitu concrete foundations. The type of foundations will be determined at preliminary design based on the Ground Investigation data. The approaches to the bridge abutments will be formed of compacted acceptable 6N/6P backfill material. The backfill layer will be designed, detailed, specified and constructed with plant and compaction methods appropriate to the requirements in accordance with TII CC-SPW-00600 for fill to structures. An inspection gallery shall be provided to the rear of the abutment to facilitate access to the bearing shelves for inspection and maintenance in accordance with DN-STR-03012 – Design for Durability.

Insitu cantilever wingwalls and gravity retaining walls will also be provided to retain the earthworks on approach and departure to the structure. Large areas of exposed concrete at the abutments and wingwalls will be finished with a pattern profile finish to improve aesthetics and avoid large areas of plain concrete.

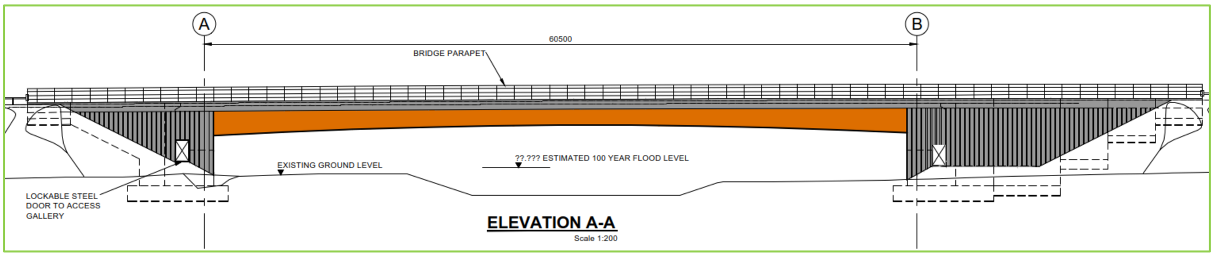


Figure 3-2: Steel Girder Elevation

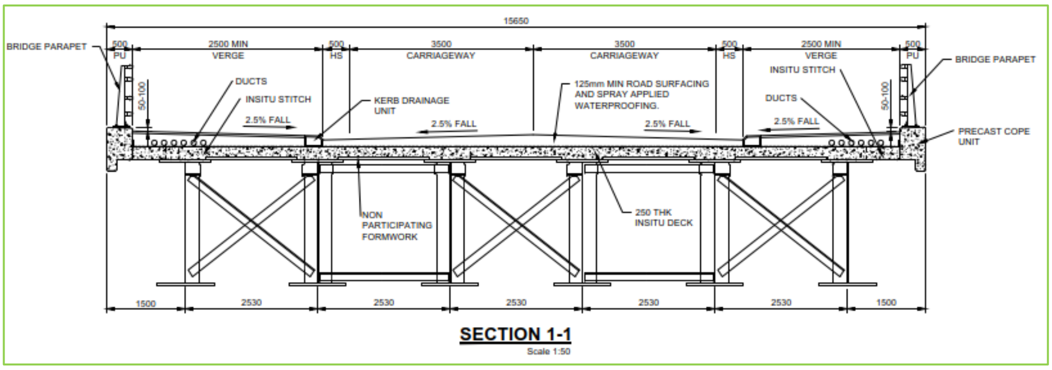


Figure 3-3: Steel Girder Cross Section

3.3.3 Option 3 – Precast Beam

Option 3 proposes a fully integral single span precast prestressed beam bridge spanning the River Abbert. The bridge shall be formed using 8 No. W19 precast concrete beams at a spacing of approximately 3m. The option assumes a skew angle of 40 degrees between the abutment and highway alignment. This results in a beam span of 45m from centreline of abutment to centreline of abutment. This is the maximum typical span length for this type of beam; however, longer spans are possible (up to 49m) through increased concrete strengths and reinforcement. The skew results in large areas of dead zone on either side of the carriageway alignment, it is assumed that these dead zones will be combined with the minimum required 2.5m raised verge. A 250mm thick insitu concrete deck shall span transversely between the precast beams with parapet edge beams also provided to the edge of the deck. This results in a total bridge width of 25.6m from parapet edge beam to parapet edge beam. The overall structural depth of this option shall be 2.55m composed of 2.3m deep W19 precast beams and 0.25m insitu concrete deck. The use of a single span precast structure will minimise the need for temporary falsework and formwork over the river during construction. Instead permanent formwork will be utilised between the beams to form the insitu concrete deck. This will help minimise the construction time on site and reduce the risks of working over water.

Integral connection between the superstructure and substructure shall be created using insitu concrete diaphragms at each abutment which create a fully fixed structure transferring loading between the elements.

The substructure shall be formed using full height concrete abutments supported on insitu concrete foundations. The type of foundations will be determined at preliminary design based on the Ground Investigation data. The approaches to the bridge abutments will be formed of compacted acceptable 6N/6P backfill material. The backfill layer will be designed, detailed, specified and constructed with plant and compaction methods appropriate to the requirements in accordance with TII CC-SPW-00600 for fill to structures. Insitu cantilever wingwalls and gravity retaining walls will also be provided to retain the earthworks on approach and departure to the structure. Large areas of exposed concrete at the abutments and wingwalls will be finished with a pattern profile finish to improve aesthetics and avoid large areas of plain concrete.

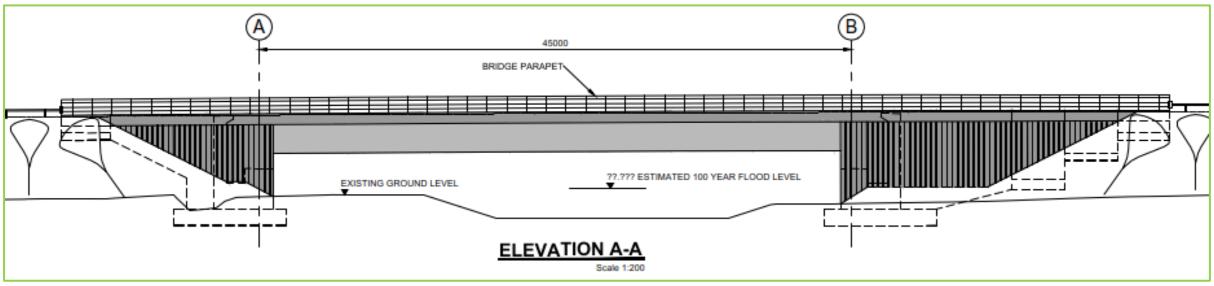


Figure 3-4: Precast Beam Elevation

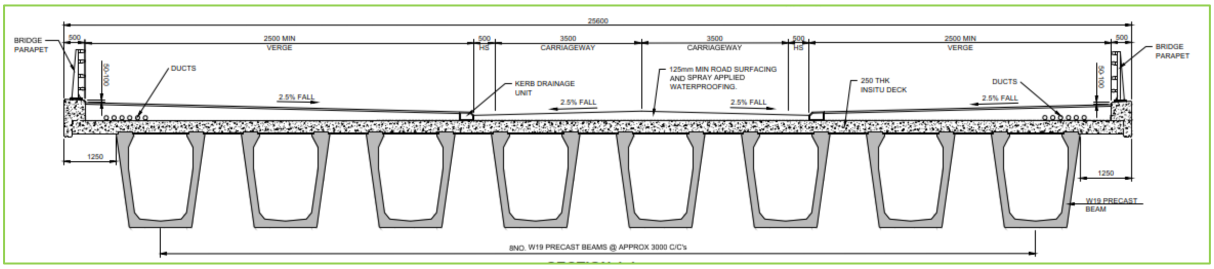


Figure 3-5: Precast Beam Cross Section

4. Technical Evaluation

4.1 Introduction

The options presented above will undergo a technical evaluation and comparison under a range of headings. The evaluation will help to identify structurally the advantages and potential pitfalls of each option when viewed against the others.

4.2 Design Life

The design working life for all options will be a minimum of 120 years as defined in the TII publication, DN-STR-03012 - Design for Durability. Maintainable elements and components listed below are subject to greater wear and will require replacement within the design life. Careful design and detailing combined with thorough routine inspections, quality control and supervision on site will help achieve the minimum expected design life listed in Table 4.1 below:

Component	Years
Bridge Bearings	50
Expansion Joints	50
Parapets	50
Drainage Systems	50
Deck Waterproofing	50
Steelwork Paint Systems	20

Table 4.1 - Minimum Design Life for Structural Elements

4.3 Structural Analysis and Design

The preferred bridge option will be designed in line with the requirements of the Design Manual for Roads and Bridges (DMRB) and any other relevant standards from TII. The bridge will also be designed in line with the Eurocode Standards, as transposed in the Irish National Standards and Annexes.

Option 1 the portal fame will be designed as fully integral buried structure based on metre strip design for the worst-case loading location. The worst-case location will need to be identified based on the skewed road alignment and predicted loading and the depth of fill above the structure. The minimum allowable depth of fill shall be 600mm and it shall be assumed that all load disperses through the fill at an angle of 45°.

The design of Option 2 shall be based on a skewed grillage analysis with longitudinal line elements representing the superstructure beams. The insitu concrete deck shall be modelled using transverse line elements. The articulation of the grillage model will be based on the required bridge bearing articulation. A number of sub models will be used to analyse the substructure abutments with loading applied based on the results of the grillage model. The founding stratum will be idealised as springs with a lateral and vertical stiffness relative to the material properties.

Option 3 shall also be designed based on a skewed grillage analysis similar to Option 2; however, the abutments and foundations shall be modelled as fully integral with the superstructure grillage model and idealised as vertical line elements. The founding stratum and fill to the rear of the abutment will be idealised as springs with a lateral and vertical stiffness relative to the material properties. The soil structure interaction to the rear of the abutment will need to be considered in detail to ensure the effects of thermal expansion and contraction of the precast beams are accounted for.

The loading applied to the structure will be based on the requirements of IS EN 1991-1-1 to IS EN 1991-1-8 and IS EN 1991-2. For all options the load combinations used in the design will be in accordance with those outlined within IS EN 1990. The section capacities and element designs will be carried out using hand calculations and design software, such as Autodesk Structural Bridge Design. Concrete sections will be checked for Ultimate Limit State (ULS) and Serviceability Limit State (SLS) conditions in accordance with Eurocode 2: Design of Concrete Structures, IS EN 1992-1-1 and IS EN 1992-2 and the Irish National Annexes. All steel elements will be designed for the ULS conditions outlined in Eurocode 3: Design of Steel Structures, IS EN 1993-1-1 and IS EN1993-2 and the Irish National Annexes.

4.4 Classification

All structures are classified based on a range of categories from 0 to 3 depending on a number of factors related to the structural and geotechnical complexity of the design. The checking requirements and form of certificates required for a structure are dependent on this structure category.

Options 1 and 3 presented above shall be Category 2 Structures as they lie outside the requirements for category 0, 1 and 3 structures in accordance with DN-STR-03001. Category 2 structures require a check from an independent checking team that may be from the same organisation as the design team.

Option 2 will be a Category 3 structure due to a single span in excess of 50m in accordance with DN-STR-03001 and will require a check from an independent checking team that must be from a separate organisation to the design team. The checking team must have their own Professional indemnity insurance in addition to sufficient knowledge and previous experience in similar designs.

4.5 Bearings and Joints

Bridge bearings and expansion joints will be used in varying degrees across the bridge options. Bridge bearings will be in accordance with the clauses set out in DN-STR-03004 – “Bridge Bearings. Use of BS 5400: Part 9:1983”. Expansion joints will be designed in accordance with DN-STR-03006.

Option 1 and 3 shall be fully integral structures which will omit the need for bridge bearings and expansion joints at the support locations.

Option 3 will be fully articulated requiring bridge bearings at the support locations to accommodate the predicted thermal expansions and contractions. The type of bearings will be determined at preliminary design based on the required movements. Bridge expansion joints will also be required at the back of the abutment to ensure a continuous surface across the bridge deck.

4.6 Parapets & Safety Barriers

For Options 2 and 3 the bridge parapets will be provided to the edge of each structure on dedicated parapet edge beams. The parapets will be designed with a minimum containment level of H2 based on the requirements of DN-STR-03011 - The Design of Vehicle and Pedestrian Parapets. This is the minimum requirement for all structures on the national road network. The parapet shall also have an impact severity level of B and a working width not exceeding W4. The minimum height of the pedestrian parapet shall be 1.25m above the top of the surfacing, this height includes the minimum plinth height of 50mm above surfacing level.

A bridge parapet shall not be provided on Option 1, instead a road safety barrier supported on a ground beam shall be provided within the verge parallel to the carriageways. This safety barrier shall also be designed with a minimum containment level of H2 based on the requirements of DN-REQ-03034 The Design of Road Restraints Systems (Vehicle and Pedestrian) for Roads and Bridges. A timber post and tension mesh fence shall be provided to the edge of the structure to prevent falls from height for users. This fence shall be 1.0m high designed in accordance with DN-STR-03005.

5. Economic Evaluation

5.1 Introduction

The cost of all options will vary considerably and will be dependent on the developments of the conceptual design. The length of the span, structural form and material will have a major impact on the total construction cost of the bridge. At conceptual design stage, the choice of materials and quality of finish may have a large effect on the cost of the structure. All rates given below are published in Spon's Civil Engineering and Highway Works Price Book 2020 in pounds sterling and converted to euro using a conversion rate of 1:1.16 correct at the time of writing this report. As the design is not sufficiently developed at this stage, AECOM recommend using an "all-in" construction rate per m^2 as detailed below in the tables. A professional consultancy fee, ex. VAT, has also been provided for, this fee is based on full detailed design, checking and full site supervision during construction.

5.2 Option 1 Economic Evaluation

Description	Quantity	Unit	Rate	Amount (€)
Precast Portal Frame	1725	m^2	3000	€ 5,175,000.00
Total Construction Cost				**€ 5,175,000.00**

Table 5.1 – Option 1 Economic Evaluation

5.3 Option 2 Economic Evaluation

Description	Quantity	Unit	Rate	Amount (€)
Steel Girder	1050	m^2	4500	€ 4,725,000.00
Total Construction Cost				**€ 4,725,000.00**

Table 5.2 – Option 2 Economic Evaluation

5.4 Option 3 Economic Evaluation

Description	Quantity	Unit	Rate	Amount (€)
Precast W19 Beams	1329	m^2	4000	€ 5,316,000.00
Total Construction Cost				**€ 5,316,000.00**

Table 5.3 – Option 3 Economic Evaluation

6. Aesthetic Evaluation

6.1 Introduction

As the three options are progressed and evaluated, the basic principles of bridge aesthetics should be incorporated and considered. These principals are described as follows:

- Expression of Function – it is generally accepted that a bridge should clearly express its overriding function. This is considered the basis of good design and any adjustments or additions to the form should add to the expression of functionality and not detract from it;
- Form – the form should derive from the function of the bridge. The form will be justified based on the loading, the clearance requirements, construction issues and the environmental needs. In certain cases, the form will be derived based on the nature of a site;
- Character – a bridge should always be a natural addition and have a permanent association with its setting and surroundings;
- Detail – the quantity and quality of the most minor details are critical to the scale, proportion and perceived attention to the aesthetics of the bridge;
- Scale – the scale of the bridge relates to its overall feeling when viewed against the overall landscape. The scale of the bridge may be large and oppressive or small and intimate all based on detail and form;
- Proportion – this is the sizing or proportion of the structural elements to each other. It is generally preferred to maintain a simple mathematical relationship or ratio throughout the major elements of the bridge; and
- Environmental Intrusion – it is always preferred to minimise the intrusion of a bridge or structure on its surrounding landscape.

6.2 National Monuments

The character of the bridge will be directly linked to the surrounding landscape and particularly the historical protected structures in the area. As discussed above, the Knockmoy Abbey, a National Monument is located within 350m of the proposed bridge location. Sensitivity to the conservation and management of this asset will be central to the approach in determining a viable and sustainable river crossing. The historic buildings have a long-standing direct relationship with the river and any proposed structure needs to ensure that it does not sever existing visual and physical connections. The appropriate design and materials will be seen as a vital. This involves an adjustment of mind-set to embrace the heritage along the river corridor rather than regarding it as a constraint.

Significant embankments on approach and departure to the structure will be of concern due to effects on the sight lines essentially acting as a visual barrier on views from the National Monuments to the surrounding undulating agricultural landscape. The preferred option will need to carefully consider these sight lines including views of the bridge from the monuments and vice versa. These sight lines will need to be considered during both hours of daylight and darkness. The structural depth of the options will be key to reducing the approach embankment height and minimising the effects on the abbey. Option 3 will have the largest structural depth and as a result will require higher embankments having the largest effect on view from the monuments. Option 2 will have a slightly smaller structural depth; however, the addition of an arched soffit improves the proportion and scale of the bridge when viewed from the abbey. Option 1 will likely have the thinnest structural depth; however, the significant dead space and additional retained embankment fill parallel to the river is likely to increase disruption to the visual landscape when compared to the other two options.

6.3 Materials and Finishes

The proposed bridge should not detract from the surrounding environment and if the design and choice of materials is carried out carefully the structure itself can potentially add life to the area. The choice of concrete finish and shape of the bridge elements will have a negligible impact on costs but can offer significant improvements to the visual aesthetics. Making the bridge as simple and elegant as possible will complement the landscape, which is a practical, cost effective approach to a visually attractive bridge solution.

The advantage of concrete for Option 1 and 3 is that it can be cast using bespoke exterior formwork to have a wide range of patterned finishes, in addition vertical concrete faces such as wingwalls can be clad in masonry blockwork to create a physical connection to masonry abbey structure creating a consistency of form. Consistency of form is an important aesthetic consideration and depends on materials, proportion, colour and details specified. Additionally, the form liners can produce concrete surfaces which avoid streaking. Surfaces with closely spaced vertical ribs or grooves can encourage channelling of rainwater or seepage. The quality of formed concrete finish can range from U1 to U5 and F1 to F5 as is detailed in CC-SPW-01700 with F5 being the highest quality finish. Fabricating the concrete elements off site can provide a higher quality of concrete finish in accordance with CC-SPW-01700.

Steel is more defined in its structural shape and as with the proposals for Option 2 can be formed to create an arched soffit profile which is aesthetically more desirable. The option also assumes the use of weathering steel rather than painted steel due to the reduced maintenance requirements which will be discussed further in the following chapter. The colour of the weathering steel with its brown and orange tones can create a more attractive appearance when compared to the concrete options. These colours can blend with the surrounding landscape particularly in autumn. The weathering steel changes colour over its lifetime, when the patina layer of rust first forms it takes on a yellow shade. When left uncoated, this colour will gradually shift to a vibrant orange before settling to a dark red after several years of exposure. The speed of the colour transition is dependent on the frequency of wet and dry cycles the steel undergoes.

Finally, the addition of bespoke parapets can add character to a bridge while maintaining the safety of the user. There is scope to increase the aesthetic of the parapets within the infill areas between the main parapet posts. The parapets can be designed in a number of finishes such as painted steel which can add contrast to the bridge superstructure material.

7. Evaluation of Durability and Maintenance Requirements

7.1 Introduction

Maintenance of the bridge will be required throughout the 120-year design life. The type and cost of maintenance will have a large effect on the Total Lifecycle cost of the bridge. Further to this, the proposed bridge options contain various articulation arrangements which may pose large maintenance costs throughout the design life.

7.2 Maintenance and Inspection Regime

Inspections of the N63 Bridge will be required regularly throughout its service life. The inspections will be carried out in line with the TII EIRSPAN Bridge Management System. The EIRSPAN system was introduced in 2001 to provide an integrated management system for the bridges in Ireland. The system coordinates activities such as inspection, repairs and maintenance work to ensure optimal management of the bridge stock.

The EIRSPAN system recommends the following intervals for inspections:

- General Inspection to be undertaken every 2 years; and
- Principal inspection to be undertaken at least every 6 years.

The above recommendations are the maximum recommended intervals and are dependent on the condition of the bridge and levels of deterioration since the previous inspection. If high levels of deterioration are identified the inspection interval should be decreased.

For all three options inspection and maintenance to the top deck, parapet systems, road safety barriers and expansion joints will be carried out from road level. Inspection of the superstructures, deck soffits and parapet edge beams will be carried out from an underbridge unit positioned on the top of deck. The positioning of an underbridge unit should consider safe working limits and any requirements for working from height and working over water. Traffic Management and lane closures maybe required during inspection using an underbridge unit. Inspection and maintenance of the bridge abutments and substructure elements can be carried out from the riverbanks. Option 2 will require increased inspection and maintenance requirements due to the larger number of connections and members associated with the steel superstructure.

An inspection gallery will also be provided to the rear of each abutment for Option 2. The gallery will provide access for inspection, maintenance and replacement of the bridge bearings and underside of the movement joint. A lockable steel door will be provided to prevent unauthorised access to the inspection gallery in accordance with DN-STR-03012.

7.3 Bearings

As previously discussed, the use of bearings will be avoided with Option 1 and Option 3 by using a fully integral design. The soil structure interaction for the fill to the rear of the bridge abutments will need to be considered at detailed design to ensure the expansion and contraction of the integral structure can be accommodated.

Option 2 by comparison will have bearings at both abutments that will be designed to ensure a minimum design life of 50 years according to DN-STR-03012. Bearings are required due to the length of the bridge and the predicted movements of the structural members under loading particularly thermal effects. Bearings which maximise the use of stainless-steel components should be specified to maximise resistance to environmental factors and exposure classes.

Proper inspection and maintenance of the bridge should allow bearings to meet and exceed the 50-year design life. Maintenance works such as painting, and lubricating should be carried out as required to maximise the design life. As the replacement of bearings will likely be a large cost item, with bearings scheduled to be replaced twice over the 120-year design life the preferred option should be designed to allow for easy access to bearings and bearing shelves with good detailing maximising the efficiency of replacement. To this end an inspection gallery will be provided to the rear of each abutment for Option 2 to provide access to the bearing shelves.

7.4 Expansion Joints

The fully integral structure proposed for Option 1 and Option 3 will not require the use of any bridge deck expansion joints.

Option 2; however, will require expansion joints at the back of the deck above the inspection galleries. Expansion joints are required due to the length of the bridge, to accommodate bridge bearings and to allow for the movements of structural members under loading or thermal effects. The type of joint will be determined at detailed design based on the likely movements within the bridge.

Expansion joints that are correctly designed allow the movement of the bridge at the expansion gaps while providing a continuous surface for users. Expansion joints are weak points in the structural continuity of the bridge. They must be correctly installed and maintained to prevent leakage and ingress from the upper deck surfaces to lower or internal surfaces and protected bearings. Expansion joints in the structure, will be required to remain watertight for a minimum of 10 years of opening. The joint should be appropriately sealed to prevent the ingress of water.

7.5 Materials

The preferred construction material will have a significant effect on the maintenance and inspection requirements for the bridge.

Options 1 and 3 are both reinforced concrete structures. Reinforced concrete as a structural material can be relatively robust if designed correctly and maintained properly. Minimum cover requirements will need to be satisfied correctly in accordance with the environmental conditions and the correct steel quantities will need to be used to avoid cracking during curing or under live or thermal loading effects. If cracks develop in the concrete to a sufficient depth the reinforcing steel can be attacked and corroded by water and de-icing salts penetrating the concrete. This can lead to the corrosion of the reinforcing steel, reducing the reinforcement area and causing further cracking and spalling of the concrete. Inclement weather conditions must be considered when pouring concrete on site outside of a controlled factory environment; rainwater can get trapped in the formwork and alter the water to cement ratio and temperature changes can affect the rate of curing leading to cracking or a reduction in strength.

All buried concrete surfaces will be treated with two coats of epoxy resin and all exposed concrete faces will receive a hydrophobic pore lining impregnation in accordance with TII publication, DN-STR-03012 - Design for Durability. Concrete bridge decks will require spray applied waterproofing and be robust to withstand direct foot traffic in accordance with DN-STR-03009 – Waterproofing and Surfacing of Concrete Bridge Decks. Concrete structures will be designed taking account of the minimum concrete and steel grades specified in DN-STR-03012.

Option 2 proposes the use of a weathering steel superstructure. Weathering steel requires less maintenance than stainless or painted steel so therefore would be more cost efficient over its design life. DN-STR-03002 Weathering Steel for Highway Structures highlights the constraints on the use of weathering steel based on the bridge location and geometry. Option 2 has been developed to ensure that these constraints do not apply, and that weathering steel can be utilised. Weathering steel is a form of a specialised steel alloy that is chemically developed to ensure the development of a stable rust-like appearance that can resist corrosion and abrasion. A stable rust like protective layer develops on the surface of the steel which is also known as the patina layer. The design of weathering steel requires the inclusion of a sacrificial steel thickness that is broken down during the development of this patina layer. If damage is caused to the patina layer during the design life the patina continuously redevelops and regenerates repairing the damage under normal weather cycles. Studies have shown that bridges fabricated from unpainted weathering steel can achieve a design life of 120 years with only nominal maintenance. It should be noted that special welding techniques and materials are needed during bridge fabrication to ensure that weld-points weather at the same rate as the other main steel elements and ensure they do not become weak points in the structure during the 120-year design life.

8. Hydraulic Considerations

8.1 Introduction

Construction of a new structure in any landscape has the potential to impact the surrounding area's likelihood to flood. As the bridge spans the River Abbert it is likely that works may affect the predicted flood levels by reducing the available flood plain storage. The potential flooding impacts caused due to the construction of a new structure should not be ignored and the potential for flooding should be investigated.

8.2 Flood Risk Assessment

A standalone Flood Risk Assessment (FRA) for the Proposed Development has been undertaken in line with 'The Planning System and Flood Risk Management – Guidelines for Planning Authorities'. This FRA consists of three primary parts as further detailed below.

8.2.1 Stage 1 – Flood Risk Identification

The Stage 1 element of the FRA examined existing available sources of data to determine if there was any likelihood of flooding. This included the following sources:

- Hydrometric Data
- OPW Flood Hazard Maps
- OSi Historical Mapping
- OPW Land Benefitting Maps
- OPW CFRAM Mapping &
- Galway County Development Plan

Of particular interest was the OSi Historical Mapping which highlighted lands both north and south of the river as "Liable to Floods", see Figure 8-1. Also, OPW Land Benefitting Maps which indicated that a significant area of "Benefitting Land" was present along with main and secondary arterial drainage channels.

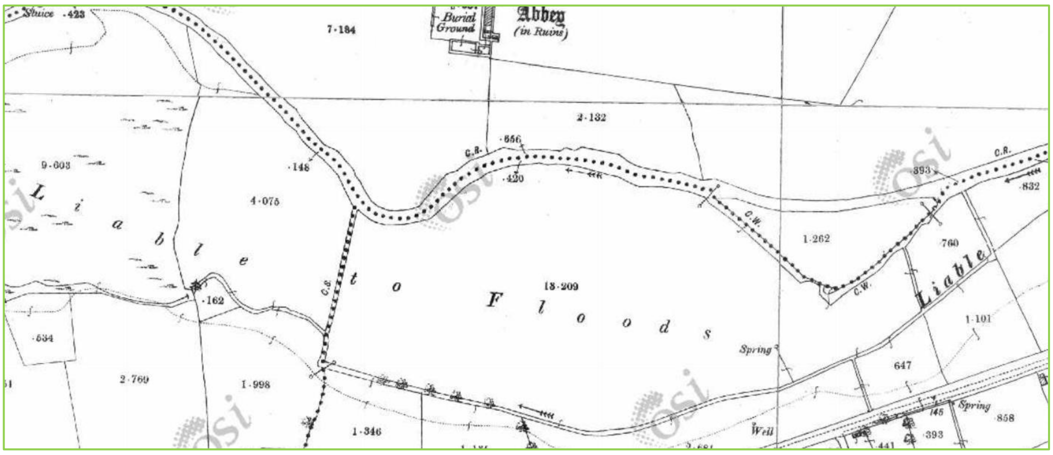


Figure 8-1: Historic 25 Inch Mapping for the River Abbert

The Stage 1 element concluded that "Fluvial flooding is likely in the vicinity of the River Abbert however no definite floodplain extents are available from historic and current information."

8.2.2 Stage 2 – Initial Flood Risk Assessment

The Stage 2 element of the FRA determined that the Proposed Road Development, as Primary Transport Infrastructure, should be considered to be a highly vulnerable development.

The lack of information available prohibited the designation of a flood zone at the development site. Based on the information collated in Stage 1, it is likely that fluvial flooding will occur in the vicinity of the River Abbert and therefore both Flood Zone A and Flood Zone B will be present.

The Stage 2 element of the FRA concluded that "In order to determine the flood extents and level for the Proposed Road Development, a Stage 3 Detailed FRA is required."

8.2.3 Stage 3 – Detailed Flood Risk Assessment

The Stage 3 element of the FRA comprised the following tasks:

- Assessment of flow using industry standard best practice; A 1% AEP flow estimate of 48.6m3/s was calculated using the FSR-6 method. A corresponding flow hydrograph was produced using the unit hydrograph method to allow unsteady hydraulic analysis to be undertaken. The resultant 0.1% AEP flow of 63.1m3/s was obtained through scaling.
- Baseline model development; A linked 1D-2D hydraulic model representative of the current/baseline conditions was developed in Infoworks ICM modelling software. This was developed from hydrographic survey data obtained by Murphy Surveys in May 2020. This included the existing N63 Liss Bridge and the L2128 bridge along with the substantial weir structure at the former corn mill.
- Determination of Flood Zones; Baseline model runs were undertaken for the 1% and 0.1% AEP flow events using the developed baseline model. This allowed determination of the extents of Flood Zones A, B and C.
- "Proposed without Mitigation" model development; The proposals were added to the baseline model which included the approach embankments, River Abbert bridge and other culverts based on a hydraulic and structural basis only. This model scenario was then ran using the 1% and 0.1% AEP flows which demonstrated an increase in flood level and extents upstream of the crossing and a subsequent reduction downstream.
- "Proposed with Mitigation" model development; Alterations were made to the "Proposed without Mitigation" to reduce the impact of the proposals. This included the provision of additional flood connectivity culverts (2No. south of the bridge, 1No. north of the bridge) through the approach embankments and upsizing of 2No. watercourse culverts. This model scenario was then ran using the 1% and 0.1% AEP flows which still demonstrated an increase in flood level and extents upstream of the crossing and a subsequent reduction downstream however this was much reduced in comparison with the "Proposed without Mitigation" scenario and within acceptable limits.

8.2.4 Climate Change Considerations

The Flood Policy Review Report (2004) produced by OPW states that climate change considerations should be taken into consideration when undertaking flood risk assessments. Sensitivity testing was undertaken for the MRFS only by increasing the flood flow estimates by 20% respectively. It should be noted that the 0.1% AEP event is equivalent to the HEFS and therefore this was already being considered.

8.2.5 Flood Levels and Freeboard Provision

The 1%+CC (MRFS) AEP flood level at the River Abbert bridge has been determined from the modelling exercise to be 39.62mOD upstream and 39.45mOD downstream. Freeboard provided at the lowest soffit point of the crossing is circa 2.88m. The freeboard provision is greatest at the centre due to the arched shape of the bridge beams.

9. Environmental Considerations

9.1 Introduction

The potential environmental effect of the bridge construction must be considered as part of project planning. The impacts on human health, biodiversity, the landscape and climate are just a few of the factors to be considered. The magnitude of the environmental impacts will be related to a number of factors such as the location, quantity and choice of materials, span and structural form etc. It is likely that an Environmental Impact Assessment (EIA), Environmental Impact Assessment Report (EIAR) and/or an Appropriate Assessment (AA) will be required for this project.

9.2 Environmental Impact Assessment

The work related to the EIA will be carried out and completed as part of the planning application to An Bord Pleanála. The design team will maintain a constant stream of communication with the EIA team throughout the progression of the River Abbert Bridge design. The submission of the EIA works will be in accordance with Section 51 of the Roads Act 1993

A number of other aspects will be investigated and assessed as part of the EIA; a full list of the EIAR proposed chapters to be produced by the EIA team is given below:

- Chapter 1: Introduction;
- Chapter 2: Need for the Proposed Road Development and Planning Policy;
- Chapter 3: Examination of Alternatives;
- Chapter 4: Project Description; and
- Chapter 5: Traffic Analysis.
- Chapter 6: Population and Human health;
- Chapter 7: Biodiversity;
- Chapter 8: Land & Soils (incorporating Soils, Geology and Hydrogeology);
- Chapter 9: Water (incorporating Water Quality and Hydrology);
- Chapter 10: Air Quality;
- Chapter 11: Climate;
- Chapter 12: Noise and Vibration;
- Chapter 13: Landscape;
- Chapter 14: Cultural Heritage;
- Chapter 15: Major Accidents and Disasters;
- Chapter 16: Material Assets (Non-Agriculture);
- Chapter 17: Material Assets (Agriculture)
- Chapter 18: Interactions of the foregoing; and
- Chapter 19: Mitigation and Monitoring Measures

9.3 Appropriate Assessment

The obligation to undertake an AA derives from Article 6(3) and 6(4) of the Habitats Directive. The first stage of an AA is to establish whether, in relation to a particular plan or project, an AA is required; this is termed AA screening. Its purpose is to determine whether the bridge could have significant effects on a Natura 2000 site in view of the site's conservation objectives. AA screening requires that potential sources of impact on Special Areas of Conservation (SAC) and Special Protected Areas (SPA) are taken into consideration.

The stages in the AA process are:

- Stage 1 – Screening for AA;
- Stage 2 – AA;
- Stage 3 – Alternative Solutions; and
- Stage 4 – Imperative Reasons of Overriding Public Interest (IROPI)

9.4 Surrounding Environment

9.4.1 Designated sites and protected areas

A number of designated sites are located near the proposed bridge location. Designated sites can be Special Protection Areas (SAC), Special Areas of Conservation (SAC) and National Heritage Areas (NHA). Each designated site type is protected under Irish and European Law due to the recognised qualifying interests of the site be they natural, ecological or cultural values.

The River Abbert forms part of the Lough Corrib SAC (000297) and as such will be crossed by the proposed alignment. In addition, a second designated site Killaclogher Bog NHA (001280) is located some 2km south west of the bridge location. The table below provides a list of the qualifying interests for each site.

Designated Site (and site code)	Qualifying Interests
Lough Corrib SAC (000297)	• Oligotrophic waters containing very few minerals of sandy plains(Littorelletalia uniflorae); • Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea • Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. • Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation; • Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) • Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) • Active raised bogs; • Old sessile oak woods with Ilex and Blechnum in the British Isles; • Degraded raised bogs still capable of natural regeneration; • Depressions on peat substrates of the Rhynchosporion; • Calcareous fens with Cladium mariscus and species of the Caricion davallianae; • Petrifying springs with tufa formation (Cratoneurion); • Alkaline Fens; • Limestone pavements; • Bog woodland; • Lesser Horseshoe bat (Rhinolophus hipposideros); • Atlantic Salmon (Salmo salar); • Otter (Lutra Lutra); • White-clawed Crayfish (Austropotamobius pallipes); • Freshwater Pearl Mussel (Margaritifera margaritifera) Sea Lamprey (Petromyzon marinus); • Brook Lamprey (Lampetra planeri); • Lesser Horseshoe Bat (Lesser Horseshoe Bat); • Slender Green Feather-moss (Drepanocladus vernicosus); • and Slender Naiad (Najas flexilis)
Killaclogher Bog NHA (001280)	• Peatlands

Table 9.1- Designated Sites Qualifying Interests

9.5 Materials

When comparing materials and their impact on the surrounding environment it is imperative to take into account the embodied energy and operational energy requirements. The affects due to steel and concrete production and construction can be comparable in terms of total energy requirement, natural resource consumption and quantity of harmful air emissions.

Concrete production and construction have a greater level of energy consumption compared to other materials. This is associated with the increased quantity of on-site formwork and falsework required, greater transportation costs due to larger and heavier mass of materials and the lengthier installation process with less opportunities for off-site fabrication and additional time allocated for casting and curing of the concrete. Structural concrete use and its energy consumption is linked with the production of a number of harmful emissions including CO_2, CO, NO_2 and hydrocarbon emissions.

Pre-cast concrete solutions should be maximised where possible. Pre-cast solutions reduce the installation time on site, reduce the transportation requirements involved with delivery of the wet concrete and steel rebar and lower the amount of personnel required on site. Pre-cast concrete members are designed in highly optimised and efficient factories so the waste material associated with cast-in-place solutions can be combatted.

In contrast, steel production and construction associate more with the release of volatile organic compounds and hard metal emissions (Cr, Ni, Mn) due to the painting, welding and fabrication involved. Steel solutions can be nearly completely fabricated and assembled in the factory with very high precision. This minimises the material waste and waste disposal requirements, lowers the time on site and reduces the quantity of on-site labour in comparison to concrete. These factors all contribute to steel having a lower embodied carbon impact on the environment.

10. Health and Safety Considerations

10.1 Introduction

It is vital that adequate safety is considered within the design of any construction project. Health and safety will be achieved through communication, competent advice and questioning, effective training and education, management systems and monitoring programmes. Health and safety should be regarded as a core value and the elimination or mitigation of health and safety risks will be considered throughout the design process and from construction to end of service life.

Construction is a dangerous industry with an abundance of risks to the health and well-being of workers, members of the public or the intended user. The hazards include, but are not limited to, harmful substances such as dust and chemicals, injuries from tools, falling from height, manual handling injuries and moving construction vehicles.

The Safety, Health and Welfare at Work (Construction) Regulations 2013 are a statutory instrument in Ireland and are applied across the construction industry. The regulations are enforced by the Health and Safety Authority which was established in 1989 under the Safety Health and Welfare at Work Act, 1999. The Authorities role is to ensure the health and safety at work of all workers in any position. The regulations cover specific requirements for the following work items.

- General safety provisions;
- Evacuation shafts, earthworks, underground works and tunnels;
- Cofferdams and caissons;
- Compressed air;
- Explosives;
- General health hazards;
- Construction work on or adjacent to water;
- Transport, earthmoving and materials-handling, machinery and locomotives;
- Demolition;
- Roads; and
- Construction site welfare facilities.

The regulations also contain duties specific to a number of roles such as Client, Contractor, Project Supervisor Construction Stage (PCSC) and Project Supervisor Design Process (PSDP).

The roles of the Client and the Designer while potentially having the greatest influence in reducing the health and safety risks on the construction site, are the least at risk to the hazards on site. The opposite is the case for the Contractor and Operatives who have the lowest ability to account for safety in the design.

During the design, a Designer's Risk Assessment (DRA) will be prepared in accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013. The DRA will include all risks identified and the resulting mitigation measures or alterations incorporated within the design, where no mitigation is possible the DRA will be used to communicate the risks to the Contractor and site personal. For example, mitigation measures will be put in place to ensure the safety of the construction personnel when working in the vicinity of the river.

Where possible, the hierarchy of risk control will be implemented within the design and construction, with the Designer and Contractor aiming to control all risks through elimination. Where this is not possible, reduction, isolation or mitigation controls will be incorporated to ensure safety during construction.

10.2 Construction Risks

Ensuring the health and safety of the workers, public and end user should always be the priority of everyone involved in a construction project. A risk register listing all potential health and safety issues along with mitigating actions should be developed as early as possible during the design. The risks should be assessed on their severity and probability to all workers and end users. Wherever possible, any risk that can be fully eliminated should be removed from the project by the hierarchy of control. Where elimination is not possible, mitigation measures should be introduced to reduce the probability and severity of the risk as much as possible. In some cases, where it is impossible to eliminate or mitigate the risk in design the risk should be properly communicated to the respective parties involved in the construction of the project and control measures should be properly implemented.

Schedule 1 of the construction regulations provides the non-exhaustive list of particular risks which should be considered during the development of the risk register:

- Work which puts persons at risk of; Falling from height, burial under earth falls and engulfment in swampland.
- Work which puts persons at risk from chemical or biological substances;
- Work with ionising radiation;
- Work near high voltage power lines;
- Work on wells, underground earthworks and tunnels;
- Work involving the use of explosives; and
- Work involving the assembly or dismantling of heavy prefabricated components.

The above risks are generic and applicable to a large number of construction projects. The following list of particular risks has been identified for the N63 bridge over the River Abbert:

- Construction of the bridge over a river is a specific risk. Lifting heavy beams over water onto the abutments is a high-risk procedure. Actions must be taken to mitigate against the risk of falling materials or debris into the river. The use of permanent formwork will also limit the requirement for temporary formwork over the river during pouring of the insitu concrete deck.
- Transportation of precast frames, beams or prefabricated beams to the building site. The number of traffic movements to and from site should be minimised to avoid increase in the traffic congestion in the area. Beams could be transported late at night or early in the morning to reduce this risk.
- Consideration during design should be given to the safety of the end user when crossing the structure. This will ensure that suitable parapet containment levels and heights are specified, and manageable gradients are applied.

11. Construction and Buildability

11.1 Introduction

Considering the construction and buildability of all structures as early as possibly in the design process is key to ensuring the structure can be successfully delivered through the construction stage. It is also important to consider the local residents of the area and surrounding environment when planning construction to ensure minimal disturbance while construction is taking place.

11.2 Temporary Works

All options use either precast concrete or prefabricated steel components in the design, to maximise the construction time off site and reduce the requirement for fabrication activity on site adding efficiency and enhancing quality for the construction process. Sufficient space should be provided within the lands made available boundary in close proximity to the bridge location. This space will need to ensure that delivery and assembly of structural elements is facilitated. In addition, space should also be provided for piling platforms (should they be required) and crane lifting platforms within the lands made available. At this stage of design development, it should be assumed that lifting platforms will be required on both sides of the river to allow construction of the bridge allowing the Contractor flexibility in their temporary works design for lifting arrangements.

Where possible the need for temporary works will be limited through good design and detailing. For example, the steel girders of Option 2 will be designed to be lifted in braced pairs. This will ensure that the beams are stable at all times during construction and avoid the need for temporary propping following lifting. Similarly, the use of permanent formwork will be maximised within Option 2 and 3 limiting the need for propping of temporary formwork during pouring of the insitu concrete deck.

11.3 Construction Traffic

Consideration will need to be given to the safe traffic movements for both members of the public and construction workers particularly at site entrances and within Abbeyknockmoy. This will be especially important during the transporting of large precast or prefabricated elements. Precast concrete or prefabricated steel components will be utilised in the design, to maximise the construction time off site and reduce the requirement for fabrication activity on site adding efficiency and enhancing quality for the construction process. The transportation of all beams and materials to the site will likely utilise the M17 motorway and the existing N63 road network.

Permission to transport prefabricated and assembled superstructures to the site or site compound will need to be granted by An Garda Siochana by applying for permit for movement of abnormal loads. An Garda Siochana will set out the allowable route, time and speed limits for the loaded vehicle and may need to provide an escort to the transporting vehicle to ensure maximum safety to other road users. It is suspected the bridge will be classed as an abnormal load as set down by Road traffic (Construction and Use of Vehicles) Regulations 2013, S.I. 5 of 2003. Abnormal loads covered under the remit of the aforementioned permit must not exceed size restrictions as set out by the Road Traffic (Permits for Specialised Vehicles) Regulations 2009. The load must not exceed 4.65m in height, 4.3m in width and 27.4m in length.

Option 2 will likely have the lowest requirement for construction traffic as the option requires the least number of large elements to be delivered to site when compared to the other two options. In addition, Option 2 will require significantly less concrete deliveries to site when compared to Option 3 due to the reduced abutment and concrete deck areas.

12. Ground Conditions

12.1 Introduction

The following provides a summary of the desk study and commentary on the findings of ground investigations that have been undertaken for the proposed route.

12.2 Historical boreholes

No historical boreholes or geotechnical investigations are recorded within the study area.

12.3 Geophysical Studies

A geophysical study was carried out and reported in:

- N63 Liss to Abbey Realignment Scheme Co. Galway Geophysical Survey: Draft dated April 7th 2020 by Minerex Geophysics Limited.

The executive summary is as follows

Corridor

The geophysical survey found the general geology along the scheme consisted of deep glacial till overburden over fresh limestone bedrock. There is a thin layer of alluvium identified close to the river and relatively shallow rock near the western end of the scheme.

The EM31 Ground Conductivity and 2D-Resistivity surveys identify the shallowest rock along the scheme as between Ch0 – 110 in the west of the survey area. The extent of alluvium was also identified using these methods and is displayed on Map 3 and Plans 2a – 2c of the above report.

The survey does not indicate karst features along the extent of the corridor. Thick layers of glacial till would provide good protection if the deeper rock should be karstified.

River Banks

Seismic refraction profiles carried out along the river indicate a thin layer of very soft to soft or loose alluvium (Layer A) underlain by firm to very stiff or medium dense to very dense overburden (Layers B –C). Fair to good quality rock (Layer D) was identified between 6 and 12.5 m deep.

Low resistivities (Layer 2) within the high seismic velocity layer (Layer D) along profiles S1/R1 (90 – 150 m) and S2/R2 (100 – 160 m) may indicate a zone of weathered or karstified limestone crossing below the river in a south to north direction. Targeted rotary core holes were recommended here if the bridge will be located here.

The depth to highly consolidated overburden and rock is slightly shallower to the east than at the west along the river banks.

12.4 2020 Geotechnical Investigation

One specific ground investigation has been undertaken to date, reported as follows:

- Report No 22751 N63 Liss to Abbey Realignment Factual Ground Investigation Report (Interim), dated February 2021

In general, the ground investigation utilised the following exploratory techniques:

- Cable percussion (CP) boring in ten locations (BH01 to BH10) sunk using shell and auger techniques. This technique was used to investigate the superficial ground conditions, undertaking in-situ testing and taking undisturbed and disturbed samples for geotechnical/geochemical laboratory testing. Typically, CP boreholes were terminated on encountering refusal on very dense/stiff soils, boulders or weathered bedrock, or at a predefined depth based on the design and construction requirements for the proposed structure/earthwork or upon encountering suspected services.

- Rotary drilling both with and without core recovery (RC02 to RC07 and RC10). Generally, when using rotary drilling within soils standard penetration tests (SPTs) were taken at regular intervals below the depth attained by the CP boring.
    - Rotary drilling without core recovery (RO) was typically used to identify rockhead level and extend CP boreholes to rockhead when the CP could not advance due to obstructions (i.e. very dense/stiff soils or boulders). At RC02, 03, 04 and 10, Symmetrix "full hole cased drilling" techniques were used to advance through the upper deposits.
    - Rotary drilling with core recovery (RC) was typically used in soils to extend CP boreholes beyond obstructions (i.e. very dense/stiff soils or boulders), where more soil information was required than would be recovered by RO methods. The use of a geotechnical wireline triple tube core barrel S-size ("Geobor") in RC03, 06 and 07 allowed recovery of good quality (Class 1) samples.
    - RC was typically used in rock to provide information on the rock (i.e. lithology, discontinuities, strength, etc.) and recover core samples suitable for laboratory testing.
- Groundwater monitoring standpipes, installed to identify groundwater levels, provide water samples for geochemical testing and monitor groundwater flow were installed in RC03,05,06, and 10.
- Machine excavated trial pits (TP01 to TP10) sunk to identify the near surface ground conditions and, at specific locations, to identify whether there was any archaeological significance. Disturbed samples and, where contamination was suspected, environmental samples were recovered from the trial pits to allow for geotechnical and geochemical testing. In-situ hand vane testing was also carried out in suitable cohesive soils.

12.5 2021 Geotechnical Investigation

An additional rotary core (RC04A) was carried out in April 2021 to target the area described by the geophysics report as possibly indicating a zone of weathered or karstified limestone.

At the time of writing, geotechnical laboratory testing had not yet been completed; however, the draft logs described the following:

- 0 to 1.4 peaty deposits
- 1.4 to 2.80 medium dense gravelly SAND
- 2.8 to 11.8 firm sandy gravelly CLAY with cobbles
- 11.8 to 17.15 Strong to very strong, thickly to thinly bedded, dark blueish grey, fine-grained, LIMESTONE fresh to locally slightly weathered.

The depth to competent limestone was similar to the other coreholes in the vicinity.

Figure 2. 2020 Rotary Core Locations at the Bridge Crossing

Although not shown in the above RC04A is shown at a similar latitude to BH06/RC06 but located immediately south of the river

12.6 Geology

12.6.1 Bedrock

The Geological Survey Ireland (GSI), bedrock geology 1:100,000 Sheet 11 indicates that the study area is entirely underlain by rocks from the Lower Carboniferous (Visean) period; online mapping identifies the rocks to be of the Burren Formation. This stratum comprises pale grey packstones and wackestones but also contains intervals of dark cherty limestones, often associated with oolitic grainstones.

Outcropping limestone is recorded along the western extent of the study area, on the northern banks of the Abbert River.

Bedrock was encountered at depth ranging from 9.4 to 13.2 m below ground level (bgl) in testholes RC02-07. The bedrock was typically described as strong to very strong fresh to locally slightly weathered Limestone: full descriptions are available in the logs.

In RC02, located about 50 m southwest of the south abutment, the driller noted a CLAY band from 14.45 to 15.45 m underlying 1.25 m of slightly weathered Limestone.

Data from rotary boreholes at the bridge site provides the following:

- The Fracture Index (fractures per metre) ranged from 2.3 in RC07 to 4.6 in RC02
- Point load $I_{s(50)}$ tests on 11 samples ranged from 2.5 to 5.26 MPa. This corresponds to a UCS of 69 to 128 MPa using a conversion factor of 20
- UCS tests on 9 samples ranged from 35.73 to 83.08 MPa.
- Seven pH tests measured values between 8.7 and 9. Seven Sulphate (2:1 Water Soluble) as SO4 recorded values between 0.11 and <0.010 g/l.

12.6.2 Superficial Deposits

12.6.2.1 Topsoil

Topsoil was encountered in all testholes and ranged in thickness from 100 mm to 300 mm.

12.6.2.2 Alluvium

These typically comprise soft, soft to firm sandy SILTs with variable gravel contents and were found underlying topsoil and peat/organic soils.

Alluvium was encountered in BH02, 03, 07, 10, RC04, 05 and TP09. The thickness encountered ranged from 0.2 to 1.1 m with an average of approximately 0.6 m.

There may be overlap between the organic soils described as sandy peaty SILT/CLAY and the soil described as alluvium. A lack of organics and a lower moisture content was used to separate the units. There may also be overlap between softened near surface Glacial Till deposits as the descriptions and moisture contents can be similar.

An SPT result of 9 blows per 300 mm was recorded in BH03 at 1 m depth.

Geotechnical laboratory testing indicated the following:

- Four Moisture contents ranged from 9.1 to 53.9 % in this layer with an average of 32 %
- An Atterberg limits test indicated a Non-plastic Silt. The Liquid limit was 23%

12.6.2.3 Peat

Peat and organic soils were generally encountered below the topsoil in the majority of testholes (BH01 to BH06, BH10, and RC02 to RC07. The soil was typically described a soft grey/brown sandy peat SILT to a soft dark brown/black Peat. The thickness of peat ranged from 0.3 to 1.4 m for an approximate average of 0.7 m. The maximum thickness of peat was encountered in BH 01.

These soils are characterised by their high organic contents and moisture contents. An SPT result of 1 blow per 300 mm was recorded in BH 01 at 1 m depth.

Geotechnical laboratory testing indicated the following:

- Five Moisture contents ranged from 49.3 to 308 % in this layer with an average of 175 %
- A one dimensional consolidation test was carried out on a sample of the peat at 1 m depth in BH 01 which indicated the peat is highly compressible upon addition of load.
- A laboratory vane carried out on a sample of the peat in BH01 at 1 m depth indicated an average undisturbed shear strength of 9.4 kPa at a moisture content of 348%.

12.6.2.4 Fluvio-glacial Gravels

Gravels were encountered in the following testholes

- Boreholes:BH01,02,03,04A: typically described as medium dense fine to coarse sandy silty to slightly silty GRAVEL with occasional to some cobbles.
- Rotary Follow on: RC02, 03,04,07: drilled using Symmetrix drilling methods which doesn’t facilitate core recovery. Driller described returns of grey silty GRAVEL with cobbles
- Trial pits: TP02,03,05,06,08,10: described as slightly clayey gravelly SAND to sandy Gravels

The gravels were typically found underlying Peat and Alluvium. The thickness of the gravels ranged from about 1.1 m in TP03 to about 11.8 m in RC03. The gravels are likely coarse grained glacial Till and likely interlayered with fine-grained glacial till as shown in RC02

There was a noticeable trend of gravels being most abundant south of the River Abbey. A fines content of less than about 15 to 20% was used to distinguish between fine and coarse grained Glacial Till.

Twenty SPTs ranged from 17 to 60 with an average of 43 blows per 300 mm.

Two pH tests measured values of 8.4 and 9. Two Sulphate (2:1 Water Soluble) as SO4 recorded values of 0.017 and <0.010 g/l. Total sulphate was between 110 and < 100 mg/kg. Two Sulphate (Acid Soluble) tests measured 0.10 and 0.025%.

12.6.2.5 Glacial Till

Fine grained Glacial Till was encountered in the majority of the test holes with the exceptions being RC03, RC04 and TP08.

The fine-grained glacial till generally comprised a stiff to very stiff sandy gravelly SILT with cobbles. The majority of boreholes refused within this layer. The maximum thickness of fine-grained Glacial Till was encountered in RC10 at about 11.6 m

Fines content in excess of about 15 to 20% was chosen to differentiate between the engineering behaviour of coarse grained and fine grained Glacial Till.

Sixty two SPTs ranged from 10 to 70 with an average of 43 blows per 300 mm.

Geotechnical laboratory testing indicated the following:

- 26 Moisture contents ranged from 6.4 to 22.3 % in this layer with an average of 11 %
- 16 Atterberg limits indicted the fines content behaved as a Non-Plastic SILT. The liquid limit varied between 16 and 36 % for an average of 22%
- Two undrained shear strength in triaxial compression without pore pressure measurement tests indicated an undrained shear strength of 23 and 25 kPa at a strain at failure of 19.8% in BH06 and BH09A at 2.5 m depth respectively.
- Laboratory vanes also carried out in samples taken at 2.5 m depth in BH06 and BH09A had undrained shear strengths of 4.6 and 13 kPa respectively. The samples were both described as grey brown slightly sandy slightly gravelly SILT.
- Four Moisture Condition Value tests had results of <1,7.6,8.4, and 9 at depths ranging between 0.5 to 0.7 below ground level.
- Six pH tests measured values between 7.2 and 10. Six Sulphate (2:1 Water Soluble) as SO4 recorded values all <0.010 g/l. Six total sulphate was between 200 and < 100 mg/kg. Six Sulphate (Acid Soluble) tests measured 0.041 and 0.025%.

12.6.3 Hydrology and hydrogeology

12.6.3.1 Hydrology

The main surface water feature within the study area is the River Abbert, which bisects the study area flowing from east to west. Historical mapping has shown the course of the river has changed over time either through natural erosion and deposition by the river channel or artificially through human intervention and land drainage schemes.

12.6.3.2 Aquifers

The site is entirely underlain by a regionally important karstified (conduit) aquifer (aquifer category Rkc).

There are no karst features recorded within the study area. However, there is a spring and two enclosed depressions (dolines) recorded 250m and 900m south of the study area, respectively. As a result of these features coupled with the presence of an underlying karstified limestone aquifer, the potential for karst within the study areas should be considered.

The northern portion of the study area is within a zone of moderate groundwater vulnerability. The area south of the Abbert River is predominantly within a zone of high to extreme groundwater vulnerability.

12.7 Foundations

The investigation has shown that underlying the soft organic and alluvial soils there is predominantly granular deposits to the south west of the River Abbert with more fine-grained glacial tills to the north east. Consolidation of underlying granular deposits will typically occur during the period of the construction programme whereas the fine Glacial Till will undergo a longer settlement duration.

To eliminate the potential for differential settlements associated with shallow footings with the relatively large bridge loads, it is proposed that the Bridge is piled with the piles deriving a significant portion of their capacity via a rock socket likely in excess of 2 m. This will also help de-risk the project with respect to the drop in rock head noted in the geophysics report but not observed in the ground investigation. Bedrock was encountered at depth ranging from 9.4 to 13.2 m bgl in testholes RC02-07. The bedrock was typically described as strong to very strong fresh to locally slightly weathered.

At the detailed design stage, the pile design should be carried out in accordance with Eurocode 7 – Part 1. and the Irish annex. There may be benefit in having a specialist piling contractor carry out the detailed design as part of the works requirements

13. Consultation with Relevant Authorities

13.1 Key Stakeholders

A number of stakeholders have been contacted as part of an ongoing consultation process for the proposed bridge. Further consultation will be required with all bodies as part of the development of a conceptual design and any further works. Consultation will be ongoing throughout the design to achieve a successful planning outcome.

Stakeholder	Contact Name	Title
Galway County Council	Aengus Breathnach	Senior Executive Engineer
	Shaun McLaughlin	Assistant Engineer
Transport Infrastructure Ireland	John Iliff	Head of Structures
	Fergal Cahill	Structures Project Manager
	Jerry O'Sullivan	Archaeologist
Office of Public Works	Liam Ward	-

Table 13.1- List of Relevant Authorities

13.2 Utility Providers

A review of the service records provided by Utility Providers has shown that no utilities are present at the bridge location or in close proximity that will be affected by the construction of the bridge.

14. Conclusions and Recommendations

The results of the multi-criteria analysis (MCA) carries out on the three options is presented in the table below. A detailed breakdown of the MCA process has been detailed Appendix B.

Assessment Criteria	Option 1 Precast Portal Frame	Option 2 Steel Girder	Option 3 Precast W19 Beams
Technical			
Economic			
Aesthetic			
Durability & Maintenance			
Environmental			
Health & Safety			
Construction & Buildability			
Ground Conditions			

Table 14.1- Summary of MCA Ratings

In summary, the following key assessment and considerations are noted:

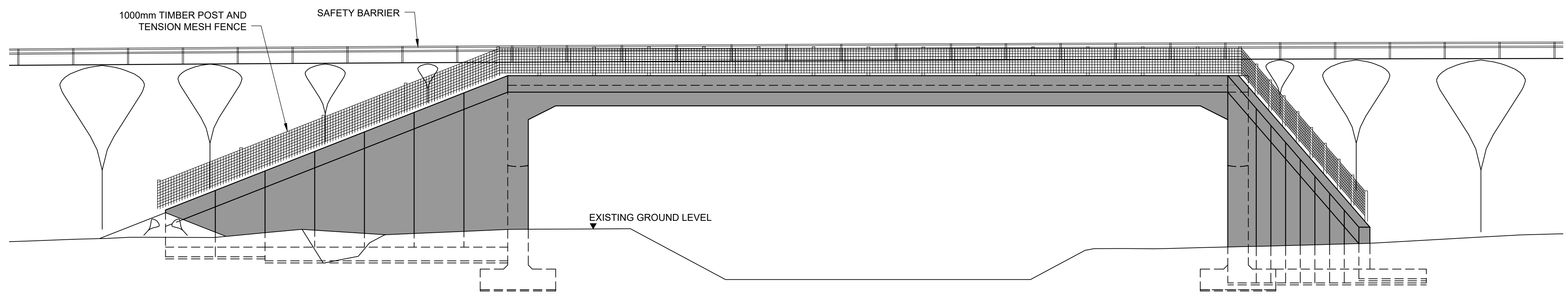
- Technical – Option 2 while being a slightly more complicated design when compared to the other options will ensure that the bridge design is lean with all structural elements aiming to achieve 100% utilisation. The large dead zones of the other two options are significant disadvantages.
- Economic – Option 2 is the cheapest option to construct based on an all-in construction rate per m^2. The significant dead zones of the other two options substantially increase their construction cost.
- Aesthetics – Option 2, the steel option, is the most aesthetically pleasing option due to the arched soffit profile. The other options also both have substantial dead zones on either side of the carriageways are a disadvantage coupled with the significant structural depth of Option 3.
- Durability and Maintenance – The use of weathering steel for Option 2 significantly improves its durability and maintenance requirements. The use of bridge bearings and expansion joints are a disadvantage.
- Environmental – Option 2 has the lowest embodied energy of the three options considered making it the most advantageous options.
- Health and Safety – All three options require the transportation of large precast/prefabricated structures and will all be assembled on site. Option 2 requires far less crane lifts when compared to the other options, in addition, the option has a far lower requirement for working over water when compared to Option 3.
- Construction and Buildability – Option 2 will require the least number of large structural elements to be delivered to site. In addition, this option will also have the lowest number of crane lifts when compared to the other options presented. The use of permanent formwork and lifting the beams in braced pairs significantly reduces the temporary works required.
- Ground Conditions – The use of bearings in this option will result in all loads being transferred to the foundations axially without any additional horizontal loads or bending moments reducing the size of foundations compared to Option 3.

Its visible from the results of the MCA that Option 2 Steel Girder is the most favourable option when compared to the alternatives and it is this option which is proposed for selection as the emerging preferred bridge option and will be carried forward to the Preliminary Bridge Design.

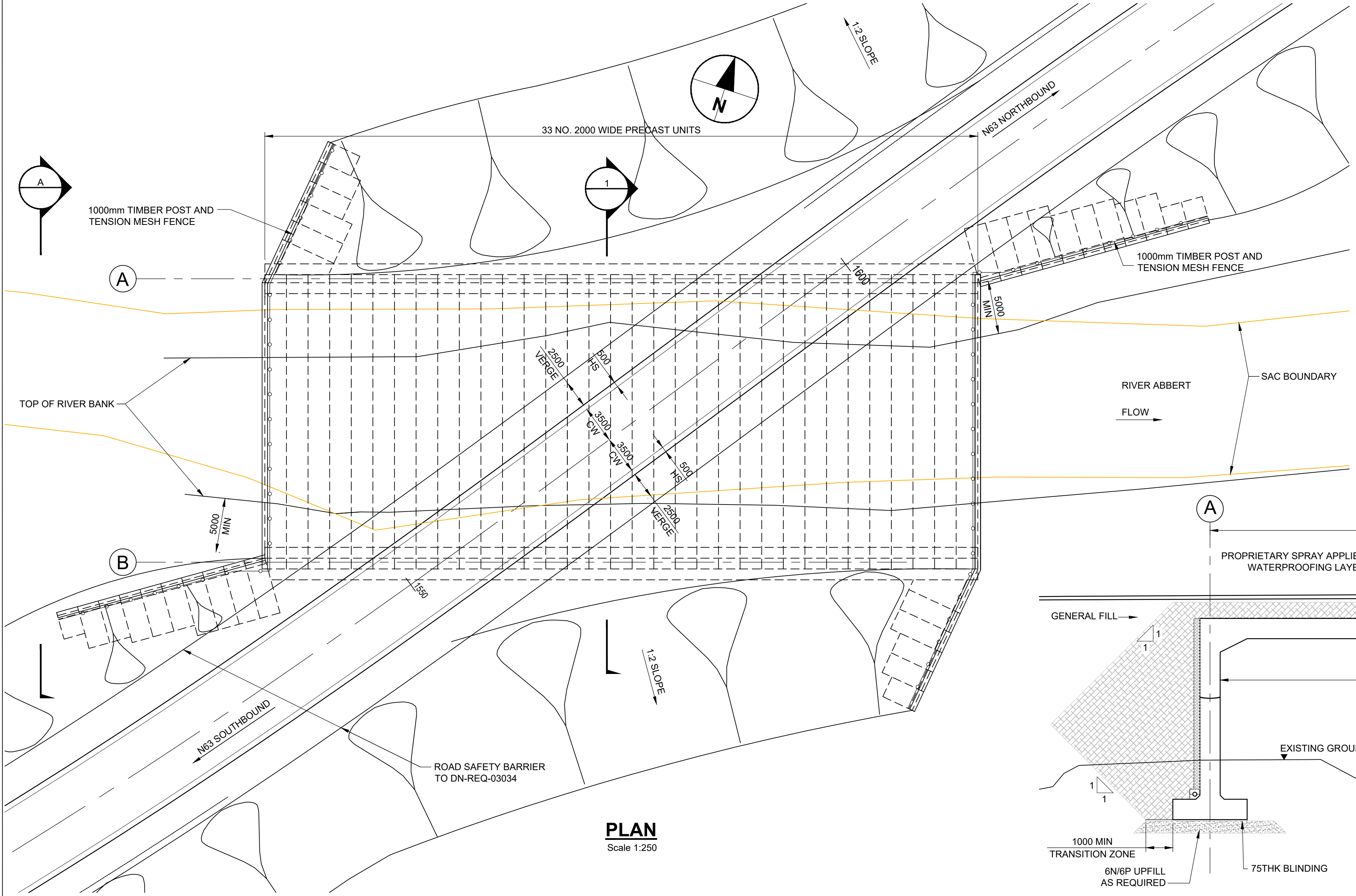
Appendix A – Drawings

NOTES:

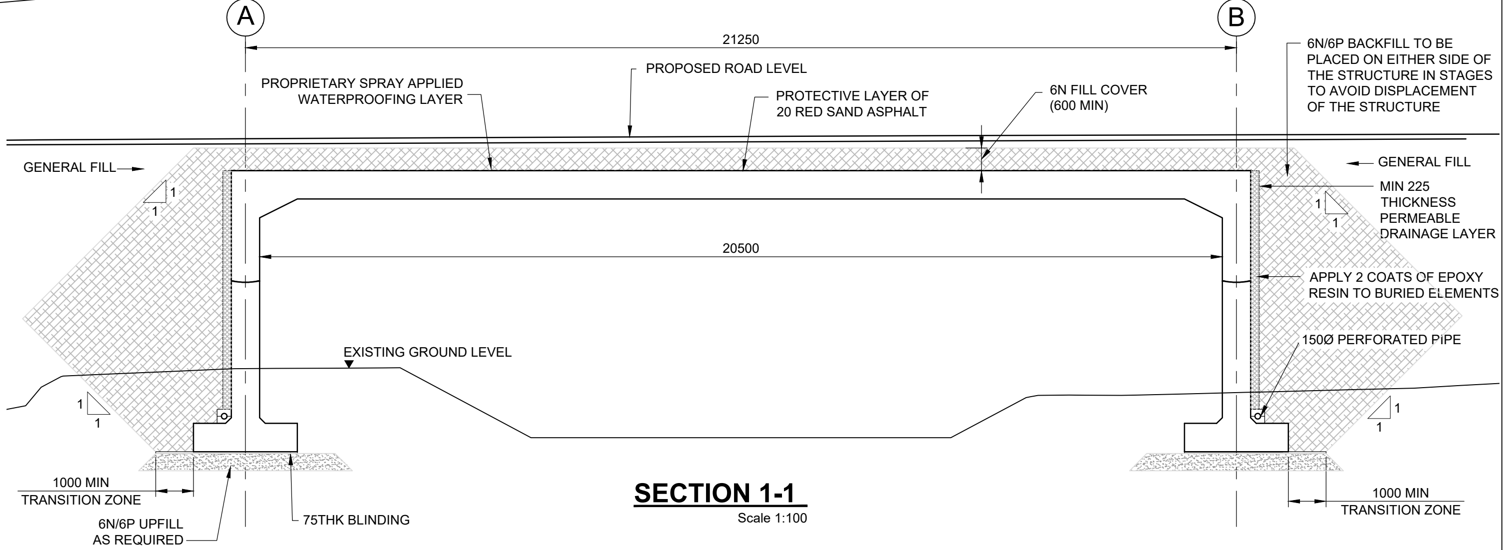
1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS IN THE SERIES.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM.



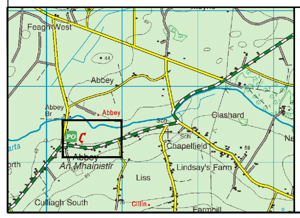
ELEVATION A-A
Scale 1:100



PLAN
Scale 1:250



SECTION 1-1
Scale 1:100



GALWAY COUNTY COUNCIL 2020/OSI_NMA_090
© ORDNANCE SURVEY IRELAND, 2020

© 2020 Microsoft Corporation © 2019 DigitalGlobe
© CNES (2019) Distribution Airbus DS

TII Bonneagar Iompair Éireann Transport Infrastructure Ireland
GALWAY NATIONAL ROADS PROJECT OFFICE
Comhairle Chontae na Gaillimhe Galway County Council
Project Ireland 2040 Building Ireland's Future

No.	Revision	Date	By	Chk'd	App'd

Roughan & O'Donovan-AECOM Alliance

ROD ROUGHAN & O'DONOVAN
AECOM

AECOM
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin
Ireland
T +353 (0)1 238 3100
www.aecom.com

Roughan & O'Donovan
Arena House
Arena Road
Sandyford
Dublin 18
Ireland
T +353 (0)1 294 0800
www.rod.ie

Drawn	Designed	Checked	Approved	Suitability Code - Description
DSH	AC	AC	NR	S0 - Work In Progress

Project Title: N63 LISS TO ABBEY REALIGNMENT SCHEME

Drawing Title: BRIDGE OPTION 1 GENERAL ARRANGEMENT

Drawing Number	Project	Originator	Phase	Series	Type	Dept.	Number
	N63	ACM	PH03	0000	DR	SE	0100

Scale: AS SHOWN | Date: 09.10.2020 | Job No: 60597858 | Rev: D1

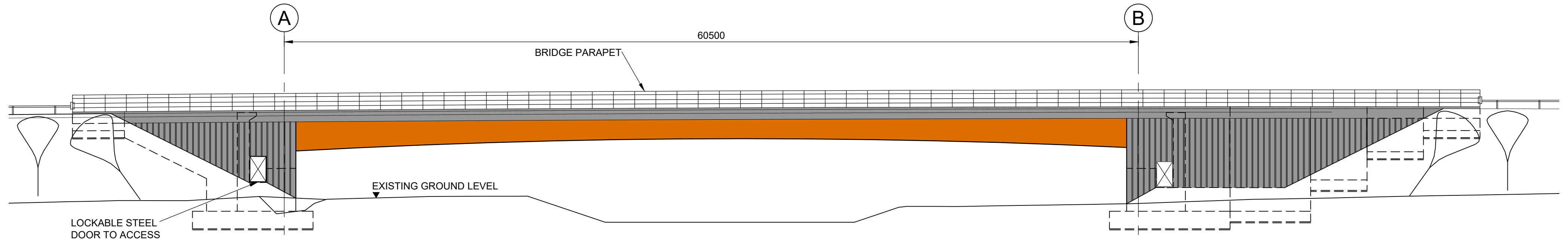
DO NOT SCALE USE FIGURED DIMENSIONS ONLY

23 March 2021 12:13:35

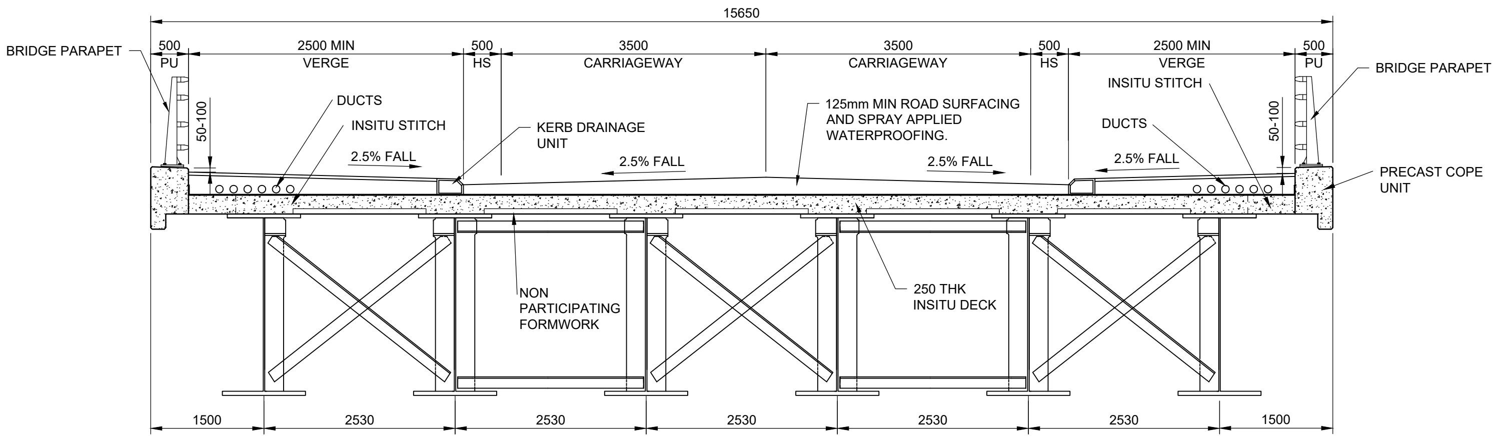
Z:\UKI\EDBL2\JOBS\PR-395964_N63_PH1-4\900_CAD_GIS\910_CAD\20-SHEETS\01-WIP\N63-ACM-PH03-0000-DR-SE-0100_BRIDGE_OPTION1_GA.DWG

NOTES:

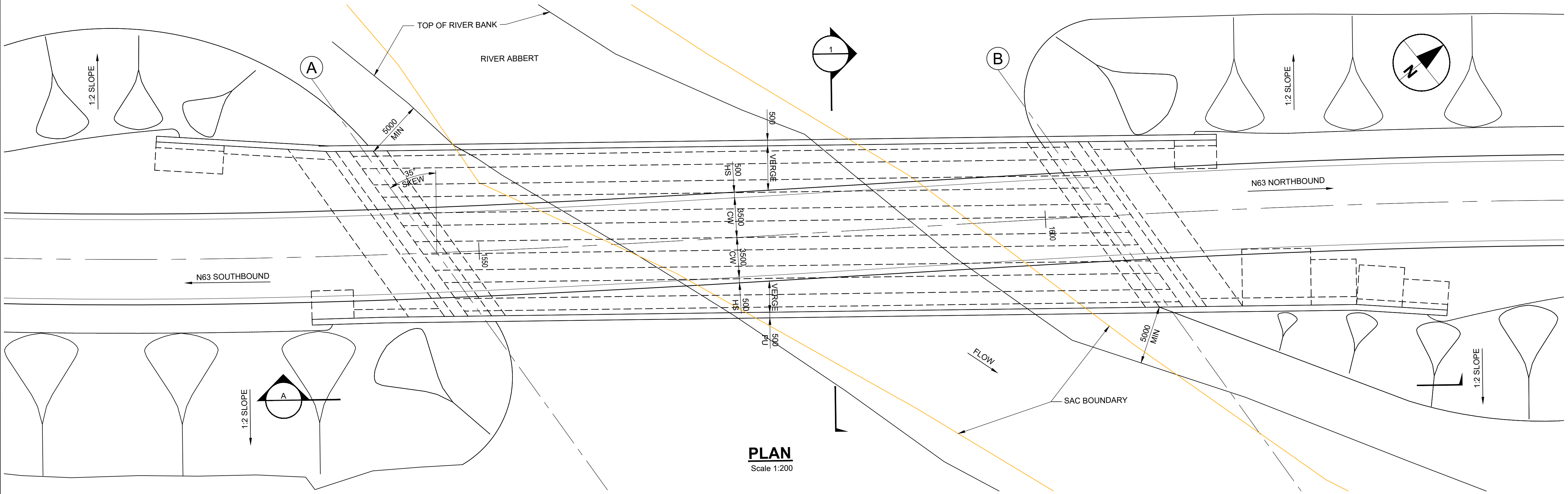
1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS IN THE SERIES.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM.



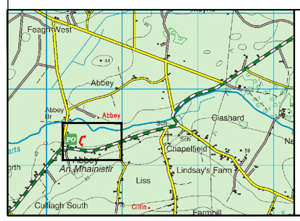
ELEVATION A-A
Scale 1:200



SECTION 1-1
Scale 1:50



PLAN
Scale 1:200



Bonneagar Iompair Éireann
Transport Infrastructure Ireland

GALWAY NATIONAL ROADS PROJECT OFFICE

Comhairle Chontae na Gaillimhe
Galway County Council

Project Ireland 2040
Building Ireland's Future

No.	Revision	Date	By	Chk'd	App'd

Roughan & O'Donovan-AECOM Alliance

ROD ROUGHAN & O'DONOVAN
AECOM

AECOM
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin
Ireland
T +353 (0)1 238 3100
www.aecom.com

Roughan & O'Donovan
Arena House
Arena Road
Sandyford
Dublin 18
Ireland
T +353 (0)1 294 0800
www.rod.ie

Drawn	Designed	Checked	Approved	Suitability Code - Description
DSH	AC	AC	NR	S0 - Work In Progress

Project Title: N63 LISS TO ABBEY REALIGNMENT SCHEME

Drawing Title: BRIDGE OPTION 2 GENERAL ARRANGEMENT

Drawing Number	Project	Originator	Phase	Series	Type	Dept.	Number
	N63	ACM	PH03	0000	DR	SE	0200

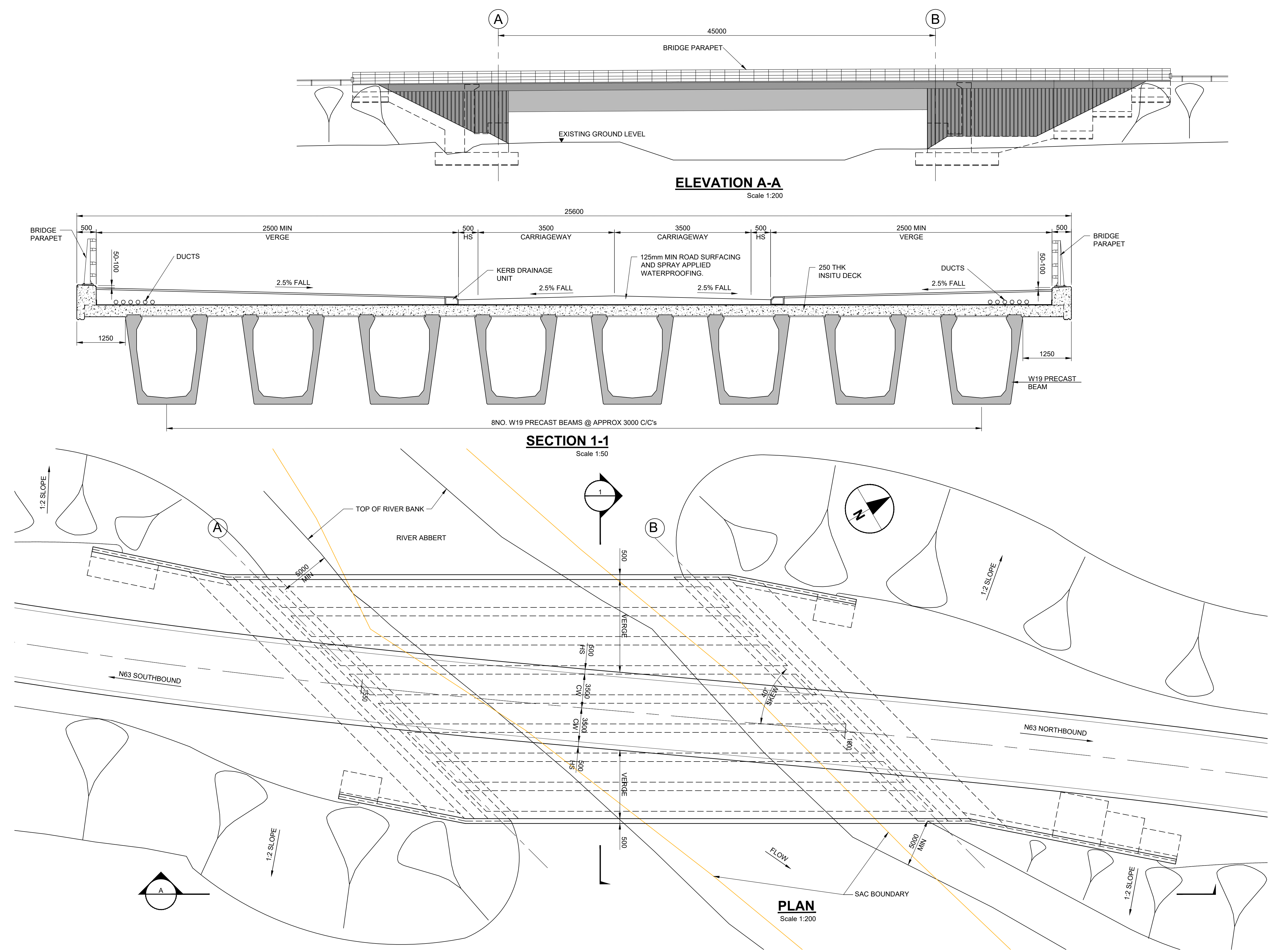
Scale: AS SHOWN | Date: 06.10.2020 | Job No: 60597858 | Rev: D1

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

GALWAY COUNTY COUNCIL 2020/OSI_NMA_090
© ORDINANCE SURVEY IRELAND, 2020
© 2020 Microsoft Corporation © 2019 DigitalGlobe
© CNES (2019) Distribution Airbus DS

23 March 2021 12:04:30

Z:\UKI\EDBL2\JOBS\PR-395964_N63_PH1-4\900_CAD_GIS\910_CAD\20-SHEETS\01-WIP\N63-ACM-PH03-0000-DR-SE-0200_BRIDGE_OPTION2_GA.DWG



NOTES:

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS IN THE SERIES.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM.

GALWAY COUNTY COUNCIL 2020/OSI_NMA_090
© ORDNANCE SURVEY IRELAND, 2020
© 2020 Microsoft Corporation © 2019 DigitalGlobe
© CNES (2019) Distribution Airbus DS

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

GALWAY NATIONAL ROADS PROJECT OFFICE

Comhairle Chontae na Gaillimhe
Galway County Council

Project Ireland 2040
Building Ireland's Future

No.	Revision	Date	By	Chk'd	App'd

Roughan & O'Donovan-AECOM Alliance

AECOM
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin
Ireland
T +353 (0)1 238 3100
www.aecom.com

Roughan & O'Donovan
Arena House
Arena Road
Sandyford
Dublin 18
Ireland
T +353 (0)1 294 0800
www.rod.ie

Drawn	Designed	Checked	Approved	Suitability Code - Description
DSH	AC	AC	NR	S0 - Work In Progress

Project Title: N63 LISS TO ABBEY REALIGNMENT SCHEME

Drawing Title: BRIDGE OPTION 3 GENERAL ARRANGEMENT

Drawing Number	Project	Originator	Phase	Series	Type	Dept.	Number
	N63	ACM	PH03	0000	DR	SE	0300

Scale: AS SHOWN | Date: 06.10.2020 | Job No: 60597858 | Rev: D1

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

23 March 2021 12:06:49

Z:\UKI\EDBL2\JOBS\PR-395964_N63_PH1-4\900_CAD_GIS\910_CAD\20-SHEETS\01-WIP\N63-ACM-PH03-0000-DR-SE-0300_BRIDGE_OPTION3_GA.DWG

Appendix B – Option Rating Evaluation

The options have been evaluated and rated under the following list of criteria:

- Technical;
- Economic;
- Aesthetic;
- Durability & Maintenance;
- Environmental;
- Health & Safety;
- Construction & Buildability; and
- Ground Conditions.

Each option has been ranked using the rating table below against each of the options under each criterion, a justification for each ranking has also been provided. The option appearing the most advantageous when compared with the other options will be deemed the preferred solution.

Colour	Description
	Significant advantages over the other options
	Some advantages over other options
	Neutral compared to other options
	Some disadvantages compared to other options
	Significant disadvantages compared to other options

Assessment Criteria	Option 1 Precast Portal Frame	Option 2 Steel Girder	Option 3 Precast W19 Beams
Technical	Option 1 is the simplest option to design. The buried portal frame will be designed based on a metre strip analysis based on the worst-case location. However, the significant area of dead zones are undesirable and will be overdesigned. The option will be an integral structure which will be beneficial due to the lack of bearings and joints. The presence of multiple restraint systems such as the road restraint system and timber post and rail fence is a disadvantage due to the additional material and clutter created on the top of bridge deck.	Option 2 will be a slightly more complicated design than the other two options.The lack of dead areas offer significant advantages to the other two options, resulting in a lean bridge design that will aim for 100% utilisation of the structural elements. The use of bearings in this option will result in all loads being transferred to the foundations axially without any additional horizontal loads or bending moments reducing the size of foundations compared to Option 3. The option will be a category 3 structure requiring an independent checking company which is a disadvantage compared to the other options.	The integral design of Option 3 is likely to be complicated to achieve due to the expected thermal expansions and contractions. The soil structure interaction will require detailed analysis to ensure that this movement can be accommodated. In addition, horizontal loads and bending moments are likely to be transferred to the foundations requiring increased foundation sizes when compared to the other options.
Economic	Option 1 is the second most expensive option with an economic estimate of €5,175,000.000	Option 2 is the cheapest option with an economic estimate of €4,725,000.00	Option 3 is the most expensive option with an economic estimate of €5,316,000.00
Aesthetic	The large dead zones of Option 1 and the large structure width will create a large environmental intrusion on the landscape particularly when viewed from the National Monuments. In addition, the dead zones detract from the expression of function of the structure.	The weathering steel option is aesthetically the most advantageous of the three options presented. The option will have an arched soffit which is aesthetically please in additional the thinner section properties of the arch make the option seem lighter and airier than the other two options. The lack of dead zone also lends itself to a better form of structure with the function of all elements being clear and concise.	Option 3 will have the largest structural depth of the options presented. This structural depth will require the largest approach embankments creating the largest visual barrier from the National Monuments restricting views of the surrounding undulating landscape. The large structural depth coupled with a low vertical clearance over the river is likely to make the concrete option seem oppressive with squat proportions.
Durability & Maintenance	Reinforced concrete as a structural material can be relatively robust to the elements if designed correctly and maintained properly. Provided that minimum cover requirements are satisfied, and correct steel quantities used a durable structure should be created. Being a fully integral bridge, the lack of bearings and expansion joints provides major savings in maintenance costs over the lifetime of the structure.	Option 2 proposes the use of weathering steel which is a highly durable and robust material requiring limited inspection and maintenance over its lifetime. However, the introduction of bearings and expansion joints are a disadvantage of this option when compared to the other two presented as it leads to having more elements and connections to maintain and inspect.	Reinforced concrete as a structural material can be relatively robust to the elements if designed correctly and maintained properly. Provided that minimum cover requirements are satisfied, and correct steel quantities used a durable structure should be created. Being a fully integral bridge, the lack of bearings and expansion joints provides major savings in maintenance costs over the lifetime of the structure.

Assessment Criteria	Option 1 Precast Portal Frame	Option 2 Steel Girder	Option 3 Precast W19 Beams
Environmental	Option 1 and Option 3 create similar environmental concerns due to the concrete production and construction have a greater level of energy consumption when compared to steel equivalents. This is associated with the increased quantity of on-site formwork and falsework required, greater transportation costs due to larger and heavier mass of materials and the lengthier installation process with less opportunities for off-site fabrication and time allocated for casting and curing of the concrete.	Option 2 is the best option environmentally. Steel production and construction associate more with the release of volatile organic compounds and hard metal emissions (Cr, Ni, Mn) due to the painting, welding and fabrication involved. Steel solutions can be nearly completely fabricated and assembled in the factory with very high precision. This minimises the material waste and waste disposal requirements, lowers the time on site and reduces the quantity of on-site labour in comparison to concrete. These factors all contribute to a lower embodied carbon impact on the environment compared to concrete.	Option 1 and Option 3 create similar environmental concerns due to the concrete production and construction have a greater level of energy consumption when compared to steel equivalents. This is associated with the increased quantity of on-site formwork and falsework required, greater transportation costs due to larger and heavier mass of materials and the lengthier installation process with less opportunities for off-site fabrication and time allocated for casting and curing of the concrete.
Health & Safety	All 3 options require the transportation of heavy prefabricated or precast structures to site and the lifting of them over the water. Option 1 however has a distinct advantage in that extremely limited concrete works will be required over the river limiting the risks for construction workers. The large number of elements that require craning into position pose a higher risk to H&S when compared to the other options.	This option will require significant works over the river for the construction of the insitu bridge deck. Suitable edge restraints will be required to prevent construction workers from falling off the edge. Lifting the steel beams in braced pairs reduces the beam lifts to three which is a significant reduction in H&S risks.	This option will require significant works over the river for the construction of the insitu bridge deck. Suitable edge restraints will be required to prevent construction workers from falling off the edge. The large number of elements that require craning into position pose a higher risk to H&S when compared to the Option 2.
Construction & Buildability	The precast portal frame will be designed and built off-site with reinforced concrete. The fully integral structure will be erected onsite on pre-poured concrete foundation slabs. As the majority of elements are precast construction time will be significantly reduced compared to the other two options.	Option 2 will require the least number of large structural elements to be delivered to site. In addition, this option will also have the lowest number of crane lifts when compared to the other options presented. The use of permanent formwork and lifting the beams in braced pairs significantly reduces the temporary works required.	Option 3 will likely have the longest construction time with significant number of beam lifts required. In addition, a significant number of large 45m bridge beams will need to be transported to site causing disruption to the residents and members of the public.
Ground Conditions	Option 1 is likely to impart the lowest loading on its foundations resulting in lower foundation requirements, however, the significant width of option 1 will result in extremely wide foundations when compared to the other options.	The use of bearings in this option will result in all loads being transferred to the foundations axially without any additional horizontal loads or bending moments reducing the size of foundations compared to Option 3.	The soil structure interaction will require detailed analysis to ensure that this movement can be accommodated. In addition, horizontal loads and bending moments are likely to be transferred to the foundations requiring increased foundation sizes when compared to the other options This option will also be significantly heavier than the other options, which will lead to increased foundation sizes.

Appendix D - Business Case

N63 Liss to Abbey Realignment Scheme

Phase 3 – Preliminary Business Case

Galway County Council

AECOM Project Number: 60571547
GCC Project Number: GC/16/13416

Document Reference: N63-ACM-PH03-ZZ-RP-ZZ-0002

7th February 2022

Quality information

Prepared by	Checked by	Verified by	Approved by
Cameron McBain Consultant	Neil Caughey Associate Director	Philip Shiels Associate Director	Eoin Greene Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
DRAFT 1	10/08/2021	1st Draft Issue	Yes	Eoin Greene	Technical Director
DRAFT 2	10/12/2021	2nd Draft Issue	Yes	Eoin Greene	Technical Director
Rev 0	07/02/2022	Final for Ph3 Close Out	Yes	Eoin Greene	Technical Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Galway County Council
Áras an Chontae,
Prospect Hill,
Galway
H91 H6KX

Prepared by:

AECOM-ROD
4th Floor
Adelphi Plaza
Georges Street Upper
Co. Dublin
Ireland

T: +353 1 238 3100
aecom.com

Prepared by:

All Rights Reserved.

This document has been prepared by AECOM Ireland Ltd and Roughan & O'Donovan Ltd ("AECOM-ROD) for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM-ROD and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM-ROD, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM-ROD.

Table of Contents

Figures

Tables

1 Introduction

1.1 Overview

This report forms the Phase 3 (Design and Environmental Evaluation) Preliminary Business Case (PBC) for the N63 Liss to Abbey Realignment Scheme and has been undertaken in accordance with the Transport Infrastructure Ireland (TII) Project Management Guidelines (PMG) 2019 and TII Project Appraisal Guidelines (PAG) 2021[1].

The TII PAG are in compliance with the Department of Transport (DoT) Common Appraisal Framework (CAF) for Transport Projects and Programmes 2020 and Department of Public Expenditure and Reform (DPER) Public Spending Code (PSC) 2019.

The Business Case document is the primary deliverable summarising the project appraisal process and is developed and updated as the project progresses through its project lifecycle. The Business Case also includes a summary of many other important aspects of the project management and delivery process, alongside the appraisal process.

AECOM - ROD have been commissioned by Galway County Council to provide multi-disciplinary engineering and other specialist consultancy services, covering Phases 1 - 4 of the TII PMGs for the development of the N63 Liss to Abbey Realignment Scheme.

1.2 Project Description

The N63 Liss to Abbey Realignment Scheme is a proposed road scheme in Abbeyknockmoy, Co. Galway, that will facilitate a number of objectives in the Galway County Development Plan (2015-2021), including improvements to safety through upgraded road alignment and the separation of regional and local traffic. The scheme will also meet a number of objectives of the Road Safety Authority's Road Safety Strategy 2013 - 2020. The proposed scheme will propose the upgrade of approximately 2.4km of the existing road alignment.

The proposed scheme is located in the north east of County Galway along the N63 Route, a National Secondary route, and directly to the east of the village of Abbeyknockmoy. The study area extends in a north easterly direction, from the eastern edge of Abbeyknockmoy, across the Abbert River, to the townland of Derreen and on towards the junction of the N63 with the L6234. The study area includes a National Monument to the west, the Cistercian Abbey.

The scheme generally runs from south west to north east across the Abbert River, which is part of the Lough Corrib Special Area of Conservation (SAC). The scheme location is characterised by the presence of open greenfield area with some wooded areas in the section south of the Abbert River.

The scheme is located in close proximity to Abbeyknockmoy Abbey, a National Monument located to the north of Abbeyknockmoy, enjoying the highest level of statutory protection under the National Monuments Acts 1930–2004.

The purpose of the scheme is to provide an improved link for regional traffic to the M17 motorway and reduce traffic congestion at the Liss Bridge and the community facilities. The existing N63 will be upgraded to provide facilities for both cyclists and pedestrians and will improve connectivity between the community facilities and residential areas. The Proposed Road Development will assist in the alleviation of the traffic congestion issues in the vicinity of Liss Bridge, while improving safety for both motorised and non-motorised users.

Strategically, while the N63 itself does not form part of the TEN-T Network, the proposed improvements will support the objectives of the TEN-T in broad terms by improving the connectivity to Junction 19 on the M17 TEN-T comprehensive network.

The location of the scheme can be seen in Figure 1-1 below.

[1] PE-PAG-02033 – PAG for National Roads Unit 8.0 – Business Case

Figure 1-1 Regional Location Plan

1.3 Background to the Project

AECOM-ROD were commissioned to begin work on the scheme in May 2019. The scheme has been progressed by AECOM-ROD through Phase 1 (Feasibility Studies) of the TII Project Management Guidelines 2019 (PE-PMG-02041) and a Scheme Feasibility Report was published in August 2019. A Phase 2 Options Selection Report has been prepared in accordance with TII Project Management Guidelines 2019 (PE-PMG-02041) and TII Project Appraisal Guidelines for National Roads (Unit 4.0 - Consideration of Alternatives and Options - PE-PAG-02013) and was published in April 2020. The Phase 2 Gate Review Statement has been accepted by TII in December 2020; the approval to progress the scheme from Phase 2 to Phase 3 was also granted by TII in December 2020.

The development of the preliminary design, the Compulsory Purchase Order (CPO), the Environmental Impact Assessment and the Appropriate Assessment progressed during 2021. A Stage 1 Road Safety Audit was produced and accepted in August 2021. At the time of writing this document, the development application documentation required for the submission to An Bord Pleanála is currently being finalised.

2 Project Context

2.1 Policy Review

The compatibility of the proposed scheme in terms of meeting the objectives of national, regional and local planning policy is considered in this section of the PBC.

2.1.1 Road Development Policies

The need for N63 Liss to Abbey Realignment Scheme has been identified within the Project Brief and is consistent with the following international, national, regional and local planning policy documents:

International and National Policy Context

- Project Ireland 2040 National Planning Framework (NPF);
- Strategic Investment Framework for Land Transport (SIFLT);
- Programme Government: Our Shared Future; and
- Road Safety Authority Road Safety Strategy 2013 – 2020[2].

Regional Policy Context

- West Regional Planning Guidelines (2010-2022).

Local Policy Context

- Galway County Development Plan (2015-2021).

2.1.2 International and National Policy

Project Ireland 2040 National Planning Framework (NPF)

The NPF is the Government's high-level strategic plan for shaping the future growth and development of Ireland to the year 2040. Its overarching visions are to:

- Develop a new region-focused strategy for managing growth;
- Linking this to a new 10-year investment plan, the Project Ireland 2040 National Development Plan 2018-2027;
- Using state lands for certain strategic purposes;
- Supporting this with strengthened, more environmentally focused planning at local level; and
- Backing the framework up in law with an Independent Office of the Planning Regulator.

The goals and objectives of the NPF are expressed within the Plan as 'National Strategic Outcomes', which include:

1. Compact Growth;
2. Enhanced Regional Accessibility;
3. Strengthened Rural Economies and Communities;
4. High Quality International Connectivity;
5. Sustainable Mobility;
6. A Strong Economy, supported by Enterprise, Innovation and Skills;
7. Enhanced Amenities and Heritage;
8. Transition to a Low Carbon and Climate Resilient Society;
9. Sustainable Management of Water, Waste and other Environmental Resources;
10. Access to Quality Childcare, Education and Health Services.

[2] Most recent document at the time of writing, but will also have regard for objectives of the draft RSA Road Safety Strategy 2021-2030

The proposed upgrade of the N63, will directly support 'Strengthened Rural Economies and Communities' and 'Sustainable Mobility', which are defined below:

> ***Strengthened Rural Economies and Communities***
>
> *Rural areas play a key role in defining our identity, in driving our economy and our high quality environment and must be a major part of our country's strategic development to 2040. In addition to the natural resource and food sector potential as traditional pillars of the rural economy, improved connectivity, broadband and rural economic development opportunities are emerging which offer the potential to ensure our countryside remains and strengthens as a living and working community.*
>
> ***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.*

The provision to of dedicated pedestrian and cycle facilities, the segregation of the national and regional traffic, and the removal of safety hazards at Liss Bridge will improve the connectivity between the community facilities and residential properties and support the use of sustainable modes in the area. The introduction of the Proposed Road Development will assist the bus services. The locations of the bus stops mean they will not be by-passed by the new section of road, but the buses will be able to use the new section of road minimising their journey time along this section of national road.

Of most significance in terms of the NPF, is the fact that the N63 connects directly to the core component of the Atlantic Economic Corridor (AEC), which is defined within the Plan as:

> *… a linear network along the Western seaboard, stretching from Kerry to Donegal, which has the potential to act as a key enabler for the regional growth objectives of the National Planning Framework. The corridor straddles parts of both the Northern and Western Region and the Southern Regions, with the potential to further extend its scope by building on the Cross-Border relationship between Letterkenny and Northern Ireland, and into Cork City and County to the south. The overarching objective of the AEC initiative is to maximise the infrastructure, talent and enterprise assets along the western seaboard and to combine the economic hubs, clusters and catchments of the area to attract investment, improve competitiveness, support job creation and contribute to an improved quality of life for the people who live there. [The lack of high-quality connectivity between the regions within the AEC has been a major impediment to its development as a counter-balance to Dublin and the East coast.]*

Improved connectivity between Counties Galway, Longford, Roscommon and Clare via the M17/M18 will be delivered through this project; thereby enhancing accessibility for the region.

Strategic Investment Framework for Land Transport (SIFLT)

The SIFLT which was published by the Department of Transport, Tourism and Sport (DTTAS) outlines the key principles against which national and regional, comprehensive and single mode-based plans and programmes will be drawn up and assessed. The framework does not set out a list of projects to be prioritised, however, the following three priorities are noted in terms of investment:

- Priority 1 – Achieve steady state maintenance;
- Priority 2 – Address urban congestion; and
- Priority 3 – Maximise the value of the road network.

In terms of Priority 3, the report states that *"the value of the road network will be maximised through targeted investments that:*

- *Enhance the efficiency of our existing network, particularly through the increased use of ITS applications;*
- *Support identified national and regional spatial planning priorities;*
- *Provide access for large-scale employment proposals; and*
- *Support identified national and regional spatial planning priorities"*

The proposed scheme will support the objectives of the SIFLT by improving the efficiency of this section of the National Roads network. This will be achieved through reduced journey times and improvements to journey time reliability on the N63 for long distance trips between the West and North-West Regions and medium distance trips between Longford/Roscommon and Galway. The scheme will also assist in supporting the economic performance of the counties of Galway and Longford/Roscommon through the provision of improved transport infrastructure.

Programme for Government: Our Shared Future – October 2020

In October 2020, the Government launched "Programme for Government: Our Shared Future" outlining the policies and objectives over the term of the government. The proposed road development aims to support the objectives and policies contained within the programme for a partnership government, by continuing *"to invest in new roads infrastructure to ensure that all parts of Ireland are connected to each other."*

Road Safety Authority Road Safety Strategy 2013 - 2020

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

> *"A reduction of road collision fatalities on Irish roads to 25 per million population or less by 2020 is required to close the gap between Ireland and the safest countries. This means reducing deaths from 162 in 2012 to 124 or fewer by 2020.*
>
> *A provisional target for the reduction of serious injuries by 30% from 472 (2011) to 330 or fewer by 2020 or 61 per million population has also been set."*

The plan sets out strategies for engineering and infrastructure in terms of the benefits that they can have in terms of reducing collisions. The principles of the proposed road development will support the proposed road safety strategy by providing essential transport infrastructure to meet these demands and ensure improved facilities are provided. will reduce the levels of traffic congestion on the road network in proximity to the existing Liss Bridge, likely providing a corresponding reduction in collisions along this link. By segregating a significant proportion of the regional traffic and the local traffic there will be less chance of conflict between these two types of road users. In addition, the proposed road development will be compliant with the current design standards, which will help improve road safety through enhanced VRU provision.

2.1.3 Regional Policy

West Regional Planning Guidelines (2010-2022)

The West Regional Planning Guidelines (2010-2022) (RPG2010) identifies the following works for priority completion in order to promote a balanced regional development:

> *IO5: Identify the following works for priority completion in order to promote a balanced regional development. The following projects must be assessed as to their environmental impact, through relevant assessment, where necessary, including Habitats Directive Assessment in accordance with the requirements of the Habitats Directive, with preferred route options ensuring minimal impact, on the natural and built environment. 8. Upgrade and improve all National Secondary roads in Particular: (C) N63 Galway to Roscommon connecting the Gateway to the County town of Roscommon; minimising environmental impact.*

The West Regional Assembly was consumed into the Northern & Western Regional Assembly in January 2015 and are preparing a Regional Spatial Economic Strategy (RSES) for the region which will support the implementation of the NPF. The RSES will put in place policies and recommendations that will better manage regional planning and economic development throughout the region.

2.1.4 Local Policy

Galway County Development Plan (2015-2021)

A County Development Plan (CDP) is a requirement by law, for every planning authority in Ireland to set out an overall strategy for the proper planning and sustainable development of the area. The Planning and Development Act 2000 (as amended) has stated under Section 27(1);

> *"A planning authority shall ensure, when making a development plan or local area plan, that the plan is consistent with the regional spatial economic strategy in force for its area"*

A primary aim of the CDP is to promote, guide and enforce high quality standards of development for urban and rural areas throughout the county. With the general emphasis to enhance the quality of life, environment, community, and economy that supports the sustainable development of each county.

A Draft Galway County Development Plan (Draft CDP) 2022 – 2028 has been prepared by Galway County Council, further information is provided in Section 2.3.4.2. The most relevant local level policy is the extant Galway County Development Plan 2015-2021 (CDP) (GCC, 2015). The relevant national and regional objectives level have been developed further and translated into local objectives through the CDP. This CDP has been prepared in accordance with Sections 11 and 12 of the Planning and Development Act, 2000 (as amended).

The overall vision of the CDP 2015-2021 aims to;

> *"Enhance the quality of life of the people of Galway and maintain the County as a uniquely attractive place in which to live, work, invest and visit, harnessing the potential of the County's competitive advantages in a sustainable and environmentally sensitive manner."*

The CDP sets out the strategic aims to achieve the overall vision for County Galway. Figure 2-1 highlights the overall spatial strategy and proposed development option.

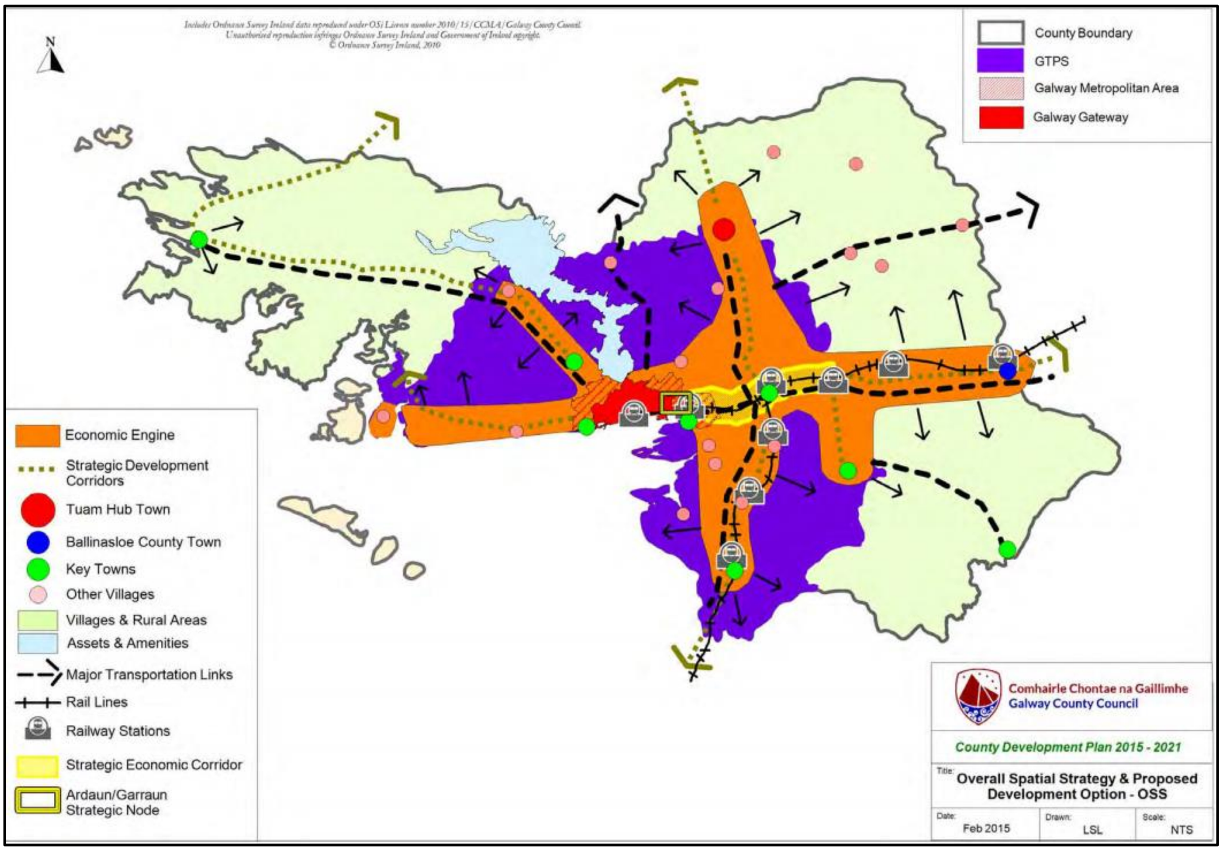


Figure 2-1 Overall Spatial Strategy & Proposed Development Option

Source: Galway County Development Plan, 2015-2021

The Proposed Road Development transverses land considered greenfield and predominantly rural in nature. The closest settlement is Abbeyknockmoy, County Galway. In the tiers set out in the hierarchy of towns, villages and settlements, Abbeyknockmoy is categorised as '*Other Settlements & the Countryside'.* Figure 2-1 highlights the proximity to Tuam, which the CDP identifies as a Hub town. In addition, the CDP has listed Objective DS 1 – Development Strategy:

> *"…To Develop the Hub Town of Tuam, Supporting the Gateway and Key Towns while Encouraging the Development of Other Settlement Centres and Appropriate Development in Rural Areas"*

The CDP specifically mentions that any development in the un-serviced countryside requires sensitive and careful management, in order to balance the need to revitalise and support communities, while ensuring the overall sustainable development of these areas.

Considering the large rural areas of County Galway, the CDP refers to the broad classification of these areas, particularly as; Rural Areas Under Strong Urban Influence and Structurally Weaker Rural Areas.

Rural Areas Under Strong Urban Influence -

> *"….areas exhibit characteristics such as proximity to the immediate environs or close commuting catchment of Galway City, rising population, evidence of considerable planning pressure for development of housing due to proximity to such urban areas or to major transport corridors with ready access to the urban area, and pressures on infrastructure such as the local road network."*

Structurally Weaker Rural Areas -

> *"….areas exhibit characteristics such as persistent and significant population decline as well as a weaker economic structure based on indices of income, employment and economic growth. In addition to the two broad rural areas listed above, there are a number of additional specific planning considerations that need to be taken into account when assessing rural housing in the countryside."*

The CDP states the above distinctions are necessary in order to be able to respond to local circumstances, such as housing, economic and population decline or areas under substantial pressure for development.

Table 2-1 lists some of the strategic aims designated by the CDP along with performance indicators of relevance to the Proposed Road Development.

Table 2-1: Strategic Aims of the Galway County Development Plan 2015-2021

Strategic Aim	Details	Performance Indicators
Promote Regional Development	Promote regional development and growth through harnessing the economic and employment potential of the competitive advantages of County Galway such as its strategic location, quality of life, landscape, heritage and natural resources, in a sustainable and environmentally sensitive manner.	• Population growth in the County is channelled into the appropriate growth settlements in accordance with the plan; • The overall population targets provided for in the Regional Planning Guidelines are not exceeded; • The zoning limits set out in the Core Strategy are carried through to local area plans; • Family income; • Unemployment rate; • Take up of new employment land; • Increase in rates base reflecting growth in commercial properties; • Diversification in employment sectors.
Balanced Urban and Rural Areas	Prioritise development within the Hub town of Tuam, the Galway Metropolitan Area, Ballinasloe, the key towns and smaller towns, villages and settlements within the County, while supporting the role of the rural area in sustaining the rural based economy.	• Number of new houses provided; • Number of areas/houses refurbished in the Local Authority housing stock; • Quality of new housing with regard to design, proximity to services, energy efficiency, green amenity; • Range of house types and size provided; • Diversification in farming and generation from the land of alternative income from farming; • Total hectares of land developed for new enterprises in the plan period on business/enterprise/industrial zoned lands.
Inclusive Communities	Encourage and support the development of inclusive communities which engage and include all members of society facilitating equal physical, social and cultural access and integration.	• Square metres of community/education/institutional zoning granted in the plan period; • Square metres of town centre/commercial zoning granted in the plan period;

Strategic Aim	Details	Performance Indicators
		• Number of new educational/childcare facilities provided; • Number of new leisure/recreational facilities provided; • Improvements in walking/cycling linkages within settlements.
Integrated Development	Ensure a more sustainable and integrated concept of development with regard to land use, transportation, water services, energy supply and waste management over the lifetime of the plan.	• Overall quantum of new infrastructure projects/schemes delivered; • Growth in broadband coverage in the County; • Number of alternative energy projects delivered.
Sustainable Transportation	Minimise travel demand and promote the increase of sustainable mobility throughout the County.	• Reduction in commuting distance time to work and school; • Increase in the provision and use of public transport services; • Overall delivery of "Smart Travel" initiatives.
Infrastructural Projects	Facilitate the development of infrastructural projects, which will underpin sustainable development throughout the County and region during the plan period.	• Delivery of key infrastructural requirements as identified in the plan.

Source: Galway County Development Plan 2015-2021

The CDP refers to the N/M6 and M17/M18 as the main access routes in the region, while the N59, N63, N83 and N84 are important inter-regional routes. In addition, the CDP makes specific reference to the wider N63 Leacht Seoirse-Ballygar route of which the Proposed Road Development is a sub-section.

The core strategy of the CDP has outlined to;

> *"Build on the regional level linkages between County Galway, the Gateway and other parts of the West Region by supporting the implementation of the regional spatial strategy, as set out in the West Regional Planning Guidelines. The regional spatial strategy aims to develop the Galway Gateway, the Tuam Hub and Castlebar-Ballina Linked Hub, supported by the development of the Athlone Gateway and key towns, encouraging the development of other settlement centres and appropriate development in the rural areas of the region;*
>
> *Focus a greater growth in the Hub town of Tuam, the key towns, lower tier other towns and villages in a sequential manner, recognising the role that new infrastructure and public transport links will play in their future, while maintaining the viability of rural communities in the hinterlands of these towns and villages;"*

In respect of the definition above, the Proposed Road Development will greatly enhance the existing regional and local level linkages, by providing improved accessibility and social inclusion to community facilities and to heritage resources. A list of relevant policies and objectives to the Proposed Road Development from the CDP are highlighted in Table 2-2.

Table 2-2 Galway County Development Plan 2015-2021, Relevant Policies and Objectives

Policy Ref.	Objective
DS 1	It is the overarching objective of Galway County Council to support and facilitate the sustainable development of County Galway in line with the preferred development strategy option: Option 4 – To Develop the Hub Town of Tuam, Supporting the Gateway and Key Towns while Encouraging the Development of Other Settlement Centres and Appropriate Development in Rural Areas, which will allow County Galway to develop in a manner that maintains and enhances the quality of life of local communities, promotes opportunities for economic development, sustainable transport options, social integration, and protects the cultural, built, natural heritage and environment while also complying with relevant statutory requirements.
DS 2	a) Continue to recognise the defined Galway Transport and Planning Study Area, the commuter zone of Galway City, which requires careful management of growth and strong policies to shape and influence this growth in a sustainable manner;

Policy Ref.	Objective
	b) Support a review of the Galway Transportation and Planning Study during the lifetime of the plan, in co-operation with Galway City Council. Consideration of the inclusion of a Strategic Transport Assessment shall form part of this review.
DS 11	Co-ordinate new growth within the key towns, villages and settlements along the strategic development corridors throughout the County in order to create more sustainable development patterns and to optimise public and private investment made within the County and support the appropriate development of the Strategic Economic Corridors.
SS 3	Galway County Council shall promote and secure the development of Tuam, to enable it to fulfil its potential as a Hub town, so that it obtains the critical mass necessary to sustain strong levels of economic growth and prosperity, while supporting improvements in connectivity between the Gateway and the Hub, enhancing their complementary status.
SS 7	In the case of smaller settlements for which no specific plans are available, development shall be considered on the basis of its connectivity, capacity (including social, cultural, and economic, infrastructural and environmental capacity) and compliance with the Core Strategy and Settlement Strategy, good design, community gain and proper planning and sustainable development.
SS 8	Galway County Council shall recognise the important role of rural communities to the sustainable development of County Galway and shall ensure the careful management of development in these areas, having due regard to the relevant policies and objectives set out elsewhere in the plan.
EDT 1	The objectives for the Strategic Economic Corridor include: • To upgrade, improve and maximise the infrastructural facilities available within the corridor; • To seek to reserve lands to support nationally and regionally significant activities and to attract specialist enterprise development that is large scale or high value; • To facilitate opportunities for science and technology based employment; • To ensure development is compatible with the enhancement, preservation and protection of the environment and cultural resources recognised within the corridor; • To identify sites of adequate size and location to accommodate necessary infrastructure or support activities which would not be appropriate in proximity to centres of population or sensitive environments or environmentally sensitive economic activities; • To inform and to aid the preparation of Local Area Plans for strategic areas and those surrounding immediate environs within the corridor.
TI 1	It is the overarching policy of Galway County Council to comply with all relevant Irish and European planning and environmental legislation in implementing its Transportation Strategy.
TI 2	It is the policy of the Council to promote the development of an integrated and sustainable high quality transport system that shall: a) Promote closer co-ordination between land use and sustainable transportation; b) Continue the provision of a range of transport options within the County in collaboration with other statutory agencies and transport providers, including a safe road network, a range of bus and rail services, adequate facilities for walking and cycling and opportunities for air and water-based travel.
TI 5	It is the policy of Galway County Council in conjunction with all relevant statutory agencies and infrastructure providers to provide road and street networks that are safe and convenient, that have adequate capacity to accommodate motorised traffic and non-motorised movements, that have a high environmental quality with appropriate adjacent development and built form, particularly in the case of urban streets and streetscapes, and that adequate parking facilities are provided to serve the needs of towns and villages within the County. In this regard, the principles, approaches, and standards set out in the Design Manual for Urban Roads & Streets (2013) (including any superseding document) shall be applied to new development as appropriate.
TI 6	Seek to protect and safeguard the significant investment made in strategic transportation infrastructure, in particular the network of national roads, the existing rail lines and the Western Rail Corridor.
TI 7	Protect the motorway and national road network and national road junctions in line with Government policies. Safeguard the carrying capacity, operational efficiency, safety and significant investment made in the motorway and national road network within the County including the M6 Dublin to Galway Motorway, the M18 Gort to Crusheen Motorway and the M17/M18 Galway to Tuam when completed.
TI 8	It is the policy of Galway County Council to work with Galway City Council and all relevant statutory bodies to develop an appropriate infrastructural response to the transportation needs of the Galway Gateway, its environs and the west of the County, with a view to relieving congestion, improving travel times, increased safety of all road users and enhancing connectivity and access within the region and enhanced accessibility of the western region in a national and international context. Any

Policy Ref.	Objective
	such solution shall have due regard to the necessity to protect the environment and will comply fully with the requirements of the Habitats Directive.
TI 9	It shall be the policy of Galway County Council to ensure that any works to be carried out by Galway County Council or other statutory authority to any part of the road network which may affect the delivery of either the Western Rail corridor or any Greenway proposal shall be carried out in such a way so as not to compromise the longer term delivery of such alternative transportation proposals or any interim objectives to use the railway as a greenway.
TI 10	It is a policy of Galway County Council to liaise with the National Roads Authority on the reclassification of Restricted Routes as a result of the construction of motorways.
TI 5	Facilitate the progression of and implement improvements to the existing National and Regional/Local Road networks including the priority transportation schemes, listed in Table 5.1: Priority Transportation Infrastructure Projects for Co. Galway 2015-2021 and those listed within Table 5.2: Regional/Local Projects Proposed 2015-2021 subject to relevant Irish planning and European environmental legislation including Article 6 of the Habitats Directive and/or other environmental assessment, where appropriate.
TI 6	It is an objective of the Council to protect the capacity and safety of the National Road Network and Strategically Important Regional Road network (listed in DM Standards and Guidelines in Chapter 13) in the County and ensure compliance with the Spatial Planning and National Roads Planning Guidelines (2012). Galway County Council will not normally permit development proposals for future development that include direct access or intensification of traffic from existing accesses onto any national primary or secondary road outside of the 50-60 kph speed limit zone of towns and villages.
TI 15	It is an objective of Galway County Council to work with all other relevant bodies to deliver the necessary improvements to transportation infrastructure, including new infrastructure if necessary, to help secure the medium and long term economic and social development of Galway Gateway and the west of the County. Any such investment or project shall be carried out with due regard to the necessity to protect the environment and in full compliance with the provision of relevant legislation, including the Habitats Directive.
ARC 1	It is the policy of Galway County Council to support and promote the conservation and appropriate management and enhancement of the County's archaeological heritage within the plan area. Galway County Council will ensure the implementation of the legislative, statutory and policy provisions relevant to the conservation of the archaeological heritage.

Galway County Development Plan 2015-2021

A primary aim of the CDP is to promote, guide and enforce high quality standards of development for urban and rural areas throughout County Galway. The general emphasis to enhance the quality of life, environment, community and economy in a manner that supports the sustainable development of the entire County. The concept, principles and design process of the Proposed Road Development is considered compliant with the policies and objectives set out in the CDP.

Draft Galway County Development Plan 2022-2028

The Draft Galway County Development Plan (Draft CDP) 2022 – 2028 has been prepared in accordance with the provisions of the Planning and Development Act 2000 (as amended). In view of recent implementation of new policies on a national and regional level as referred to in Section 2.1.2 and 2.1.3, the Draft CDP states to have considered these changes associated with these overarching policy frameworks in Ireland (GCC, 2021).

The Draft CDP has not yet been adopted, however has been on public display and available for public consultation from the 20th May 2021 to the 30th July 2021. The adoption of the Draft CDP is required to be completed by May 2022. As mentioned previously, for the purposes of this chapter, the most relevant local level policy is the extant Galway County Development Plan 2015-2021 listed in the previous section.

Notwithstanding this, since the Draft CDP is now publicly available information, this section has reviewed the Draft CDP and included a list of relevant policies and objectives to the Proposed Road Development, these are highlighted in Table 2-3.

Table 2-3 Draft Galway County Development Plan 2022-2028, Relevant Policies and Objectives

Policy Ref.	Objective
PM 4	It is a policy objective of the Council to encourage modal shift in our towns to more sustainable transport alternatives through mixed use development that enables local living and working which is well connected to sustainable transport infrastructure such as walking, cycling, public bus and rail transport.
PM 5	Promote sustainable transport options as an alternative to the private car for people to access local services which will facilitate the transition to a low carbon climate resilient society.
GCTPS 1	It is a policy objective of Galway County Council to support and facilitate the implementation of the Galway County Transport & Planning Strategy and Galway Transport Strategy across all modes of transport.
GCTPS 2	Galway County Council will pursue a fully integrated approach to land use and transportation, actively supporting measures which facilitate and attract developments to locations with high levels of sustainable transport provision (or which can achieve such provision as a result of the development in question).
GCTPS 3	The County will seek to support a variety of measures which will reduce car dependency for residents, and will specifically seek to improve access to sustainable transport choices (including responsive and “flexible” modes) for those residents in rural areas of the County.
GCTPS 7	The County will manage and maintain the efficient and safe operation of the road network under its control, and will work with TII and NTA to identify locations on the national network where targeted improvements may be required to address specific issues.
GCTPS 8	The County will co-operate with TII and the NTA with regard to the maintenance and enhancement of national networks for longer-distance and cross-country travel and movement of through-traffic including freight.
PRP 1	Galway County Council will facilitate the progression of the necessary infrastructure improvements including new roads/projects listed in Table 6.1: Priority Transportation Infrastructure Projects for County Galway 2022-2028 and those listed within Table 6.2: Regional/Local Projects Proposed for 2022-2028 subject to relevant Irish planning and European environmental legislation including Article 6 of the Habitats Directive and/or other environmental assessment, where appropriate.
NR 1	To protect the strategic transport function of national roads, including motorways through the implementation of the ‘Spatial Planning and National Roads Guidelines for Planning Authorities’ DECLG, (2012) and the Trans-European Networks (TEN-T) Regulations.

Draft Galway County Development Plan 2022-2028

Of further importance, Chapter 6 (Transport and Movement) of the Draft CDP, sets out to;

> *“…encourage investment and improvements across all sectors of transport that will support targeted population, economic growth and more sustainable modes of travel including, walking, cycling and public transport”.*

Similar to the Overall Spatial Strategy & Proposed Development Option for the CDP shown in Figure 2-1, the Draft CDP has issued the Strategic Transport Network also highlighted in Figure 2-2. This visually highlights the on-going intentions of Galway County Council.

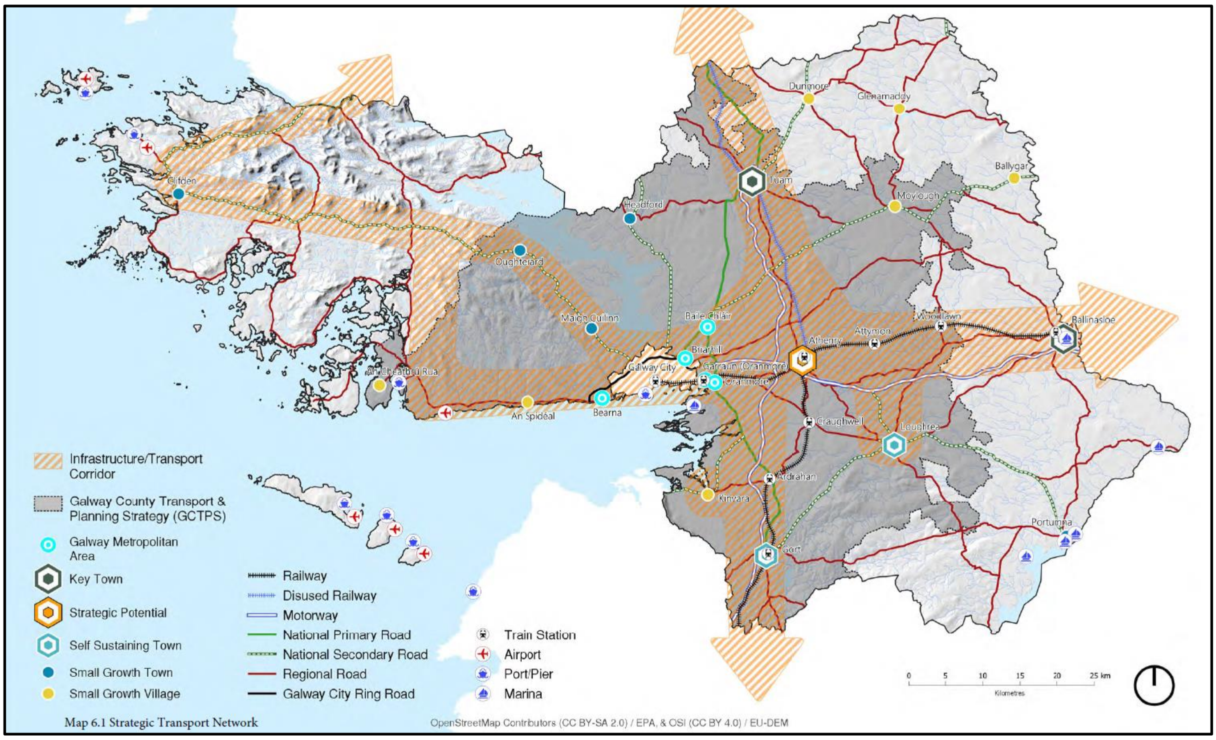


Figure 2-2 Strategic Transport Network

Source: Draft Galway County Development Plan, 2022-2028

As stated in Policy Objective PRP 1 in Table 2-3, and summarised below;

> *"Galway County Council will facilitate the progression of the necessary infrastructure improvements including new roads/projects listed in Table 6.1: Priority Transportation Infrastructure Projects for County Galway 2022-2028 and those listed within Table 6.2: Regional/Local Projects Proposed for 2022-2028…"*

Table 6.2 of the Draft CDP refers to regional/local projects proposed for 2022-2028. As shown in Figure 2-2, the Proposed Road Development is considered a regional road, of relevance, its further states that; "*Local and regional road networks within the County"*, have an objective to; "*Continue strengthening, improvements and realignment work where necessary, to these networks."*

In reviewing the Draft CDP for 2022-2028, it is our view that the concept, principles, and design process of the Proposed Road Development is considered compliant with the policies and objectives set out in the current Draft CDP.

2.1.5 Policy Summary

Policy and planning documents have further identified the need for the scheme and support the objectives of an improved N63 corridor, particularly;

1. Sustaining economic growth through the provision of improved transport connectivity in this rural location
2. Enhanced regional and local accessibility, providing improved accessibility & social inclusion to school and community facilities
3. Enhanced environmental benefits, through a reduction in traffic queuing and journey time reliability
4. Improved safety through improved road alignment, pedestrian and cycle user segregation ultimately reducing accidents in line with the Road Safety Strategy (2013-2020).

2.2 Need for Scheme

The N63 forms part of the National Secondary Road network. The TII National Roads Network Indicators 2018 report describes that the N63 is operating at a volume / capacity (V/C) ratio of below 80% in most areas but at a number of pinch points it is operating at a V/C ratio of 100%-120% of it's daily capacity. Along one section, the N63 is operating at above 120% V/C. A review of the condition of the existing N63 within the study area was carried out, and is reported in Chapter 5 of the Phase 2 - Option Selection Report (N63-ACM-PH02-ZZ-RP-ZZ-0001).

Within the study area the existing N63 is generally narrow with no hard shoulders. Alignment of the road is poor in both the horizontal and vertical planes. There is no off-carriageway provision for pedestrians or cyclists. The existing Liss Bridge significantly restricts traffic flows due to its narrow width and inadequate vertical and horizontal alignment. The bridge is not fit for purpose in the context of modern vehicles, with two HGV's travelling in opposite directions unable to safely pass. During a site inspection a number of bridge strikes were apparent, with the existing sub-standard parapet walls repaired in several locations.

Given the rural nature of the study area, agricultural vehicles conflict with local road traffic on the Liss Bridge on a regular basis, which in turn generates localised traffic issues. There have been collisions at this location as identified in TII and RSA collision data.

The N63 is a regional connector route connecting Roscommon to the M17 which leads on to Galway. Any proposed upgrade to the current sub-standard N63 alignment will improve the route consistency of the National Roads network and increase the overtaking opportunities. This will help with connectivity between these areas and improve journey times and reliability.

Outside of the study area the N63 is a relatively straight road with standard verges, no pedestrian/cyclist facilities and a number of overtaking areas when travelling from east to west towards Abbeyknockmoy. To the west of Abbeyknockmoy there is a recently upgraded section of the N63 connecting to the M17 consists of a Type 2 single carriageway cross-section. The proposed upgrade for this section of the N63 will use the same cross-section to improve route consistency along the National Roads network.

Figure 2-3 N63 Westbound at L3110 Junction

Figure 2-4 N63 Eastbound approaching Liss Bridge

The N63 Liss to Abbey Realignment Scheme is considered to be consistent with local and regional and national policy and guidance. The scheme is described as a specific objective within both the current development plan and local transport plan.

The proposed scheme is a multi-modal transport scheme, with a provision for both cyclists and pedestrians. The scheme will improve journeys across the Abbert River, with improved horizontal and vertical alignments. In addition, improved cross-sections, realignment and upgraded junctions will improve safety, particularly for pedestrians and cyclists.

2.3 Project Objectives

The following are the objectives for any proposed intervention on this section of the N63. These may evolve as the project is developed, and the extent to which the project is capable of meeting them will emerge from the process of analysis.

The framing of scheme objectives has been undertaken in accordance with the guidance provided in the TII's PAG - *PAG Unit 3.0: Project Brief*. That document includes a recommendation that scheme objectives are established which fall under the criteria included in the Common Appraisal Framework, inter alia:

- Economy;
- Safety;
- Environment;
- Accessibility & Social Inclusion;
- Integration; and
- Physical Activity.

2.3.1 Economy

The key economic objectives are:

- To reduce journey times and improve journey time reliability on the N63 for long distance trips between the West and North-West Regions and medium distance trips between Longford/Roscommon and Galway; and
- To assist in supporting the economic performance of the counties of Galway and Longford/Roscommon through the provision of improved transport infrastructure which will reduce the cost of travel for business and tourism and assist in reducing the overall cost of production thereby improving competitiveness.

2.3.2 Safety

The key safety objectives are:

- To reduce the collision rate along the National Roads network between Abbeyknockmoy village and Derreen to below the national average rate;
- To reduce the severity of collisions along the National Roads network between Abbeyknockmoy village and Derreen;
- To improve safety for all road users including pedestrians and cyclists along both the National Roads network and on the surrounding road network between Abbeyknockmoy village and Derreen;
- To support the RSA Road Safety Strategy 2013-2020; and
- To improve the security of vulnerable road users by providing for non-motorised users.

2.3.3 Environment

The key environmental objectives of the scheme are:

- To avoid or minimise adverse impacts on the internationally important European Sites;
- To improve road drainage;
- To be sensitive to the visual amenity of the Abbey and surrounding areas; and
- To minimise any noise impacts on properties.

2.3.4 Accessibility & Social Inclusion

The principal accessibility and social inclusion objectives are:

- To improve accessibility to key facilities, such as employment, education, transport, and healthcare for all road users, but in particular for vulnerable groups;
- To improve accessibility and reduce severance particularly within the community of Abbeyknockmoy village and in turn support social and economic development within the village and its hinterland; and
- To support the accessibility and social inclusion objectives of national, regional and local planning policy.

2.3.5 Integration

The proposed scheme is required to integrate with general policies and plans under the headings of Transport, Land Use, Geographical and Government Policy. The following objectives are outlined for integration:

- To support the integration objectives set out in European, National, Regional and Local planning policy by upgrading the N63 National Secondary between Abbeyknockmoy village and Derreen;
- To support initiatives to bring investment into the West Region; and to support transport integration within the wider region, maximising the benefits of previous investment in the N63 corridor, integrating with regional public transport facilities, and improving access to the main ports and airports.

2.3.6 Physical Activity

The following objectives are outlined for physical activity:

- To improve facilities and segregation between national strategic traffic and local non-motorised users' movements such as pedestrians and cyclists;
- To provide a dedicated route for amenity pedestrians and cyclists along the existing road network promoting healthy lifestyle choices, particularly in regard to children's movements to and from school; and
- To improve connectivity to the community facilities for all in the local in the area.

3 Analysis Tools

3.1 Overview

This section of the PBC presents and discusses the tools that were developed and used to inform the project appraisal process.

The complexity of Minor Projects (€5m to €20m) varies considerably. To aid the appraisal process, TII Minor Projects (€5m to €20m) can be classified into three broad categories as follows:

1. Online or offline improvements – economic appraisal supported by 'TII Simple Appraisal Tool' and COBALT;
2. Bypasses – economic appraisal supported by an assignment model; and
3. Junction upgrades (including the optimisation of existing merge/diverge layouts) – economic appraisal supported by modelling proportionate to the upgrade.

The section of existing N63 under consideration is approximately 2.4km in length and consists of online and offline realignment. For this reason, the first approach described above has been considered.

3.2 Traffic Modelling

For minor projects where significant re-routing does not take place (costing between €5m and €20m) the TII Simple Appraisal Tool can be used to inform the project appraisal process instead of building a full traffic assignment model. In order to use the TII Simple Appraisal Tool there are a number of assumptions that need to be considered as these are discussed in the following sections.

3.2.1 Traffic Reassignment Assumptions

The delivery of an alternative route for traffic to use will lead to the re-assignment (re-routing) of traffic away from the existing route. The level of re-assignment relates to the type of traffic using the existing route (local, regional/strategic etc.), with local traffic likely to remain on the existing route to access residential dwellings, commercial premises, schools etc. and regional/strategic traffic rerouting to the proposed scheme.

In order to calculate the number of vehicles which would use the proposed scheme (regional/strategic traffic), the number of vehicles that would remain on the existing route (local traffic) needed to be determined first. Based on the traffic survey data a simple spreadsheet model was created which calculated the percentage of local and regional/strategic traffic.

The simple model calculated that 75% of light vehicles and 76% of HGVs would be regional/strategic traffic and therefore assumed to use the proposed scheme, while the remaining 25% and 24% respectively would be local traffic and would use the existing N63 to access the village and the L3110, L7138 and L21821.

3.2.2 Travel Demand Projections

For the TII Simple Appraisal Tool, traffic flows are generally represented as vehicular traffic flows on links, with limited information on origin, destination or trip length. In such cases, future year traffic growth is projected using growth rates which describe likely traffic growth that may occur over the appraisal period of the scheme.

The derivation of link-based growth rates is based on an aggregate projection of growth in vehicle kilometres within a defined geographical area, with appropriate classifications by vehicle type and projected period. This allows the specification of a series of growth rates which can be applied directly to traffic flows on simple networks to generate an appropriate estimate of future traffic flows.

The growth rates for Galway from Table 6.2 of TII PAG Unit 5.3 - Travel Demand Projections (PE-PAG-02017 - May 2019) were applied to the base year (2019) traffic volumes. An extract from PAG Unit 5.3 can be seen in Table 3-1 below.

Table 3-1 Growth Rates (Galway) – From Table 6.2 of TII PE-PAG-02017

Area	2016-2030		2030-2040		2040-2050		2050+	
	LV	HV	LV	HV	LV	HV	LV	HV
Galway	Central Growth							
	1.0259	1.0446	1.0109	1.0198	1.0105	1.0236	1.0000	1.0000
	High Sensitivity Growth							
	1.0294	1.0480	1.0148	1.0236	1.0181	1.0336	1.0000	1.0000
	Low Sensitivity Growth							
	1.0243	1.0430	1.0087	1.0177	1.0088	1.0218	1.0000	1.0000

Using the link-based growth rates that have been provided for county Galway, the future AADT flow were determined, for both the proposed scheme Opening Year of 2023 (Figure 3-2) and Design Year of 2038.

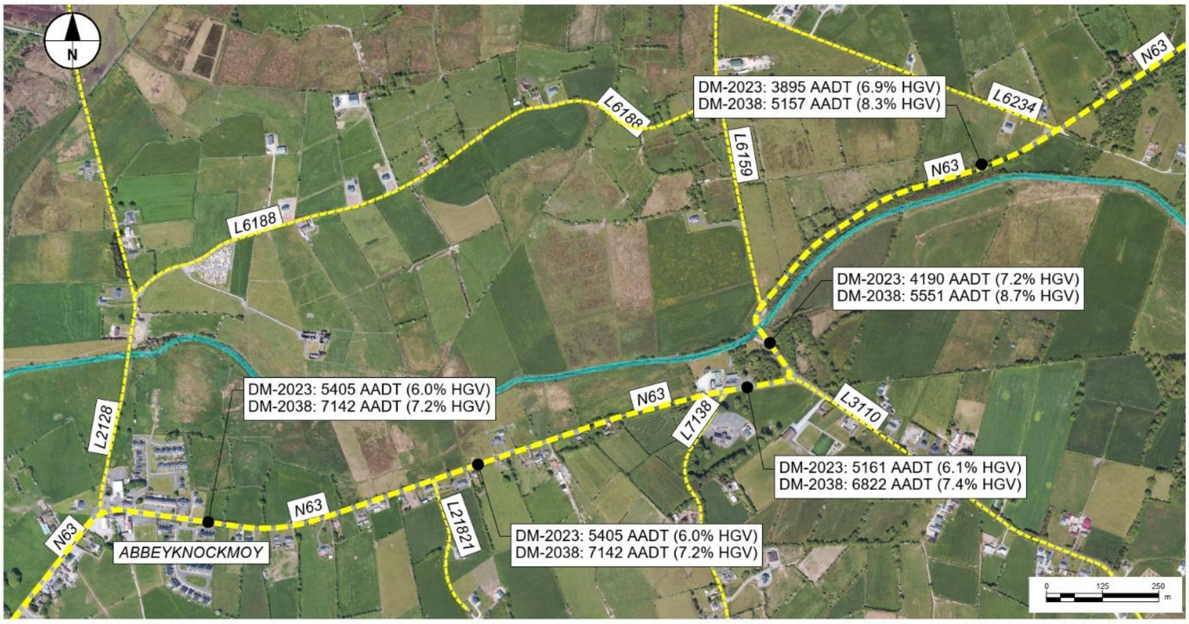


Figure 3-1 2023 and 2038 Do Minimum Central Growth AADT & HGV% Projections

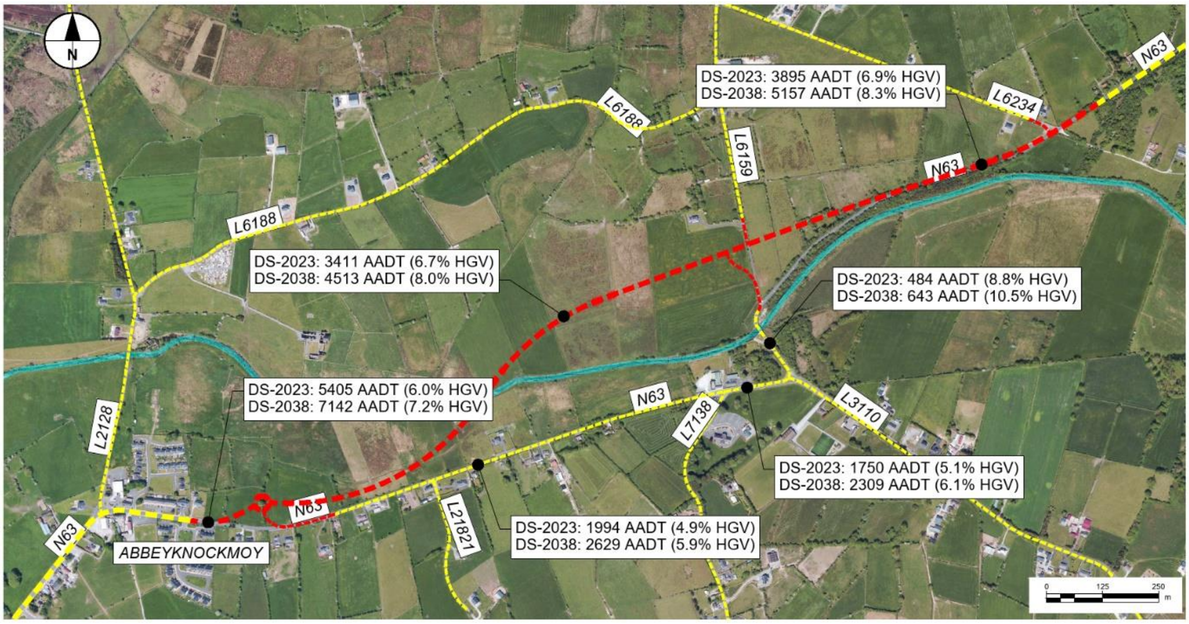


Figure 3-2 2023 and 2038 Do Something Central Growth AADT & HGV% Projections

3.3 TII Simple Appraisal Tool

TII PAG Unit 12: Minor Projects (€5m to €20m) provides a spreadsheet-based tool to assesses the economic case for online or offline minor improvement to the National Roads network. This tool requires the following information to be detailed:

- Scheme Information;
- Existing Annual Average Daily Traffic (AADT);
- Scheme Costs; and
- Target Performance.

All general parameters such as value of time, value of time growth rates, discount rates, fuel cost changes, fuel consumption, vehicle operating costs fuel/non-fuel, trip purpose distribution, tax rates, change in tax rates, vehicle occupancy rates and vehicle proportions were taken from the TII *PAG Unit 6.11 - National Parameters Value Sheet*.

The CBA assessment assumes a Discount Rate of 4% (years 1-30) and 3.5% (years 31-60), with all costs and benefits discounted back to a common base year of 2011.

The details entered into the TII Simple Appraisal Tool and the outputs generated are provided in Appendix F of the Option Selection Report (N63-ACM-PH02-ZZ-RP-ZZ-0001).

3.3.1 Scheme Information

The following information was used for the Scheme Information section of the Simple Appraisal Tool:

- County – Galway;
- Existing Route Length – 2.34 km;
- New Route Length – 2.17 km;
- Scheme Opening Year – 2023;
- Existing Route Standard – 2 Lane Single Carriageway;
- New Route Standard – 2 Lane Single Carriageway;
- Appraisal Period – 30 years;
- Residual Period – 30 years;

- Observed AADT – 3,065;
- HGV% – 6.2%; and
- Year of Observed AADT – 2019.

3.3.2 Scheme Cost

The Total Scheme Budget was determined in accordance with the TII Cost Management Manual under the following seven expenditure headings.

- Main Contract Construction;
- Main Contract Supervision;
- Archaeology;
- Advance Works & Other Contracts;
- Public Transport Connectivity/Asset Renewal;
- Land & Property; and
- Planning & Design.

The Total Scheme Budget is prepared based on the Target Cost plus a TII Programme Risk and Total Inflation contingency. The Total Scheme Budget (inclusive of VAT) is outlined in Table 3-2.

Table 3-2 Total Scheme Budget (2021 Prices inclusive of VAT)

Cost Expenditure Heading	Base Cost	Risk Allocation to Cost	Un-Inflated Cost
Main Construction Contract	€12.58m	€1.04m	€13.61m
Main Contract Supervision	€0.41m	€0.08m	€0.49m
Archaeology	€0.33m	€0.05m	€0.38m
Advance Works & Other Contracts	€0.19m	€0.06m	€0.25m
Public Transport Connectivity/Asset Renewal	€0.98m	€0.06m	€1.04m
Land & Property	€2.54m	€0.21m	€2.76m
Planning & Design	€0.68m	€0.16m	€0.84m
Sub-Total	**€17.70m**	**€1.66m**	**€19.36m**
Total Inflation Allowance			**€1.22m**
TII Programme Risk			**€0.97m**
Total Scheme Budget			**€21.46m**

3.3.3 Target Performance

An existing average speed of 62 kph and a forecast average speed of 92 kph were used for the Target Performance section of the Simple Appraisal Tool. The existing average speed was calculated from data obtained from Google API data (GPS data taken anonymously from mobile phones), and the forecast average speed was obtained from a speed survey conducted by the Road Safety Authority in 2018.

The end to end average speed will be 92 kph, which comprises of a short section with a 50 kph speed limit and the remainder a 100 kph speed limit, where vehicles are assumed to travel at an average speed of 96 kph. This 96 kph value was obtained from the RSA Free Speed Study in 2018 for National Secondary Roads.[3]

[3] https://www.rsa.ie/Documents/Road%20Safety/Speed/RRD_Res_20190204_FreeSpeedSurvey2018FINAL.pdf

3.4 Safety Model (COBALT)

The TII Simple Appraisal Tool does not calculate safety benefits. Therefore, an assessment of the potential safety benefits of the scheme has been undertaken using the TII software programme COBALT.

COBALT (COst and Benefit to Accidents – Light Touch) is a computer program developed by the UK Department for Transport (DfT) to undertake the analysis of the impact on collisions as part of the economic appraisal for a road scheme.

An Irish specific version of the COBALT program was developed by TII for use on road schemes in the Republic of Ireland and is referred to as COBALT – Ireland. COBALT assesses the safety aspects of road schemes using detailed inputs of links that may be impacted by the scheme.

The assessment is based on a comparison of collisions by severity and associated costs across an identified network in 'Without-Scheme' and 'With-Scheme' forecasts, using details of link characteristics, relevant collision rates and costs and projected traffic volumes. All parameters used in COBALT are taken from TII PAG Unit 6.11 – National Parameter Values Sheet.

3.4.1 Use of Local Collision Rates

As part of a Phase 3 CBA, PAG stipulates that local collision rates can be calculated and input in to the COBALT model to refine the assessment of the potential safety benefits delivered by the proposed road development. Local collision rates along the N63 were therefore calculated using historic AADT data and collision data from the Road Safety Authority (RSA) Personal Injury Accident (PIA) database between 2005 and 2016. Figure 3-3 shows the location of all PIA along the relevant section of the N63 during this twelve-year period.

Figure 3-3 RSA Collision Map (2005-2016)

The calculation of a local collision rate is based on the number of observed collisions per million vehicle kilometres (mvkm) travelled. TII PAG Unit 6.11 – National Parameter Values Sheet provides national average collision rates for several road types and speeds (i.e. <60 km/h or >60 km/h), but as the local collision rate was higher than that from PAG Unit 6.11 (0.080 PIC/mvkm) the local collision rate was used for the existing N63 in the COBALT analysis.

A collision rate of 0.491 PIC/mvkm was used for the section of the existing N63 between the eastern end of Abbeyknockmoy and the L7138, and a rate of 2.003 PIC/mvkm was used between the L3110 and L6159 (at Liss Bridge). All other sections had a local collision rate of 0 PIC mvkm.

4 Consideration of Alternatives & Options

4.1 Option Selection Process

The full option selection process for the scheme is outlined in the N63 Liss to Abbey Realignment Scheme Option Selection Report (March 2020). In summary, the option selection process was undertaken in two stages in accordance with the TII PMG:

- Stage 1 - Develop a number of feasible route options (typically 6 or more and including 'Do-Nothing' and 'Do-Minimum' alternatives) and carry out a Preliminary Options Assessment using a Framework Matrix (comprising the assessment criteria of Engineering, Environment and Economy). This will result in the number of options being refined to between 3 and 5.
- Stage 2 - After Stage 1, carry out a Project Appraisal of these options using the Project Appraisal Matrix (comprising the six CAF criteria of Safety, Environment, Economy, Integration, Accessibility & Social Inclusion and Physical Activity), enabling the selection of a Preferred Option Corridor.

A short summary of the option selection process is provided in the sections below.

4.2 The Do-Nothing and Do-Minimum Options

The 'Do-Nothing' Option

The 'Do-Nothing' option does not provide for any additional crossing of the Abbert River or improvement of the existing road network other than routine maintenance.

Any local or regional traffic travelling on the N63 wishing to cross the Abbert River will be restricted by the substandard road geometry and Liss Bridge in both directions.

The 'Do-Minimum' Option

The 'Do-Minimum' option identified the lack of additional crossings of the Abbert River, the narrow cross-section of the carriageway and poor alignment of the N63. There are road safety issues relating to the existing layout of the N63 which require consideration.

The 'Do-Minimum' option investigates the potential to undertake minor improvement works that would improve safety concerns in the vicinity of the Liss Bridge through localised widening and the introduction traffic control across the bridge. As part of the Do-Minimum traffic signals would be introduced on approaches to the bridge to help reduce vehicle conflicts. However, this may increase journey times in either or both directions.

Consideration has been given to improving the junctions along the N63 to improve driver safety. The limited width of the existing bridge over the Abbert River and the constrained environment in the area surrounding the bridge restrict the options for safety improvements. Improvements to non-motorised users' facilities (cycle facilities in particular) along the N63 are not considered in the Do-Minimum.

4.3 Stage 1 - Preliminary Options Assessment

The potentially feasible Options were assessed by applying the three-stage option selection process set out in the TII Project Management Guidelines 2019 (PE-PMG-02041). At Stage 1, all Options were subject to a Multi Criteria Analysis assessing Engineering, Economy and Environment.

The six Stage 1 Options can be seen in Figure 4-1 below. The results of the Stage 1 Preliminary Options Assessment can be seen in Table 4-1.

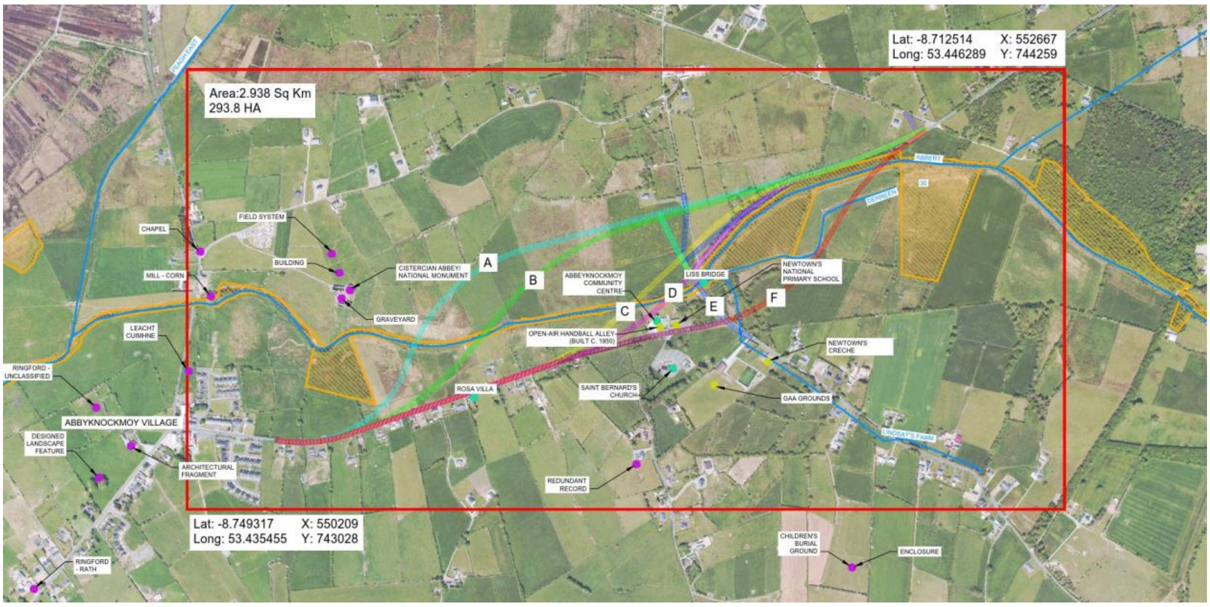


Figure 4-1 Stage 1 Options

	Do-Nothing / Do-Minimum Option	Option A (Cyan)	Option B (Green)	Option C (Yellow)	Option D (Pink)	Option E (Blue)	Option F (Red)
Engineering	Minor or slightly negative	Moderately positive	Major or highly positive	Minor or slightly positive	Not significant or neutral	Minor or slightly negative	Minor or slightly negative
Environment	Not significant or neutral	Major or highly negative	Moderately negative	Moderately negative	Moderately negative	Moderately negative	Moderately negative
Economy	Minor or slightly negative	Minor or slightly positive	Moderately positive	Minor or slightly positive	Not significant or neutral	Minor or slightly negative	Not significant or neutral
Overall Ranking	**Minor or slightly negative**	**Not significant or neutral**	**Minor or slightly positive**	**Not significant or neutral**	**Minor or slightly negative**	**Moderately negative**	**Minor or slightly negative**

Table 4-1 Stage 1 Preliminary Option Assessment Summary

4.4 Public Consultation No.1

A Public Consultation was held in October 2019 to present the study area, and the six Options (A-F) that arose from the Stage 1 Preliminary Options Assessment.

Following the Stage 1 Preliminary Options Assessment, it was decided that three options (A, B and C) and the Do-Minimum should be brought forward to Stage 2 Project Appraisal.

Following review of the submissions at the first Public Consultation, it was observed that the majority of the public in attendance were in support of an improvement scheme, with significant requests for non-motorised user facilities to connect the community facilities to the residential area of Abbeyknockmoy.

4.5 Stage 2 - Project Appraisal Matrix

The three options that were taken forward to Stage 2 Project Appraisal are shown in Figure 4-2.

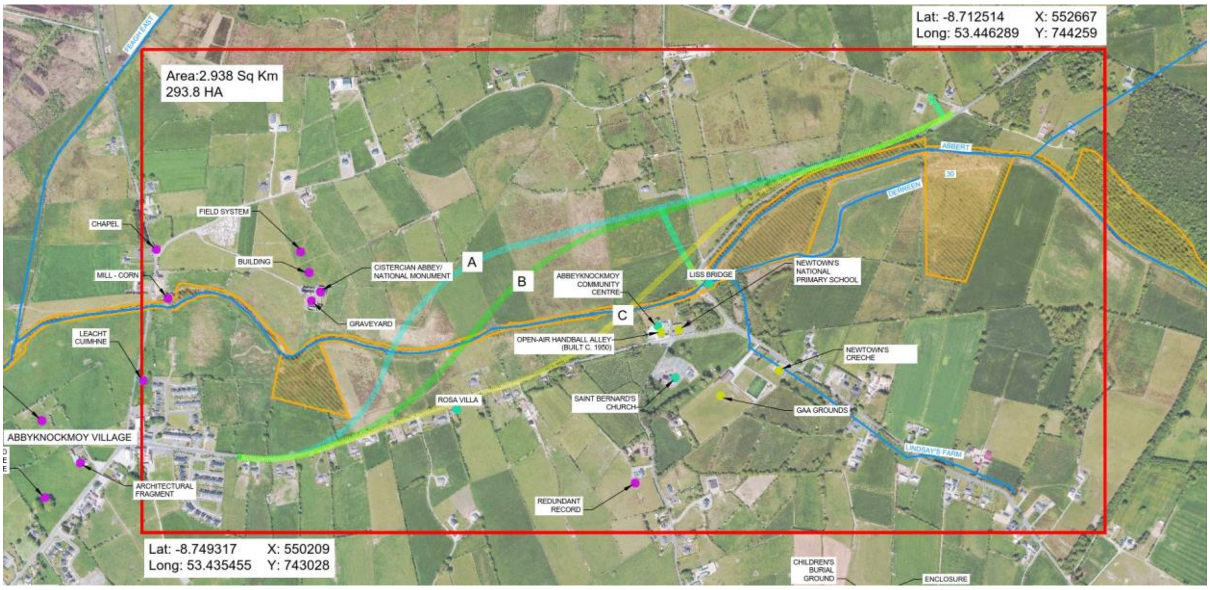


Figure 4-2 Stage 2 Options

A detailed and informed comparative assessment was undertaken in accordance with the TII Project Management Guidelines 2019 (PE-PMG-02041) and the CAF. The results of the assessment under each of the six required criteria are summarised in Table 4-2.

	Do-Nothing / Do-Minimum Option	Option A (Cyan)	Option B (Green)	Option C (Yellow)
Economy	Major or highly negative	Moderately positive	Major or highly positive	Minor or slightly positive
Safety	Moderately negative	Moderately positive	Moderately positive	Moderately positive
Environment	Not significant or neutral	Major or highly negative	Moderately negative	Moderately negative
Integration	Not significant or neutral	Moderately positive	Moderately positive	Moderately positive
Accessibility & Social Inclusion	Not significant or neutral	Moderately positive	Moderately positive	Moderately positive
Physical Activity	Not significant or neutral	Moderately positive	Moderately positive	Moderately positive
Overall Ranking	**Minor or slightly negative**	**Not significant or neutral**	**Minor or slightly positive**	**Not significant or neutral**

Table 4-2 Stage 2 Project Appraisal Matrix Summary

Following the Stage 2 Project Appraisal, it was recommended that Option B (Green) should be taken forward as the Preferred Option for the N63 Liss to Abbey Realignment Scheme.

4.6 Preferred Option - Public Consultation No.2

A further Public Consultation was held in February 2020 to present the Preferred Option and seek public input to inform its further development.

Following review of the submissions at the second Public Consultation, it was observed that the majority of the public in attendance were in support of the Preferred Option, with the request for non-motorised user facilities to connect the community facilities to the residential area of Abbeyknockmoy being reiterated. Some concerns about visual impact and land take were raised and these will be reviewed at the preliminary design stage.

5 The Preferred Option

5.1 The Preferred Option

The option selection process concluded that the Preferred Option is Option B. The Preferred Option can be seen in Figure 5-1 below.

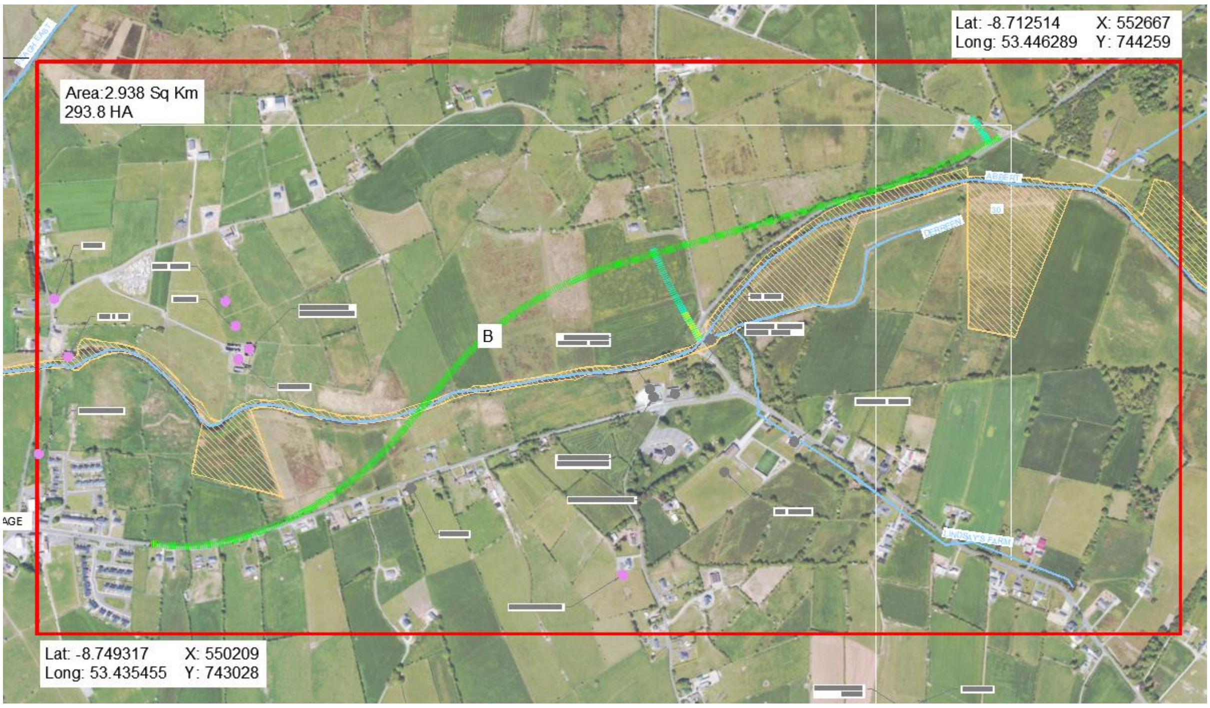


Figure 5-1 Emerging Preferred Route (Option B)

Beginning at the eastern side of the study area and travelling west the Preferred Option ties-in west of an existing crossroads that is to be realigned. The Preferred Option then runs westbound adjacent to a small area of woodland, before crossing agricultural land. A new major/minor junction is proposed to tie in with the L3110, which will be extended across the existing Liss Bridge to tie into the new scheme. The junction with the L6188 will be amended according to the outcome of further traffic modelling analysis. The Preferred Option then sweeps south-westbound and crosses the Abbert River at a skew before sweeping west and tying into the existing road network east of Abbeyknockmoy village.

As part of this scheme it is also proposed to include improved facilities for non-motorised users along the existing N63 section. These facilities are expected to be an improved footway and/or cycleway along one side of the existing N63, however the details will be subject to development at Phase 3 - Preliminary Design. As such, the provision for non-motorised users will not be required along the realigned section of the N63.

Due to the responses from Public Consultation 2 there may be some changes to the Preferred Option to mitigate landowner concerns, similarly these elements will be reviewed in more detail in Phase 3.

5.2 Projected Traffic Flows

The future traffic flows (AADT) have been determined for the Preferred Option, for both the Opening Year (2023) and Design Year (2038). The results of the traffic model are presented in Figure 5-2 below.

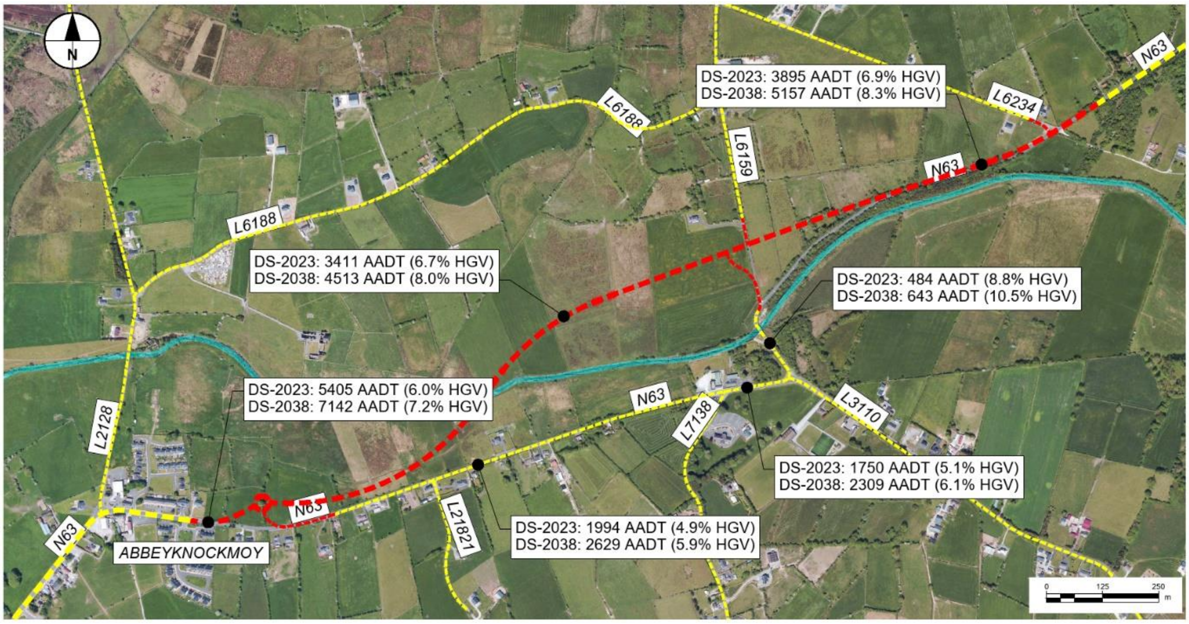


Figure 5-2 Preferred Option: Traffic Flows - Opening Year (2023) and Design Year (2038)

5.3 Design Standard and Road Type

For the purpose of the assessment an appropriate cross-section for the proposed scheme has been selected. Considering the rural nature of the scheme, the cross-section has been designed in accordance with TII DN-GEO-03031 – Rural Road Link Design.

In consideration of the expected level of traffic on the N63 mainline and to maintain a route consistency with road improvement already completed to the west of Abbeyknockmoy, a Type 2 Single Carriageway have been selected.

The preferred option (Option B) has been designed in compliance with TII Standard Construction Detail CC-SCD-00002. The proposed cross section is indicated in Figure 5-3 below.

The cross section that has been considered is in line with the requirements included in Table 4.2 of TII DN-GEO-03036 - Cross Sections and Headroom, and includes:

- 7.0m single carriageway;
- 0.5m hard strip (both sides);
- 3.0m verges (both sides);

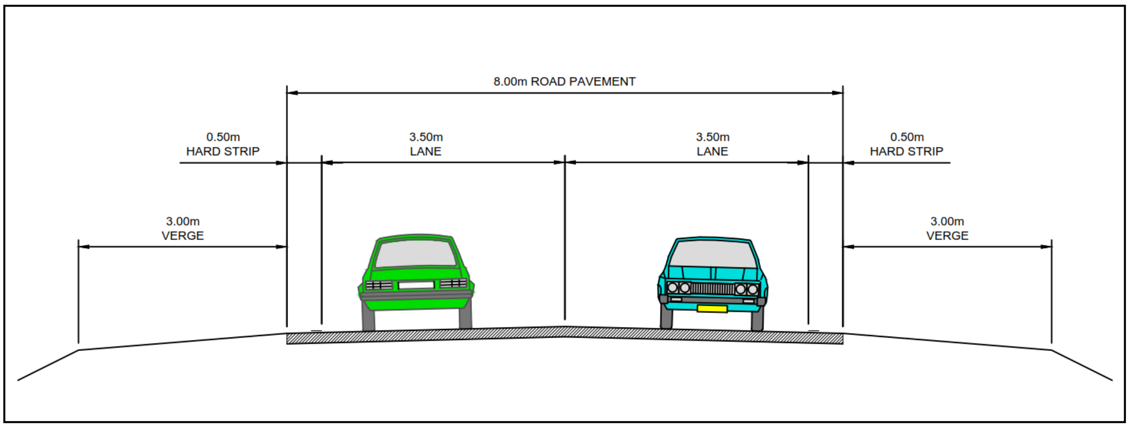


Figure 5-3 Proposed Cross-Section (Indicative Layout Only)

As part of the development of the Options, while considering the feedback received at the scheme public consultation event, it was proposed to include facilities for non-motorised users along the existing N63. These facilities are expected to be implemented by provision of a footway / cycleway along one side of the existing N63, however the detail of this is subject to development at Phase 3 - Preliminary

Design. As such, the provision for non-motorised users will not be required along any realigned section of the N63. Note that the above cross-section is indicative.

It is not proposed to include bus lanes on the proposed N63 Liss to Abbey Realignment Scheme as there is no current requirement for a dedicated bus route on the scheme. However, it is noted that the scheme will facilitate public transport routes operating along the existing N63.

The provision of an offline/online Type 2 Single Carriageway would:

- Segregate local (journeys stopping in the locality) and regional traffic (longer distance journeys on N63 which do not stop in the locality);
- Improve the alignment to a National Road standard;
- Reduce the potential for right-turning vehicles to affect the predominant flows;
- Reduce the risk of rear shunt collisions; and
- Provide an opportunity for the provision of safe walking and cycling facilities along the existing route to serve the existing community centre, the Abbey heritage site, community facilities and a number of local schools.

5.4 Speed Limits

The Stage 1 Preliminary Options Assessment assumed that a speed limit of 100km/h would be imposed on the proposed realigned section of the N63 in line with existing conditions. In the interim, Galway County Council have reduced the speed limit in the vicinity of the study area from 100km/h to 80km/h. The extent of the imposed speed limit can be seen in Figure 5-4 below.

Following consultation with GCC, it was agreed that the design speed for the scheme would remain as 100km/h.

Although all options have been designed for a Design Speed of 100km/h (in line with the TII Guidelines DN-GEO-03031 – Rural Road Link Design); during the Stage 2 Project Appraisal, all Options were assessed for a posted speed limit of 80km/h to ensure a conservative approach for calculating scheme benefits.

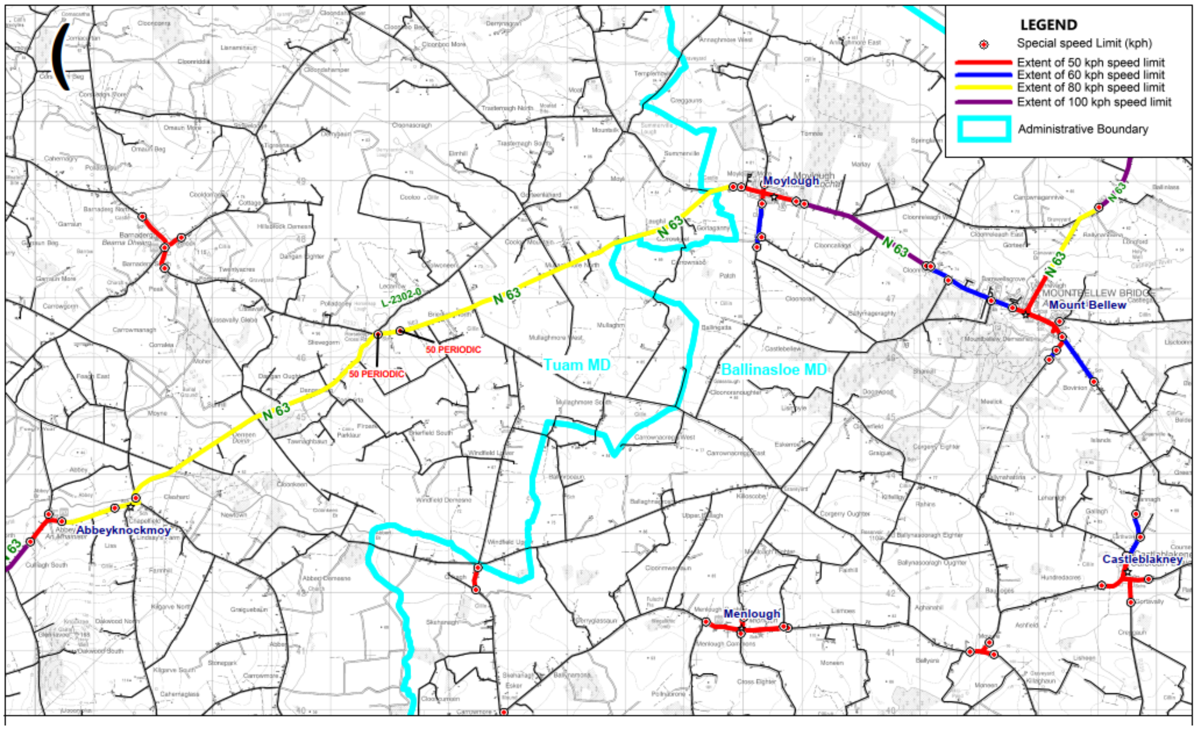


Figure 5-4 Updated Speed Limits

5.5 Breakdown of Scheme Costs

As part of the Stage 2 Economy Appraisal, cost estimates were prepared for the Preferred Option[4] . These cost estimates were updated for Phase 3 and are presented in Table 5-1 below.

Base Cost Expenditure Heading	Base Cost (incl VAT)	Contingency (incl VAT)	Budget
Main Construction Contract	€12.58m	€1.04m	€13.61m
Main Contract Supervision	€0.41m	€0.08m	€0.49m
Archaeology	€0.33m	€0.05m	€0.38m
Advance Works & Other Contracts	€0.19m	€0.06m	€0.25m
Public Transport Connectivity/Asset Renewal	€0.98m	€0.06m	€1.04m
Land & Property	€2.54m	€0.21m	€2.76m
Planning & Design	€0.68m	€0.16m	€0.84m
Sub-Total	**€17.70m**	**€1.66m**	**€19.36m**
Total Inflation Allowance		**€1.22m**	
TII Programme Risk		**€0.97m**	
Total Scheme Budget		**€21.46m**	

Table 5-1 Preferred Option – Total Scheme Budget (2021 Prices inclusive of VAT)

[4] Stage 1 Preliminary Options Assessment was reviewed and refined to take account of the preliminary earthworks and junction designs and further refinement of the proposed structures, including updated span and widths and likely options for pedestrian/cycleway routing.

6 Detailed Appraisal

6.1 Overview

A detailed appraisal of the preferred scheme was conducted in accordance with the TII PAG and DoT CAF. A Cost Benefit Analysis (CBA) and a Multi-Criteria Analysis (MCA) were developed for evaluating the proposed scheme and presented in the following sections.

6.2 Cost Benefit Analysis

The benefit cost ratio (BCR) is a function of the monetised benefits, Present Value of Benefits (PVB) versus the Present Value of Costs (PVC), and has been calculated using the TII Simple Appraisal Tool. In accordance with the Department of Transport guidelines, a discount rate of 4% for the design life of the scheme (30 years), and falling to 3.5% after that, has been applied to the benefits. A shadow pricing for labour factor of 1.0, with a factor of 1.3 for public funds has been applied to the costs, with all costs and benefits discounted back to a common base year of 2011.

Table 6-1 below highlights the PVB and PVC and the associated BCR of the Preferred Option.

Option	Present Value Benefits (PVB) (€ Million)	Present Value Costs (PVC) (€ Million)	Net Present Value (NPV) (€ Million)	Benefit Cost Ratio (BCR)
Preferred Option (Option B)	€ 18.13	€ 16.00	€ 2.13	1.13

Table 6-1 Preferred Option – Net Present Value and Benefit Cost Ratio (discounted to 2011)

6.3 Multi-Criteria Analysis

An MCA was undertaken at Stage 1 and Stage 2 of the Options Selection process. The Project Appraisal Balance Sheet (PABS) in Appendix D provides a one-page summary of the total impacts of the project. The appraisal considers 6 main aspects:

- Economy – the direct economic benefits to road users and transport providers, and the wider boost to businesses from lower transport costs.
- Safety – the road safety impacts of the scheme, including the statistical increase or decrease in numbers of personal injury accidents, and any impact on the personal security of road users
- Environment – including the operational and construction impacts of the scheme on the natural environment (air quality, water quality, habitat of other species), the impact of changes in traffic noise on the living environment for human beings, and any impact on irreplaceable resources (land and cultural heritage)
- Integration – the extent to which the project supports government policy more generally;
- Accessibility and Social Inclusion – the extent to which the project reduces social exclusion by enhancing the accessibility of low-income rural areas; and
- Physical Activity – Summary of the nature of physical activity impacts including impacts on particular groups of road users such as pedestrians and cyclists.

Supporting detail on the derivation of the appraisal scores under each heading is provided in the following sections.

6.3.1 Economy

The BCR for the scheme was calculated using the TII Simple Appraisal Tool. The assessment demonstrated that the proposed scheme will generate a positive return on investment with a BCR of 1.13.

6.3.2 Safety

The impact on collisions as part of the safety appraisal was calculated using COBALT. The assessment outcomes, based on a thirty-year design life, for the road scheme are shown in Table 6-2 below and detailed in the following sections.

	Preferred Option
Total Collision Benefits	€ 1.354m
Total Collisions Saved by Scheme	17
Total Casualties Saved by Scheme (Fatal, Serious, Slight)	1, 2, 33

Table 6-2 Preferred Option - Safety Assessments

A number of road collisions are currently recorded on the road network surrounding the proposed N63 Liss to Abbey Realignment Scheme.

The scheme will reduce the levels of traffic congestion on the road network in the proximity of the existing Liss Bridge, likely providing a corresponding reduction in collisions along this link. By segregating the regional traffic and local traffic there will be less chance of conflict between these two types of road users. In addition, the scheme will be compliant with current design standards and seek to achieve improved levels of safety. Providing an alignment to a recognised design standard for regional traffic will offer an improved safety performance.

The safety assessment also considered the constructability of each option and the complexity of the works, with particular reference to the bridge structure, and the extent of works which would require an upgrade of the existing road network. The upgrading of existing roads will require extensive traffic management and generally result in a higher number of conflicts with the existing direct accesses to properties along the main road. Complexity of bridge construction has also been considered, specifically how the skew of the bridge will increase the complexity of construction.

6.3.3 Environment

An overview of the key environmental impacts of the scheme, as identified in the Environmental Impact Assessment Report, is outlined in the following sections.

6.3.3.1 Biodiversity

The Proposed Road Development will cross the Abbert River which forms a part of the Lough Corrib SAC. There is therefore a potential for direct impacts on this designated site. Habitats associated with this designated site occur within the Proposed Road Development site.

The Proposed Road Development will result in the loss of a portion of grassland that corresponds with an Annex I habitat type. Following translocation of turves/plant material and habitat recreation works, mitigation will be achieved by replacement with compensatory habitat which will be suitably managed by the local authority. The significance of the residual impact is assessed as a **negative** effect at the local-county geographic scale. All other residual effects will be **limited to significance** at Local level.

Significant residual effects during operation to other species and habitats are predicted to be limited to Local level in all cases, namely in relation to disturbance during operation to localised populations of nationally protected species including nesting birds, hedgehog, pygmy shrew, stoat, and common frog.

Following implementation of mitigation measures, residual effects to the SAC will be **non-significant** during the construction phase. There will be **no significant** residual effects on designated sites during operation.

6.3.3.2 Water (incorporating hydrology)

The potential impacts to the water environment from the Proposed Road Development were assessed. During construction, potential impacts include sedimentation, accidental spills and leaks, use of concrete and lime, bridge construction, culverting and drainage works. A number of mitigation measures will be implemented to reduce the likelihood of significant adverse effects to the water environment during the construction of the Proposed Road Development.

During operation potential impacts include accidental spills and leaks, discharges to surface water, flooding resulting from the Proposed Road Development and impacts of flooding on the Proposed Road Development. A number of embedded mitigation measures will reduce the likelihood of significant adverse effects to the surface water environment during the operation of the Proposed Road Development. Surface water collected on the Proposed Road Development site will be discharged via ponds to the Abbert River. Surface water will be discharged at greenfield runoff rates. In order to achieve this, flow control devices will be installed on the outlets from the settlement tanks.

In terms of cumulative impacts, the impact of the Proposed Road Development has been considered in relation to a number of proposed and consented developments adjacent to the Proposed Road Development site. However, due to the proposed mitigation measures, the cumulative effects from both construction and operation are considered to be imperceptible.

It is considered that the residual effect from the Proposed Road Development will be imperceptible provided that appropriate mitigation measures as specified are applied. The embedded mitigation measures will significantly reduce the likelihood and magnitude of the potential effects on the water environment occurring during the operational phase.

6.3.3.3 Land and Soils (incorporating Soils and Geology, and Hydrogeology)

The potential impacts to the soils, geology and hydrogeology from the Proposed Development were assessed. Potential impacts assessed included impacts to soil and groundwater quality from accidental spills and leaks, excavation and stockpiling of soils, removal of hardstanding, pumping of groundwater, use of concrete and lime and depletion of non-renewable natural resources. A number of mitigation measures were identified and will be implemented so that there will be no significant adverse effects to the soils, geological and hydrogeological environment during the construction and operation of the Proposed Road Development. The cumulative impacts of the Proposed Road Development on soil, geology and hydrogeology were considered and it was concluded cumulative effects will be imperceptible.

It is considered that residual negative effects of the Proposed Road Development on soil, geology and hydrogeology will overall be imperceptible provided that appropriate mitigation measures are applied.

6.3.3.4 Landscape and Visual

The majority but not all of the identified likely adverse landscape and visual effects will be able to be mitigated. The design of the Proposed Road Development has incorporated a new viewing area for the abbey for the benefit of users and in particular for the benefit of the local community. While the existing N63 road has been retained for access, a new roundabout is introduced to the periphery of Abbeyknockmoy.

The Proposed Road Development takes a more northerly route than the existing road and crosses the Abbert River on an embankment and bridge. The raised road embankments create the greatest landscape effects and are the most difficult feature to mitigate. Mitigation proposals have avoided planting woodland along the entire road corridor as the resultant tree belt will further affect the landscape character. Instead, clusters of trees are proposed to break up the linear form of the road and integrate the roadside boundaries with the existing hedgerows and riverbanks.

6.3.3.5 Air Quality

The air quality assessment has been carried out based on the National Roads Authority's/TII's 'Guidelines for the Treatment of Air Quality during Planning and Construction of National Roads' (TII, 2011). The assessment considers the pollutants nitrogen dioxide (NO_2), and particulate matter (PM_{10} and $PM_{2.5}$). These are the two main air pollutants of concern which come from the exhaust gas of vehicles, among other sources

By using standard industry good practice mitigation measures as outlined in the Construction Environmental Management Plan, the dust effect will be **not significant**. Similarly, the number of HGVs used is expected to be small enough that the effect of the construction traffic will also be **not significant**.

The Index of Overall Change of Exposure calculations concludes that there will be an overall reduction in exposure to NO_X and PM_{10} as a result of the operation of the Proposed Road Development. The same theme is shown in the local air quality assessment, where pollutant concentrations decrease at locations close to the existing N63. However, at some locations closer to the Proposed Road Development, pollutant concentrations will increase, though, the absolute levels are still very low, well within the legal limits. Therefore, the effects will be **negligible** and **not significant**.

In conclusion overall, the Proposed Road Development will **not be significant** and considered **neutral** with respect to air quality.

6.3.3.6 Climate

Lifecycle GHG impact assessment

The lifecycle GHG impact assessment assesses the impact of the greenhouse gas emissions arising as a result of the Proposed Road Development on the global climate. This includes direct greenhouse gas emissions arising from activities within the Proposed Road Development site boundary and indirect emissions from activities outside the site boundary

In relation to Ireland's national greenhouse gas inventory, the effect from greenhouse gas emissions during the construction and operation of the Proposed Road Development have been found to be **minor (low significance)**. As the impact, and therefore the associated effect, is not considered to be major and of high significance, the mitigation measures are considered to be adequate.

Climate change resilience review

The climate change resilience review considers the resilience of the Proposed Road Development to projected climate change impacts. The receptor for the climate change resilience review is the Proposed Road Development including workers, users and associated infrastructure.

Future climate change impacts considered include: increased year-round average temperatures, increased winter rainfall, decreased summer rainfall, and increased severity of extreme weather events (e.g. storms).

The climate change resilience measures are considered to adequately mitigate the effects of the projected climate change impacts. Therefore, no residual effects have been identified in relation to climate change resilience.

6.3.3.7 Noise

To determine the potential noise impact of the Proposed Road Development, a 3D noise model of the existing adjacent road network and the Proposed Road Development was developed for the future traffic years of 2023 and 2039. Road traffic noise levels were predicted at 37 locations within the study area using the projected traffic flows for the two assessment years. It was determined that mitigation will be required to reduce traffic noise levels at properties at the eastern end of the Proposed Road Development and at properties immediately towards the middle of the development.

Noise mitigation in the form of a low-noise road surface and a set of noise barriers has been proposed and modelled to reduce traffic noise levels to below the Transport Infrastructure Ireland design goal of 60 dB L_{den}. With the proposed measured in place, calculated noise levels will be reduced for both assessment years to within the design goal at the relevant assessment locations.

The magnitude of traffic noise change has been determined for the assessment locations using guidance from the UK's Design Manual for Roads and Bridges Noise and Vibration 2020 document, along with professional judgement. The assessment has determined that once operational, the noise impact associated with the new link road will result in an **imperceptible to moderate** noise impact during the long-term period at the assessment locations. Noise levels will be reduced at locations along the existing route.

Taking into account the residual reduction in predicted noise levels at 32 of the 37 locations assessed and the magnitude of change (negligible to minor in the long-term) in noise levels predicted at the 5 locations which are predicted to experience an increase in noise levels, it is considered that the likely effects on the noise environment will be **negative**, of **slight significance**, **local**, and **long-term**.

Indicative calculations have been made to estimate the range of likely noise levels during the construction phase of the project. The application of noise limits, controlled hours of operation, along with implementation of appropriate noise control measures, have indicated that the construction noise impact will be **short-term moderate to major** impact. Therefore, it is considered that the likely residual effects on the noise environment will be **negative**, **moderate to significant**, **local**, and **short-term**.

6.3.3.8 Population and Human Health

During the construction phase of the Proposed Road Development, potential impacts include impacts on amenity at local residential properties and land acquisition. It is envisioned that the majority of effects experienced will be restricted to a local scale and will be temporary and/or short term in nature. The permanent acquisition of the land will likely result in a permanent, negative, and negligible effect on the existing land use and its users; therefore, the significance of the effects will likely be slight as a result of the land take.

During the operational phase, the Proposed Road Development is expected to reduce network travel time, traffic volumes, and associated congestion at Liss bridge, thereby improving accessibility to local services and businesses. The separation of regional and local traffic coupled with the introduction of pedestrian/cycling facilities will improve accessibility to employment sites in Abbeyknockmoy and potentially creating a more attractive, safer router for vulnerable road users and improved in the area. The separation of regional and local traffic and the improvement of the quality of the existing N63 will also improve accessibility to employment sites in the wider region.

These dedicated pedestrian/cycle routes will allow for direct access from Abbeyknockmoy town to the community facilities. These new routes will introduce safe access to the school, creche, GAA club and church in the study area. In turn this will allow safe access for children but will also offer safe access for vulnerable road users and give people a new connection to the community facilities.

Overall, it is considered the Proposed Road Development will have a net positive effect on population and human health.

6.3.3.9 Cultural Heritage (incorporating Architectural Heritage, Archaeology and the Historic Landscape)

The Cultural Heritage Chapter identifies eight archaeological and architectural heritage assets on which the Proposed Road Development has the potential to impact. Mitigation has been proposed in the form of archaeological testing, excavation and recording, screening of boundaries and controls to ensure accidental impact during construction to reduce significant effects. Following mitigation, there remains an adverse residual effect upon the following assets.

The National Monument, Knockmoy Abbey (National Monument No. 166), is an asset of national importance. This was identified as experiencing a significant effect from the Proposed Road Development during construction and operation. This effect will not change so the overall residual significance will not change from significant. The residual significance of effect will be **significant**, **long-term** and **adverse**.

Newtown Planned landscape (NIAH Ref. 5365) is an asset of regional importance. This was identified as experiencing a moderate effect from the Proposed Road Development during construction. This effect will not change so the overall residual significance will not change from moderate. The residual effect will be **moderate**, **long-term** and **adverse**.

CH1 Former islands identified through historic cartographic evidence may contain previously unrecorded archaeological assets. These will experience a very high effect from the Proposed Road Development. Mitigation has been proposed in the form of archaeological testing and excavation, if appropriate, to determine the presence/absence of such features and to preserve them by record. The residual effect is therefore assessed to be **moderate**, **negative** and **long-term**.

CH2 Buildings identified through historic cartographic evidence will experience a very high effect from the Proposed Road Development. Mitigation has been proposed in the form of archaeological testing and excavation, if appropriate, to determine the presence/absence of such features and to preserve them by record. The residual effect is therefore assessed to be **moderate**, **negative** and **long-term**.

CH3 Former mill pond associated with the Newtown Planned landscape (NIAH Ref. 5365) will experience a very high effect from the Proposed Road Development. Mitigation has been proposed in the form of archaeological testing and excavation, if appropriate, to determine the presence/absence of such features and to preserve them by record. The residual effect is therefore assessed to be **moderate**, **negative** and **long-term**.

Potential currently unrecorded archaeological deposits which are likely to be present within the Proposed Road Development site will experience a very high effect from the Proposed Road Development. Mitigation has been proposed in the form of archaeological testing and excavation, if appropriate, to determine the presence/absence of such features and to preserve them by record. The residual effect is therefore assessed to be **moderate**, **negative** and **long-term**.

The Protected Structures Liss Bridge (RPS No. 3925), Rose Villa (RPS No. 3923), St. Bernard's Church (RPS No. 83) are assets of regional importance. These were identified as experiencing a low effect from the Proposed Road Development, resulting in a slight effect. This effect has been assessed as positive and therefore mitigation is not applicable. The residual effect is therefore assessed to be **slight**, **long-term** and **beneficial.**

The Protected Structures *Leacht Cuimhne* (RPS No. 3921) and *Leacht Cuimhne* (RPS No. 3918) are assets of regional importance. These were identified as experiencing a low effect from the Proposed Road Development, resulting in a **slight** effect. This effect has been assessed as neutral and therefore mitigation is not applicable. The residual effect is therefore assessed to be **slight**, **long-term** and **neutral**.

6.3.3.10 Material Assets - Agriculture

The effects on agricultural land parcels are assessed by considering the type of land parcel affected, assessing the extent of land taken from each land parcel and how a land parcel may be affected if severed by the Proposed Road Development, assessing the potential disturbance impacts due to construction and operation of the Proposed Road Development and assessing effects on access to the land parcel and other potential adverse effects. Based on these assessments, a residual effect is arrived at for each affected land parcel.

Mitigation measures will minimise the effects from the Proposed Road Development.

The Proposed Road Development would traverse an agricultural area which is predominantly medium sensitivity. The main farming enterprise is beef cattle and/or sheep. One plot is being farmed by a dairy farmer. The effects on individual land parcels would be;

- 57% of land parcels (18no.) are predicted to have not significant and slight adverse effects;
- 34% of land parcels (11no.) are predicted to have moderate adverse effects; and
- 9% of land parcels (3no.) are predicted to have significant adverse effects.

Taking into account the low – medium sensitivity of the study area, the overall effect on agriculture within the study area would be slight adverse where approximately 9% of the study area is taken and 13% is severed (with mitigation).

When cumulative effects from land loss due to other road developments are considered, the effect at a regional level (i.e. County Galway) is not significant.

6.3.4 Integration

The Abbert River creates a natural barrier to the flow of people and goods and therefore any improvements incorporating a new bridge, such as the N63 Liss to Abbey Realignment Scheme will have a positive improvement in the overall integration across County Galway. The Preferred Option proposes a relatively similar river-crossing location and level of function and are therefore expected to provide a generally positive integration improvement.

6.3.5 Accessibility and Social Inclusion

Accessibility and social inclusion have been viewed as providing improved access to services, for example, to schools, hospitals, Galway town centre, and onward connectivity.

For residents within the study area and Abbeyknockmoy, the Preferred Option will improve journeys on a daily basis due to a reduction of traffic on the downgraded section of the N63. Regional traffic will use the new alignment, this will reduce the volume of traffic in the vicinity of the community facilities such as a local school and the church. This will facilitate shorter journey times and reduce the risk of traffic collisions between high speed regional traffic and local traffic manoeuvring into or out of community facilities.

A significant benefit for the community surrounding the Preferred Option is the introduction of dedicated pedestrian and cycle facilities. These will allow direct access from Abbeyknockmoy town to the community facilities for all types of road users, including those accessing the likes of local schools, creche, GAA club and church. In turn, this will allow safe access for children but will also offer safe access for vulnerable road users and give people a new connection to their community facilities. This new connection may in turn lead to job opportunities and social opportunities.

The introduction of the realignment will create a diversion of a section of the existing N63. Along this diverted section there are no bus stops, but buses may stop along these areas on an ad-hoc bases at the side of the road to collect/ drop off passengers. The scheme may result in some properties being by-passed by buses, but the introduction of dedicated pedestrian and cycle facilities will give people the opportunity to access dedicated bus stops in improved locations. Any school buses will be affected by the by-pass, their route to/from the school would alter slightly but no homes would be by-passed so no pupils would be adversely affected.

The Preferred Option will allow for all existing connections to be retained, so there will be no adverse effects on local traffic traversing the new alignment.

6.3.6 Physical Activity

The Preferred Option would be expected to improve the uptake of local walking and cycling. Where safe and efficient junctions are provided as part of the scheme, with appropriate visibility, it would be expected that school and recreational walking and cycling participation may increase.

The Preferred Option will offer dedicated pedestrian/cycle facilities, the introduction of these will help a number of different road users, in particularly school children as there would be an improved connection between the school and the residential areas.

Section 6.5 goes into more a more detailed analysis of Physical Activity and Active Modes as a benefit of this scheme.

6.4 Project Appraisal Balance Sheet

The Project Appraisal Balance Sheet (PABS) in Appendix D provides a summary of the total impacts of the project.

6.5 Benefits of Active Modes Infrastructure

There is currently no specific facilities or supporting infrastructure for active modes between Abbeyknockmoy village and important community facilities to the east of the study area including: Newtown National School; Abbeyknockmoy Community Centre; Abbeyknockmoy GAA Club; St. Bernard’s Church and the amenity area at the Abbert River. The proposed scheme will provide a dedicated walking and cycling facility on the south side of the existing N63, connecting Abbeyknockmoy with these community facilities. New pedestrian and cycle crossings will be provided at the school and at the junction of the N63 and local road L3110. The new walking and cycling facility and the removal of regional traffic from the existing road will enable a significant increase in the use of active modes. The new link will also provide access to and from the existing walking and cycling facility to the west which connects the village to the junction of the N63 and R347.

The Newtown National School, located just 1.4km from the village centre, will experience a notable improvement in connectivity to the village. The school currently has 172 pupils. CSO data indicates that very few children walk or cycle to the school, which is unsurprising considering the lack of existing active mode infrastructure. Census data shows that 49 children aged between four and twelve years old lived in the village (within the CSO ‘settlement’ boundary) in April 2016, while a further 68 children in the same age range lived in the wider electoral district (ED) known as ‘Abbey West’ (excluding those living in the settlement). However, no children from the village usually walked or cycled to school, while only under five children from the wider ‘Abbey West’ ED walked to school. The provision of a continuous dedicated facility will increasingly enable pupils living in the village to walk or cycle to school regularly. Some pupils from the wider area may also walk or cycle some or all of the way to school due to the new facility, and/or as a result of the reduced traffic in the vicinity of the school and the new pedestrian crossings. The school already actively participates in the An Taisce Green Schools Programme which supports the use of active travel modes as part of the ‘Travel Theme’.

In addition to school trips, the improvements will enable both children and adults to travel to activities at the GAA club, community centre and church, and to access the river amenity area using active modes. Only residents of the village and residents living along the N63 to the west of the village (i.e. the section of road which has already been upgraded) will have access to a continuous dedicated route to the community facilities. However, some residents of the wider area to the west are still likely to increase their use of active modes. Although they will need to travel on a local road without dedicated facilities to access the scheme, these local roads have significantly lower traffic volumes and speeds compared to the N63. Similarly, the scheme will enable some residents living along Lisch Road and the L3110 in the eastern part of the scheme area to use active modes to access businesses, bus stops and other facilities in Abbeyknockmoy village.

The improvements will enable a wide variety of recreational trips. Although residents living in the village and other areas to the west of the village already have access to a dedicated facility between Abbeyknockmoy and Crossard, this new facility will be more attractive for recreational trips as regional traffic will not be travelling along the old N63. Recreational cyclists using the existing facilities to the west of Abbeyknockmoy will also be able to extend their trip and make use of a newly formed loop option (involving the use of local roads in combination with the dedicated facilities). The existing facilities on the N63 also intersect with the proposed Quiet Man Greenway route (the Western Rail Corridor) at Derrintogher, just 3km west of Abbeyknockmoy village. A feasibility study on the Quiet Man Greenway is currently ongoing, in the longer term a continuous cycle facility may be present from the eastern end of this proposed scheme to Athenry, Milltown and beyond.

There is strong opportunity for recreational trips using the new facility to be made in conjunction with a visit to any of the community facilities or services to the east or west, possibly as part of a linked trip. For example, an adult dropping or collecting a child to/from school, shopping or as part of personal business in the village, may choose walk or run before or after the primary purpose tasks. Individuals or groups would be able to go for a walk before or after attending activities in the community centre, church services or while waiting for family members who are engaged in an activity for a short period such as GAA practice.

Three categories of benefit related to improved infrastructure for active modes have been monetised using the parameters and guidelines within CAF and PAG Unit 13. These include:

- the reduced risk of mortality associated with increased physical activity;
- reduced absenteeism (an increase in physical activity has been shown to have a beneficial effect on work absenteeism for employees); and
- journey quality benefits (the user's perception of improved journey quality as a result of the scheme, which are based on stated 'willingness-to-pay' values).

The calculation of any quantified benefits depends on the assumptions made regarding the future use of the scheme. It is difficult to forecast the potential future use of infrastructure for active modes with any level of certainty as the demand for these modes in general is suppressed due to a lack of a comprehensive, safe, attractive network. However, a number of reasonable assumptions were developed with reference to the population of the surrounding catchment and the age structure of this population, the distribution of the population throughout the area and the range of community facilities and businesses served by the route. The main assumptions developed from this process were:

- By the third year after opening, the scheme will generate a daily average of 90 adult walking trips with an average duration of 20 minutes and 54 adult cycling trips with an average duration of seven minutes per day;
- That the facility would be used for approximately 70 percent of the distance of an average new walk trip and 60 percent of the distance of an average new cycle trip;
- Most trips are made by people who make return trips and approximately half of new walkers and cyclists are employees.

Benefit	Present Value Benefits (PVB)
Reduction in relative risk of mortality	€644,126
Journey quality / 'ambience'	€ 180,077
Absenteeism	€ 67,550
Total monetised walking and cycling benefits	**€ 891,753**

Table 6-3 Monetised Walking and Cycling Benefits

In addition to the above, there are numerous other important benefits to be gained from increasing the use of active modes in the wider Abbeyknockmoy community which will contribute significantly to improving the quality of peoples' lives and support wider government policy objectives.

Walking and cycling reduce the risk factors for a number of chronic diseases, including cardiovascular disease, respiratory disease, some cancers and Type II diabetes. Only an estimate of the value of the reduced risk of mortality among adults has been captured in the monetised benefits. However, increasing physical activity would also achieve other health related benefits, such as reducing future healthcare costs to society and reducing the negative impact of ill health on an individual's quality of life. The future health benefits of increased physical activity among children in the community may also be significant considering the connectivity provided from the main residential area to the school and GAA club. In 2018, a study found that only 17 percent of primary school age children and 10 percent of secondary school age children in Ireland were active enough to meet recommended physical activity guidelines[5].

Walking and cycling also have benefits for general wellbeing and mental health. People derive enjoyment from walking and cycling and there is also evidence that these activities can contribute to

[5] https://www.sportireland.ie/sites/default/files/2019-11/csppa-2018-final-report.pdf

the prevention and treatment of anxiety and depression, reduce stress and improve cognitive function[6],[7].

The new facilities will provide a means of access to important community facilities for individuals without access to a car. While there are relatively few households without at least one car, access to alternative modes would open up opportunities in cases where a car is not available for a particular trip because it is being used by another member of the household for another purpose or the driver of the vehicle is not available. The fact that walking or cycling will become a viable option for many frequent local trips may also enable some households to reduce the number of cars they own from two to one which would have financial benefits.

The new facility will provide opportunities for social interaction and will enhance community cohesion and social networks. Intercept surveys undertaken on greenways in Limerick and Waterford found that social benefits such as 'meeting people' were one of the things users liked most about these facilities. Social benefits are likely to be particularly strong for this new facility considering the number of community facilities located along the route and the lack of alternative safe places to walk or cycle near these facilities, as well as the variety of different users and trip types the scheme will attract. The infrastructure can also facilitate organised community walking and/or cycling events and in this case, there is potential for both school and/or the GAA club to organise mass participation events and/or set up lower key regular weekly walking groups, potentially with the support of the Galway Sports Partnership and/or the 'Get Ireland Walking' initiative[8],

Older children, particularly those living in the village, will enjoy enhanced opportunities for independent mobility as a result of the new facility. As well as increasing physical activity, the ability to travel independently and interact with the environment and other members of the community can contribute to the social, cognitive and personal development of children and to helping them to build friendships[9]. There are also large potential time savings which can be gained for adults if they no longer need to accompany children on every trip.

As the scheme will enable more local trips to be made by active modes, instead of by car, there is potential to achieve reductions in greenhouse gas emissions associated with regular local trips. However, the facility will attract some recreational users from the wider community who will drive to their starting point. Although many of the users who drive will already be in the area for another reason (as identified previously), it is also possible that some residents from the wider area will drive specifically to access the facility. This could potentially counterbalance some or all of the emissions savings associated with modal shift for regular trips.

[6] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/757756/Cycling_and_walking_for_individual_and_population_health_benefits.pdf
[7] https://www.bicycling.com/training/a20029339/how-cycling-makes-you-smarter-and-happier/
[8] https://www.getirelandwalking.ie/registergroup/
[9] https://www.sciencedirect.com/science/article/pii/B9780128119310000053?via%3Dihub

7 Risk Assessment

7.1 Overview

The Scheme Budget estimation for the N63 Liss to Abbey Realignment Scheme was based on the application of the risk contingencies to each element of the base costs. The risk contingency values varied relative to the level of risk associated with each element.

Risks were identified within the following risk identification categories:

- Highways;
- Geotechnics;
- Structures;
- Technology;
- Environment;
- 3rd Parties;
- Land and Compensation;
- Resources/Market;
- Pre-Construction Programme/Procurement;
- Buildability & Construction Programme;
- Finance; and
- Other-General.

These risks were assessed assigning a probability to each risk along with cost and time impacts (1-5 scale). The cost and time rank values were calculating by multiplying the cost/time impacts by the probability. Mitigation measures and the owner for each risk were identified. The minimum, most likely and maximum value (€) of each risk were calculated and these figures were multiplied by the risk probability to find the contingency for each risk. The "most likely" value was used for each risk and these values were assigned to the appropriate Scheme Cost heading. The sum of each these values under each heading were used for the contingency in the Total Scheme Budget, which can be seen below in Table 7-1.

Base Cost Expenditure Heading	Base Cost (incl VAT)	Contingency (incl VAT)	Budget
Main Construction Contract	€12.58m	€1.04m	€13.61m
Main Contract Supervision	€0.41m	€0.08m	€0.49m
Archaeology	€0.33m	€0.05m	€0.38m
Advance Works & Other Contracts	€0.19m	€0.06m	€0.25m
Public Transport Connectivity/Asset Renewal	€0.98m	€0.06m	€1.04m
Land & Property	€2.54m	€0.21m	€2.76m
Planning & Design	€0.68m	€0.16m	€0.84m
Sub-Total	**€17.70m**	**€1.66m**	**€19.36m**
Total Inflation Allowance		**€1.22m**	
TII Programme Risk		**€0.97m**	
Total Scheme Budget		**€21.46m**	

Table 7-1 Total Scheme Budget (2021 Prices inclusive of VAT)

8 Procurement

Due to the scale of the scheme and total cost below €20m it is anticipated the N63 Liss to Abbey Realignment Scheme will be procured via a traditional employer designed contract, however, this will be confirmed post completion of the statutory process in consultation with GCC.

9 Implementation Proposals

Due to the scale of the scheme it is anticipated the N63 Liss to Abbey Realignment Scheme will be implemented in a single phase, however, the construction phasing and the associated timescales will be confirmed post completion of the statutory process in consultation with GCC.

10 Monitoring & Evaluation Plan

10.1 Overview

The Department of Public Expenditure and Reform (DPER) and the Department of Transport. (DoT) require a Post Project Review to be carried out for all projects in excess of €20m. Guidance on the requirements and preparation of a Post Project Review are provided in PAG Unit 9.0 – Post Project Review.

The Post Project Review for the proposed road development will be undertaken 5 years after opening to allow sufficient time for the project impacts to be evaluated. The Post Project Review will evaluate the following four stages of the project:

- Project Conception;
- Project Planning;
- Project Implementation; and
- Project Operational Performance.

10.2 Performance Targets

As part of the operational performance section of the Post Project Review a number of targeted objectives will be quantified and assessed. Three performance targets have been included below which will aim to be achieved after the completion of the project:

1. An end-to-end speed of at least 92 kph on the new scheme;
2. The reduction of the local collision rate within the study area, in line with the collision reductions that have been calculated as part of the Cost Benefit Analysis; and
3. A 50% reduction in total traffic on the existing route, measured against the 2019 baseline.

11 Conclusions

This Phase 3 PBC was developed for the proposed N63 Liss to Abbey Realignment Scheme, Co. Galway. The project aims to divert a section of the existing N63 that has poor horizontal and vertical alignment along with a narrow bridge crossing the Abbert River. The proposed scheme is approximately 2.4km in length.

The proposed upgrade for this section of the N63 will use a Type 2 Single carriageway cross-section to improve route consistency along the National Roads network, and is considered to be consistent with local and regional and national policy and guidance. The scheme is described as a specific objective within both the current development plan and local transport plan.

The proposed scheme is a multi-modal transport scheme, with a provision for both cyclists and pedestrians. The scheme will improve journeys across the Abbert River, with improved horizontal and vertical alignments. In addition, improved cross-sections, realignment and upgraded junctions will improve safety, particularly for pedestrians and cyclists.

The framing of scheme objectives has been undertaken in accordance with the guidance provided in the TII's PAG, under the following criteria:

- Economy – the direct economic benefits to road users and transport providers, and the wider boost to businesses from lower transport costs.
- Safety – the road safety impacts of the scheme, including the statistical increase or decrease in numbers of personal injury accidents, and any impact on the personal security of road users
- Environment – including the operational and construction impacts of the scheme on the natural environment (air quality, water quality, habitat of other species), the impact of changes in traffic noise on the living environment for human beings, and any impact on irreplaceable resources (land and cultural heritage)
- Integration – the extent to which the project supports government policy more generally;
- Accessibility and Social Inclusion – the extent to which the project reduces social exclusion by enhancing the accessibility of low-income rural areas; and
- Physical Activity – Summary of the nature of physical activity impacts including impacts on particular groups of road users such as pedestrians and cyclists.

A detailed appraisal of the preferred scheme was conducted in accordance with the TII PAG and DTTaS Common Appraisal Framework. A Cost Benefit Analysis (CBA) and a Multi-Criteria Analysis (MCA) were developed for evaluating the proposed scheme, and the CBA presented a Benefit to Cost Ratio of 1.13, generating a positive return on the required investment, while the MCA assessment showed that overall the project will have a positive impact.

Appendix A – Project Brief

N63 Liss to Abbey Realignment Scheme

Phase 3 – Project Brief

Galway County Council

AECOM Project Number: 60571547
GCC Project Number: GC/16/13416

Document Reference: N63-ACM-PH03-ZZ-RP-ZZ-0002_AppendixA

7th February 2022

Quality information

Prepared by	Checked by	Verified by	Approved by
Cameron McBain Consultant	Neil Caughey Associate Director	Philip Shiels Associate Director	Eoin Greene Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
D1	10/08/2021	1st Draft Issue	Yes	Eoin Greene	Technical Director
Rev 0	07/02/2022	Final for Ph3 Close Out	Yes	Eoin Greene	Technical Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Galway County Council

Áras an Chontae,

Prospect Hill,

Galway

H91 H6KX

Prepared by:

AECOM-ROD

4th Floor

Adelphi Plaza

Georges Street Upper

Co. Dublin

Ireland

T: +353 1 238 3100

aecom.com

Prepared by:

All Rights Reserved.

This document has been prepared by AECOM Ireland Ltd and Roughan & O'Donovan Ltd ("AECOM-ROD) for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM-ROD and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM-ROD, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM-ROD.

Table of Contents

Figures

Tables

1 Introduction

1.1 Overview

This report forms the Phase 3 (Design and Environmental Evaluation) Project Brief (PB) for the N63 Liss to Abbey Realignment Scheme and has been undertaken in accordance with the Transport Infrastructure Ireland (TII) Project Management Guidelines (PMG) 2019 and TII Project Appraisal Guidelines (PAG) 2021[1].

The TII PAG are in compliance with the Department of Transport (DoT) Common Appraisal Framework (CAF) for Transport Projects and Programmes 2020 and Department of Public Expenditure and Reform (DPER) Public Spending Code (PSC) 2019.

The purpose of the Project Brief is to outline the particular issues that a project is intended to address, the high level need for the project, and to explore the supporting policy documentation and outline. The Project Brief then guides the subsequent scheme development process and is used to inform the development of the scheme Business Case.

AECOM - ROD have been commissioned by Galway County Council to provide multi-disciplinary engineering and other specialist consultancy services, covering Phases 1 - 4 of the TII PMGs for the development of the N63 Liss to Abbey Realignment Scheme.

1.2 Project Description

The N63 Liss to Abbey Realignment Scheme is a proposed road scheme in Abbeyknockmoy, Co. Galway, that will facilitate a number of objectives in the Galway County Development Plan (2015-2021), including the provision of higher-quality National Roads and the separation of regional and local traffic. The scheme will also meet a number of objectives of the Road Safety Authority's Road Safety Strategy 2013 - 2020. The proposed scheme will propose the upgrade of approximately 2.4km of the existing road alignment.

The proposed scheme is located in the north east of County Galway along the N63 Route, a national secondary route, and directly to the east of the village of Abbeyknockmoy. The study area extends in a north easterly direction, from the eastern edge of Abbeyknockmoy, across the Abbert River, to the townland of Derreen and on towards the junction of the N63 with the L6234. The study area includes a National Monument to the west, the Cistercian Abbey.

The scheme generally runs from south west to north east across the Abbert River, which is part of the Lough Corrib Special Area of Conservation (SAC). The scheme location is characterised by the presence of open greenfield area with some wooded areas in the section south of the Abbert River.

The scheme is located in close proximity to Abbeyknockmoy Abbey, a National Monument located to the north of Abbeyknockmoy, enjoying the highest level of statutory protection under the National Monuments Acts 1930–2004.

The purpose of the scheme is to provide an improved link for regional traffic to the M17 motorway and reduce traffic congestion at the Liss Bridge and the community facilities. The existing N63 will be upgraded to provide facilities for both cyclists and pedestrians and will improve connectivity between the community facilities and residential areas.

Strategically, while the N63 itself does not form part of the TEN-T Network, the proposed improvements will support the objectives of the TEN-T in broad terms by improving the connectivity to Junction 19 on the M17 TEN-T Comprehensive network.

The location of the scheme can be seen in Figure 1-1 below.

[1] PE-PAG-02033 – PAG for National Roads Unit 8.0 – Business Case

Figure 1-1 Regional Location Plan

1.3 Background to the Project

AECOM-ROD were commissioned to begin work on the scheme in May 2019. The scheme has been progressed by AECOM-ROD through Phase 1 (Feasibility Studies) of the TII Project Management Guidelines 2019 (PE-PMG-02041) and a Scheme Feasibility Report was published in August 2019. A Phase 2 Options Selection Report has been prepared in accordance with TII Project Management Guidelines 2019 (PE-PMG-02041) and TII Project Appraisal Guidelines for National Roads (Unit 4.0 - Consideration of Alternatives and Options - PE-PAG-02013) and was published in April 2020. It was deemed that a Stage F Road Safety Impact Assessment was not required due to the minor land take required. The Phase 2 Gate Review Statement has been accepted by TII in December 2020; the approval to progress the scheme from Phase 2 to Phase 3 was also granted by TII in December 2020.

The development of the preliminary design, the Compulsory Purchase Order (CPO), the Environmental Impact Assessment and the Appropriate Assessment progressed during 2021. A Stage 1 Road Safety Audit was produced and approved in August 2021. At the time of writing this document, the development application documentation required for the submission to An Bord Pleanála is currently being finalised.

2 Need for the Scheme

2.1 Overview

This section of the report outlines and discusses the condition of the existing sections of the National Roads network under consideration and identifies any network deficiencies. These deficiencies combined with the national, regional and local policy of Section 3 of this report constitute the 'Need for the Scheme'. The following areas are assessed in terms of network deficiencies:

- Existing Road Network;
- Existing Traffic Levels & Journey Times;
- Existing Road Safety Issues; and
- Consideration of Alternatives & Options.

2.2 Existing Road Network

The N63 (Roscommon to Galway) lies in a southwest-northeast orientation, providing a link between Galway, central counties and eastern region. Regional roads provide for traffic movements to surrounding towns including Monivea (L3110), Tuam (L2114 and R332), and Barnaderg (Old Road).

1. The recently completed Abbeyknockmoy to Annagh Hill Scheme (2018) is located along the existing N63 directly to the south west of the proposed project; this scheme entailed improvement of two discreet sections of the N63 totalling 3.2km of online upgrade, linking the M17/M18 Gort to Tuam PPP Scheme to the section of the N63 which was upgraded in 2013. The second section of this scheme linked the upgraded section of the N63 (completed in 2013) with the village of Abbeyknockmoy. The existing road was upgraded to a Type 2 single carriageway with a separate footway/cycleway.
2. The existing section of the N63 between Liss and Abbey is narrow with no hard shoulders. Alignment of the road is poor in both the horizontal and vertical planes. There is no off-road provision for pedestrian and cycling movements.
3. The existing Liss Bridge is narrow and significantly restricts traffic flows, with two HGVs travelling in opposite directions unable to safely pass. Given the rural nature of the scheme, agricultural vehicles regularly conflict with local road traffic on the bridge, which in turn generates localised traffic issues. There have been accidents at this location as identified in TII and RSA collision data.
4. The Liss bridge currently has poor vertical and horizontal alignment and poor capacity due to narrow lanes. Upon site inspection a number of bridge strikes are apparent, with the existing parapet walls repaired in a number of locations (See Figure 2-1).

Figure 2-1 Existing N63 Liss Bridge with patchwork parapet repairs.

5. L3110 is a minor road to the south of the site which leads to Mullagh Hill.
6. L7138 Lisch Road, a local road to the south that leads to Monivea, and L6188 Old Road to the north, a local road that leads to Carrogorm.

7. Between the L3110 and Lisch Road there is Abbeyknockmoy GAA Club, a creche, and Saint Bernard's Church. Immediately north of the N63 is Abbeyknockmoy Community Centre, and Newtown National School. Each of these facilities have independent car parks, apart from the creche which does not have a dedicated car park.
8. There are numerous dwellings along the L3310, Lisch Road, and in a linear fashion heading west on the N63 into Abbeyknockmoy.
9. A footpath connects the GAA Club to the Church, between the L3310 and the Lisch Road along the south of the N63, there are no other non-motorised user facilities in the area.

2.3 Existing Traffic Levels

2.3.1 Traffic Counts and Surveys

TII maintains a network of traffic counters on the National Roads Network. One such traffic counter (Ref. TMU N63 080.0W) is located on the N63 between Roscommon and Galway at Derreen, Co. Galway. Traffic flow data is available for this counter since 2014.

Analysis of this data indicates that the AADT flow on the N63 at Derreen townland North East of Abbeyknockmoy village in 2019 was 3,598 vehicles per day with 3.3% HGV. The percentage of HGV has increased from 3.1% in 2014 to 3.6% in 2018. It is noted that the removal of the Rail Bridge near Finn's Cross, completed as part of the 2017 scheme just south of the N63 Liss to Abbey section, may have given rise to the increased volume of HGVs using the route.

As part of the assessment of the scheme, a number of traffic surveys have been completed around Abbeyknockmoy and adjacent junctions. The traffic surveys were undertaken in May 2019. The surveys included a mix of automatic traffic counters (ATC) and junction turning counts (JTC). The survey locations are illustrated in Figure 2-2 below.

The ATCs were installed at three locations within the study area, collecting data over a two week period between 21st May 2019 and 3rd June 2019. The JTCs were completed at five junction locations over a 12-hour period (7am to 7pm) on 21st May 2019. This data indicated that the Annual Average Daily Traffic (AADT) flow on the N63 at Derreen townland, North East of Abbeyknockmoy village, in 2019 was 3,500 vehicles per day with 3.2% HGVs.

Figure 2-2 ATC, JTC and TMU Locations

2.3.2 Link Count

The 2017 – 2019 AADTs from TII Traffic Counter along with existing traffic flows from automatic traffic counts are shown in Figure 2-3 below.

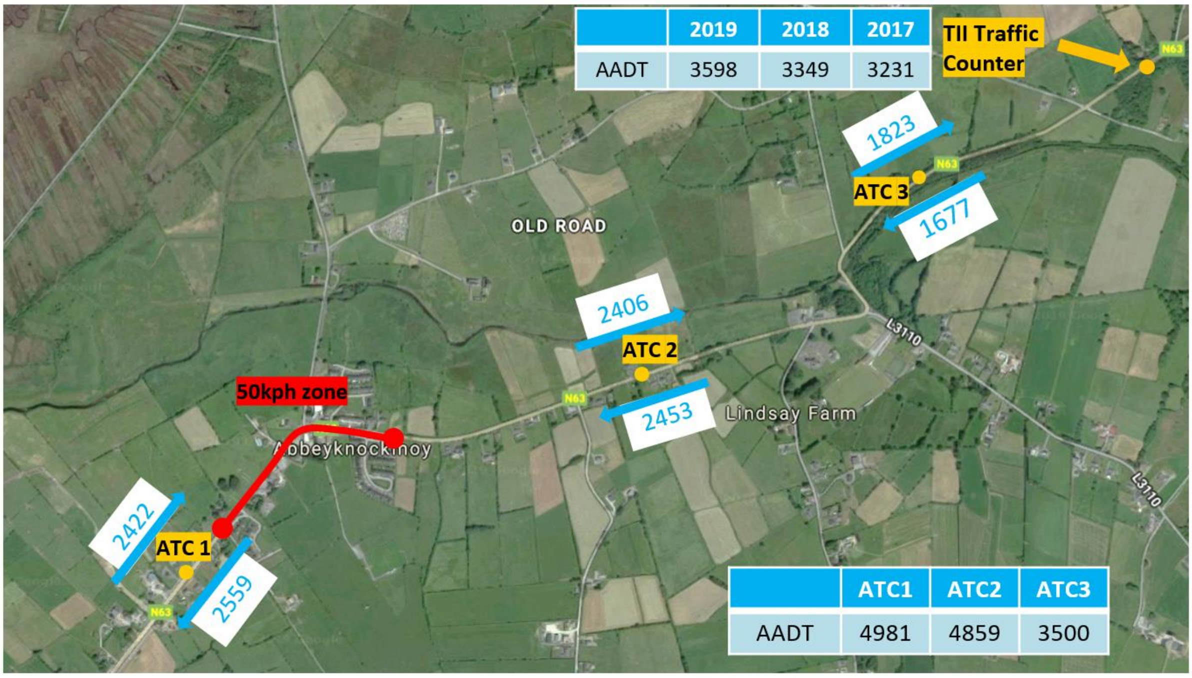


Figure 2-3: Existing Traffic Flows

An ATC captures the numbers of vehicle passing a given point on a road and classifies the vehicles into different vehicle classifications, for example cars, LGV and HGV.

ATC AADT and percentage HGV values recorded are illustrated in Table 2-1 below.

Table 2-1: Link Counter Data – N63 Mainline

ID	Location	AADT	HGV %	Source
ATC1	N63, southwest of Abbeyknockmoy	4,981	3.2	ATC, 2 weeks period
ATC2	N63, east of Abbeyknockmoy	4,859	3.2	ATC, 2 weeks period
ATC3	N63, north of River Abbert crossing	3,500	3.2	ATC, 2 weeks period
N63 (080.0W)	N63 (080.0W)	3,598	3.6	TII Counter (2019 data)

2.3.3 Existing Average Speeds

ATCs also recorded vehicles speeds. Table 2-2 below presents the average speeds observed at the ATC locations (the speed limit is 100kph at all locations).

Table 2-2: Average Speeds

Location	Direction	No. of Vehicles	85th Percentile Speed (km/h)
ATC 1 West of Abbeyknockmoy	Southbound	35,383	87
	Northbound	33,501	86
	Average	34,442	87
ATC 2 Central Location	Southbound	34,040	93
	Northbound	33,410	91
	Average	33,725	92
ATC 3 West of Liss Bridge	Southbound	19,463	95
	Northbound	20,303	87
	Average	19,883	92

2.3.4 Junction Turning Movements

JTCs were recorded at five points within the study area over a 12-hour period on 21st May 2019. The location of the turning movement surveys can be seen in Figure 2-2.

Although the turning movements along the N63 Liss to Abbey are minor, given that the route is a single lane carriageway with no ghost island, dedicated right turn facilities or undertaking (passing) provision, vehicles may be required to stop on the mainline to perform a right turning movement.

The typically high traffic speeds along the section (shown in Table 2-2 above) coupled with the absence of turning provision yields a higher potential for rear end shunts and other traffic collisions especially during peak times when there may be an increased number of vehicles turning off the mainline to access the community facilities.

2.3.5 Journey Times

Typical journey times along the N63 within the study area are in the order of three minutes. As a consequence of the narrow bridge, journey time reliability is negatively affected; with some vehicles achieving a clear movement across the existing narrow bridge, while others need to yield to opposing traffic, generating an unreliability within vehicular journey times.

2.3.6 Conclusions of Traffic Surveys

A number of key conclusions can be drawn from the review of the existing TMU data and project-specific traffic surveys, these include;

- Traffic volumes along the route have grown at rate of 4% between 2017-2018 and 7% between 2018-2019, based on the TII Permanent Traffic Count data.

- The traffic flows are reasonably balanced between east and west movements, and do not have any clear peaks throughout the day.
- The 85th percentile speed along the existing N63 is high, particularly in consideration of the existing sub-standard road alignment. The existing community buildings and schools in close proximity to the road edge, the single lane bridge with substandard entry radii, and the significant number of road junctions and direct accesses also give rise to a safety concern when considered in in conjunction with these high speeds.
- There are a number of right turn movements along the route. The movement to the L3110 from the N63 has potential to generate shunt accidents, given the limited junction visibility and proximity to the community and school facilities.

2.4 Existing Road Safety Issues

An initial desktop safety review has been undertaken for the surrounding road network. Collision data from 2005 – 2016 has been retrieved from the Road Safety Authority portal and is provided in Figure 2-4.

This stretch of the existing N63 road has a substandard cross section, poor vertical and horizontal alignments with road safety compromised as a result.

The narrow cross section of the existing road and Liss Bridge combined with sharp bends and restricted visibility makes it unsuitable for non-motorised users (pedestrians and cyclists). The rural section of the N63 has a high density of road junctions (6) and private accesses (32) from the east of Abbeyknockmoy Village to the eastern study area extents.

Numerous minor severity collisions have taken place on the roads surrounding the study area, with some limited clustering within the network, namely Abbeyknockmoy town centre and the Liss Bridge.

Figure 2-4 RSA Collision Map (2005-2016)

Based on Road Safety Authority data, the recorded collisions along this section of road between 2005 and 2016 are as follows:

- Fatal: 0
- Serious: 2
- Minor: 4

The accident rate on the N63 is twice above the average collision rate for the years 2012-2014 and twice below for the years 2014-2016 as outlined in Figure 2-5 and Figure 2-6 below, which has been extracted from the TII Collision Maps. Although the average collision rate was low between 2014-2016, overall this section of road has a higher than average collision rate across all years.

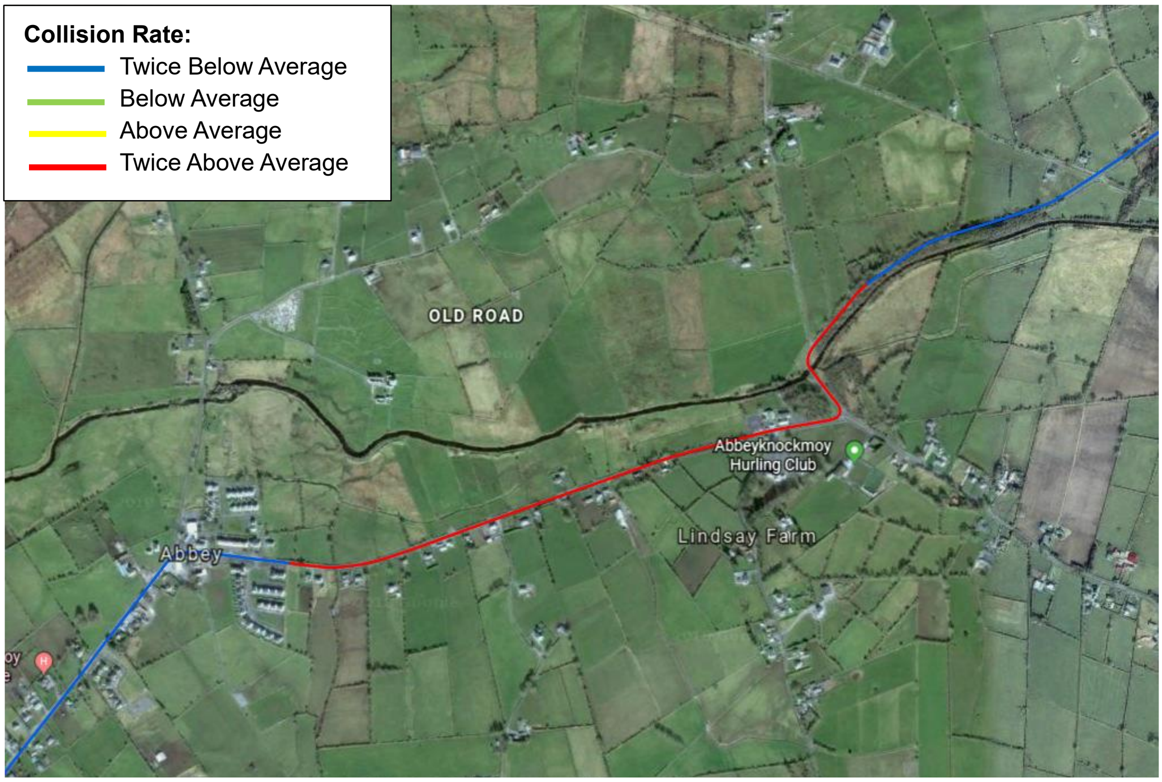


Figure 2-5: TII collision maps 2012-2014

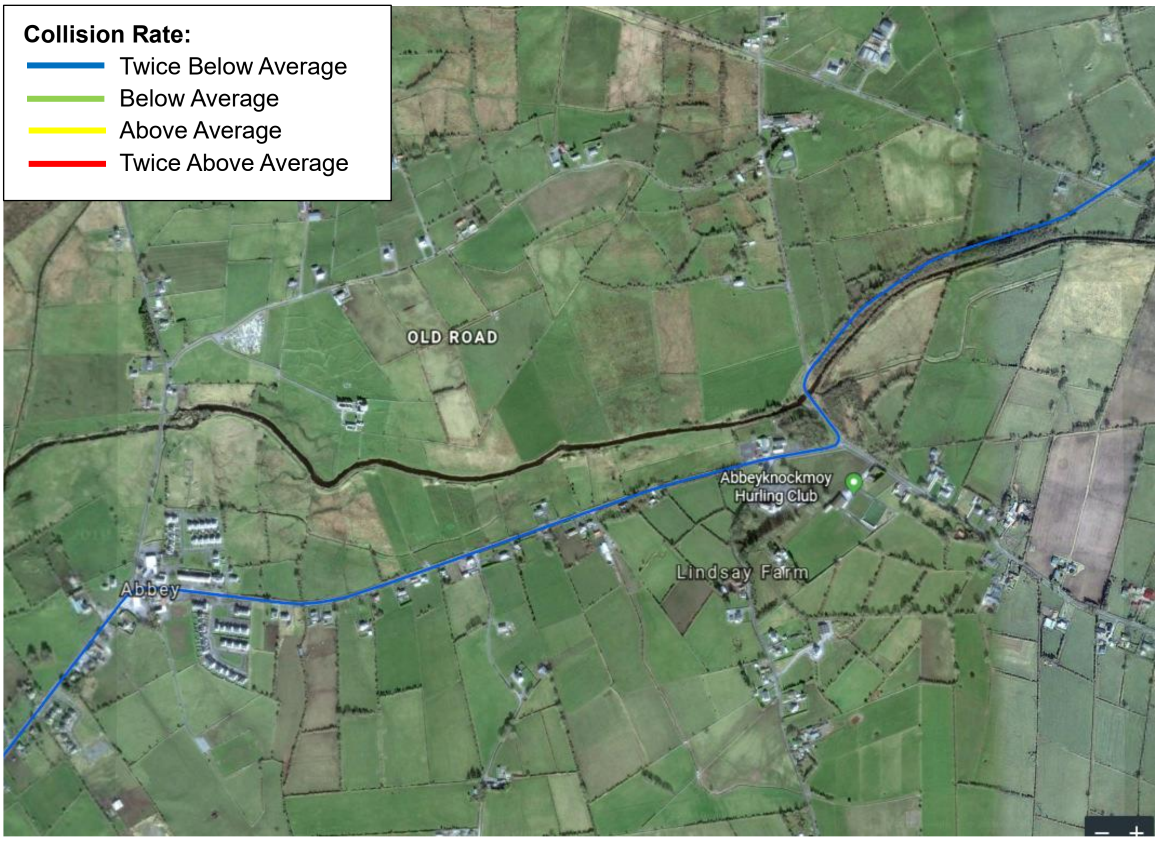


Figure 2-6: TII collision maps 2014-2016

2.5 Network Deficiencies

An initial desktop review of the network deficiencies has been conducted within the study area. The review identified that the existing road alignment has:

1. A substandard horizontal alignment with the two curves approaching the existing bridge well below standard. The design standard for a 100km/h curve without the application of superelevation or curve widening is 2040m, both the curves approaching the existing bridge are less than 70m;
2. A substandard vertical alignment with 70% of the vertical curves not achieving the standard design hog and sag curves;
3. Substandard forward visibility with the minimum stopping sight distance (215m) failing to be achieved along approximately 30% of the route, with forward site overtaking distance achieved on only 15% of route. This is substantially below the requirement of 30% for Type 2 single carriageway rural roads;
4. A large number of hazards remain within the clear zone of the road, generating an unforgiving roadside that can significantly increase the severity of injury should a vehicle leave the road;
5. Liss bridge is narrow and two HGVs travelling in opposite directions are not able to pass safely on the bridge at the same time. The bridge is frequently damaged by HGVs. The total width of the bridge is less than 6m (parapet to parapet).
6. Safety is also compromised by the number of at-grade junctions and private accesses. There are 32 direct accesses onto the N63 beyond the national speed limit from Abbeyknockmoy Village west to the study area extents. The overriding principle in TII publication DNGEO-03060, is that direct access onto National Roads should be avoided. These accesses typically have substandard forward sight stopping distances.
7. Although the turning movements along the N63 Liss to Abbey present as minor, given that the route is a single lane carriageway with no ghost island or undertaking provision, vehicles stop on the mainline to perform a right turning movement.

2.6 Consideration of Alternatives and Options

2.6.1 Option Selection Process

The full option selection process for the scheme is outlined in the N63 Liss to Abbey Realignment Scheme Option Selection Report (March 2020). In summary, the option selection process was undertaken in two stages in accordance with the TII PMG:

- Stage 1 - Develop a number of feasible route options (typically 6 or more and including 'Do-Nothing' and 'Do-Minimum' alternatives) and carry out a Preliminary Options Assessment using a Framework Matrix (comprising the assessment criteria of Engineering, Environment and Economy). This will result in the number of options being refined to between 3 and 5.
- Stage 2 - After Stage 1, carry out a Project Appraisal of these options using the Project Appraisal Matrix (comprising the six CAF criteria of Safety, Environment, Economy, Integration, Accessibility & Social Inclusion and Physical Activity), enabling the selection of a Preferred Option Corridor.

A short summary of the option selection process is provided in the sections below.

2.6.2 The Do-Nothing and Do-Minimum Options

The 'Do-Nothing' Option

The 'Do-Nothing' option does not provide for any additional crossing of the Abbert River or improvement of the existing road network other than routine maintenance.

Any local or regional traffic travelling on the N63 wishing to cross the Abbert River will be restricted by the substandard road geometry and Liss Bridge in both directions.

The 'Do-Minimum' Option

The 'Do-Minimum' option identified the lack of additional crossings of the Abbert River, the narrow cross-section of the carriageway and poor alignment of the N63. There are road safety issues relating to the existing layout of the N63 which require consideration.

The 'Do-Minimum' option investigates the potential to undertake minor improvement works that would improve safety concerns in the vicinity of the Liss Bridge through localised widening and the introduction traffic control across the bridge. As part of the Do-Minimum traffic signals would be introduced on approaches to the bridge to help reduce vehicle conflicts. However, this may increase journey times in either or both directions.

Consideration has been given to improving the junctions along the N63 to improve driver safety. The limited width of the existing bridge over the Abbert River and the constrained environment in the area surrounding the bridge restrict the options for safety improvements. Improvements to non-motorised users' facilities (cycle facilities in particular) along the N63 are not considered in the Do-Minimum.

2.6.3 Stage 1 - Preliminary Options Assessment

The potentially feasible Options were assessed by applying the three-stage option selection process set out in the TII Project Management Guidelines 2019 (PE-PMG-02041). At Stage 1, all Options were subject to a Multi Criteria Analysis assessing Engineering, Economy and Environment.

The six Stage 1 Options can be seen in Figure 2-7 below. The results of the Stage 1 Preliminary Options Assessment can be seen in Table 2-3.

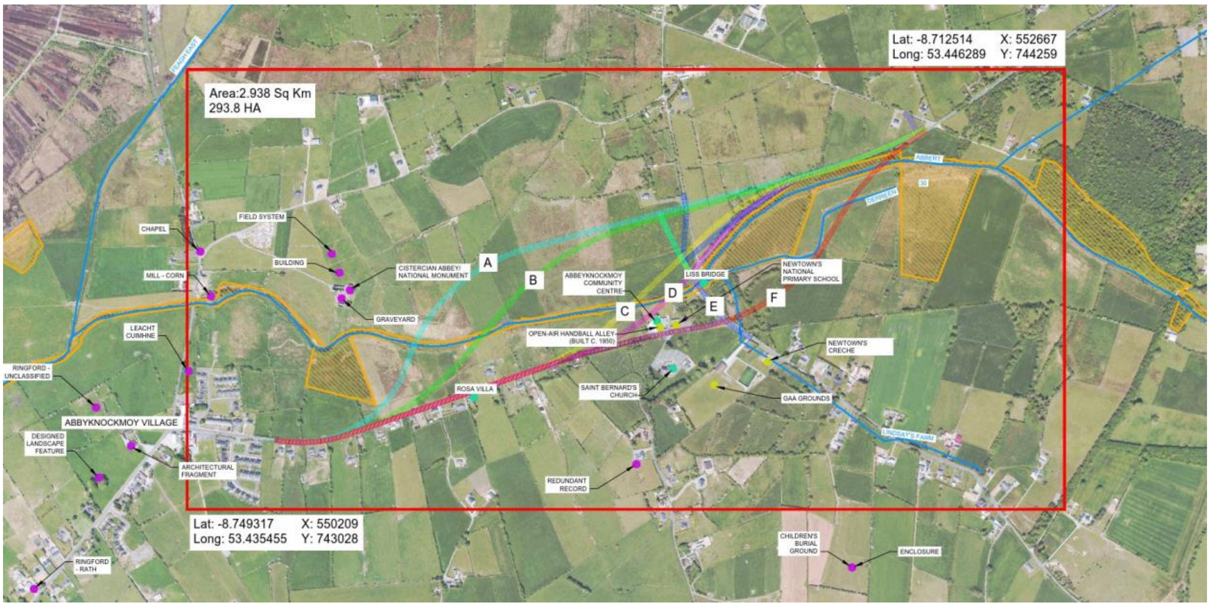


Figure 2-7 Stage 1 Options

	Do-Nothing / Do-Minimum Option	Option A (Cyan)	Option B (Green)	Option C (Yellow)	Option D (Pink)	Option E (Blue)	Option F (Red)
Engineering	Minor or slightly negative	Moderately positive	Major or highly positive	Minor or slightly positive	Not significant or neutral	Minor or slightly negative	Minor or slightly negative
Environment	Not significant or neutral	Major or highly negative	Moderately negative	Moderately negative	Moderately negative	Moderately negative	Moderately negative
Economy	Minor or slightly negative	Minor or slightly positive	Moderately positive	Minor or slightly positive	Not significant or neutral	Minor or slightly negative	Not significant or neutral
Overall Assessment	**Minor or slightly negative**	**Not significant or neutral**	**Minor or slightly positive**	**Not significant or neutral**	**Minor or slightly negative**	**Moderately negative**	**Minor or slightly negative**

Table 2-3 Stage 1 Preliminary Option Assessment Summary

2.6.4 Public Consultation No.1

A Public Consultation was held in October 2019 to present the study area, and the six Options (A-F) that arose from the Stage 1 Preliminary Options Assessment.

Following the Stage 1 Preliminary Options Assessment, it was decided that three options (A, B and C) and the Do-Minimum should be brought forward to Stage 2 Project Appraisal.

Following review of the submissions at the first Public Consultation, it was observed that the majority of the public in attendance were in support of an improvement scheme, with significant requests for non-motorised user facilities to connect the community facilities to the residential area of Abbeyknockmoy.

2.6.5 Stage 2 - Project Appraisal Matrix

The three options that were taken forward to Stage 2 Project Appraisal are shown in Figure 2-8

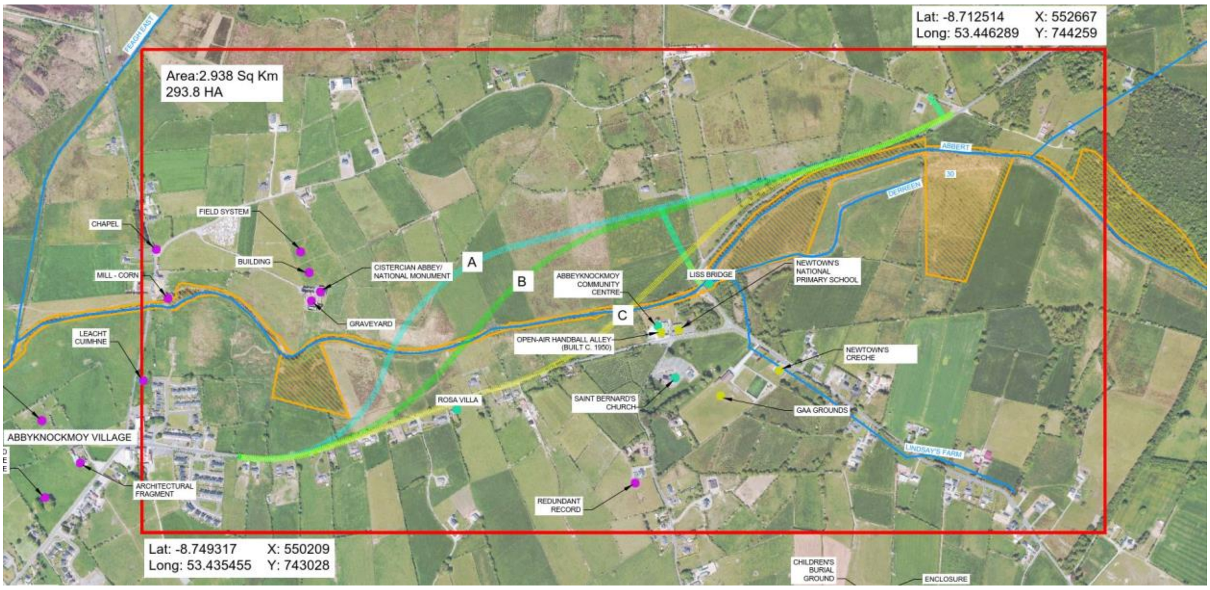


Figure 2-8 Stage 2 Options

A detailed and informed comparative assessment was undertaken in accordance with the TII Project Management Guidelines 2019 (PE-PMG-02041) and the CAF. The results of the assessment under each of the six required criteria are summarised in Table 2-4.

	Do-Nothing / Do-Minimum Option	Option A (Cyan)	Option B (Green)	Option C (Yellow)
Economy	Major or highly negative	Moderately positive	Major or highly positive	Minor or slightly positive
Safety	Moderately negative	Moderately positive	Moderately positive	Moderately positive
Environment	Not significant or neutral	Major or highly negative	Moderately negative	Moderately negative
Integration	Not significant or neutral	Moderately positive	Moderately positive	Moderately positive
Accessibility & Social Inclusion	Not significant or neutral	Moderately positive	Moderately positive	Moderately positive
Physical Activity	Not significant or neutral	Moderately positive	Moderately positive	Moderately positive
Overall Assessment	**Minor or slightly negative**	**Not significant or neutral**	**Minor or slightly positive**	**Not significant or neutral**

Table 2-4 Stage 2 Project Appraisal Matrix Summary

Following the Stage 2 Project Appraisal, it was recommended that Option B (Green) should be taken forward as the Emerging Preferred Option for the N63 Liss to Abbey Realignment Scheme.

2.6.6 Emerging Preferred Option - Public Consultation No.2

A further Public Consultation was held in February 2020 to present the Emerging Preferred Option and seek public input to inform its further development.

Following review of the submissions at the second Public Consultation, it was observed that the majority of the public in attendance were in support of the Emerging Preferred Option, with the request for non-motorised user facilities to connect the community facilities to the residential area of Abbeyknockmoy being reiterated. Some concerns about visual impact and land take were raised and these will be reviewed at the preliminary design stage.

3 Strategic Fit & Priority

3.1 Overview

The compatibility of the proposed scheme in terms of meeting the objectives of national, regional and local planning policy is considered in this section. The following documents have been reviewed as part of this process:

3.1.1 International and National Policy Context

- TEN-T Trans European Transport Network;
- Project Ireland 2040 National Planning Framework (NPF);
- Strategic Investment Framework for Land Transport (SIFLT);
- Programme for Government: Our Shared Future; and
- Road Safety Authority Road Safety Strategy 2013 – 2020.[2]

3.1.2 Regional Policy Context

- West Regional Planning Guidelines (2010-2022).

3.1.3 Local Policy Context

- Galway County Development Plan (2015-2021).

3.2 International and National Policy

3.2.1 TEN-T Trans European Transport Network

The TEN-T Trans European Transport Network (Regulation (EU) No. 1315/2013), provides for the TEN-T and requires the development of a core network by 2030 with a connecting comprehensive network of high-quality routes incrementally by 2050. The requirements for the comprehensive network, is described by the regulation as follows:

> *The comprehensive network should be a Europe-wide transport network ensuring the accessibility and connectivity of all regions in the Union, including the remote, insular and outermost regions, as also pursued by the Integrated Maritime Policy established by Regulation (EU) No 1255/2011 of the European Parliament and of the Council, and strengthening social and economic cohesion between them. The guidelines laid down by this Regulation ("the guidelines") should set the requirements for the infrastructure of the comprehensive network, in order to promote the development of a high-quality network throughout the Union by 2050.1*

While the N63 does not form part of the comprehensive TEN-T Network, the proposed improvements will support the objectives of the TEN-T in broad terms by improving the connection to Junction 19 on the M17 TEN-T network which in turn feeds into:

> *...the core network at regional and national level. The aim is to ensure that progressively, throughout the entire EU, the TEN-T will contribute to enhancing internal market, strengthening territorial, economic and social cohesion and reducing greenhouse gas emissions.*

[2] Most recent document at the time of writing, but will also have regard for objectives of the draft RSA Road Safety Strategy 2021-2030

Figure 3-1: TEN-T Trans European Transport Network Map

3.2.2 Project Ireland 2040 National Planning Framework (NPF)

The NPF is the Government's high-level strategic plan for shaping the future growth and development of Ireland to the year 2040. Its overarching visions are to:

- Develop a new region-focused strategy for managing growth;
- Linking this to a new 10-year investment plan, the Project Ireland 2040 National Development Plan 2018-2027;
- Using state lands for certain strategic purposes;
- Supporting this with strengthened, more environmentally focused planning at local level; and
- Backing the framework up in law with an Independent Office of the Planning Regulator.

The goals and objectives of the NPF are expressed as 'National Strategic Outcomes', which include:

1. Compact Growth;
2. Enhanced Regional Accessibility;
3. Strengthened Rural Economies and Communities;
4. High Quality International Connectivity;
5. Sustainable Mobility;
6. A Strong Economy, supported by Enterprise, Innovation and Skills;
7. Enhanced Amenities and Heritage;
8. Transition to a Low Carbon and Climate Resilient Society;
9. Sustainable Management of Water, Waste and other Environmental Resources;
10. Access to Quality Childcare, Education and Health Services.

The proposed upgrade of the N63, will directly support 'Enhanced Regional Accessibility', 'Strengthened Rural Economies and Communities' and 'Sustainable Mobility' which are defined below:

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. Not every route has to look east and so accessibility and connectivity between places like Cork and Limerick, to give one example, and through the Atlantic Economic Corridor to Galway as well as access to the North-West is essential.

Strengthened Rural Economies and Communities

Rural areas play a key role in defining our identity, in driving our economy and our high quality environment and must be a major part of our country's strategic development to 2040. In addition to the natural resource and food sector potential as traditional pillars of the rural economy, improved connectivity, broadband and rural economic development opportunities are emerging which offer the potential to ensure our countryside remains and strengthens as a living and working community.

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.

Of most significance in terms of the NPF, is the fact that the N63 connects directly to the core component of the Atlantic Economic Corridor (AEC), which is defined within the Plan as:

… a linear network along the Western seaboard, stretching from Kerry to Donegal, which has the potential to act as a key enabler for the regional growth objectives of the National Planning Framework. The corridor straddles parts of both the Northern and Western Region and the Southern Regions, with the potential to further extend its scope by building on the Cross-Border relationship between Letterkenny and Northern Ireland, and into Cork City and County to the south. The overarching objective of the AEC initiative is to maximise the infrastructure, talent and enterprise assets along the western seaboard and to combine the economic hubs, clusters and catchments of the area to attract investment, improve competitiveness, support job creation and contribute to an improved quality of life for the people who live there. [The lack of high-quality connectivity between the regions within the AEC has been a major impediment to its development as a counter-balance to Dublin and the East coast.]

Improved connectivity between Counties Galway, Longford, Roscommon and also to Clare via the M17/M18 will be delivered through this project; thereby in turn enhancing accessibility for the region.

3.2.3 Strategic Investment Framework for Land Transport (SFILT)

The SFILT which was published by the Department of Transport, Tourism and Sport (DTTAS, at the time of publishing) outlines the key principles against which national and regional, comprehensive and single mode-based plans and programmes will be drawn up and assessed. The framework does not set out a list of projects to be prioritised, however, the following three priorities are noted in terms of investment:

- Priority 1 – Achieve steady state maintenance;
- Priority 2 – Address urban congestion; and
- Priority 3 – Maximise the value of the road network.

In terms of Priority 3, the report states that *"the value of the road network will be maximised through targeted investments that:*

- *Enhance the efficiency of our existing network, particularly through the increased use of ITS applications;*
- *Support identified national and regional spatial planning priorities;*
- *Provide access for large-scale employment proposals; and*
- *Support identified national and regional spatial planning priorities"*

The proposed scheme will support the objectives of the SFILT by improving the efficiency of this section of the National Roads network.

3.2.4 Programme for Government: Our Shared Future – October 2020

In October 2020, the Government launched "Programme for Government: Our Shared Future" outlining the policies and objectives over the term of the government. The proposed road development aims to support the objectives and policies contained within the programme for a partnership government, by continuing "to invest in new roads infrastructure to ensure that all parts of Ireland are connected to each other."

3.2.5 Road Safety Authority Road Safety Strategy 2013 - 2020

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

> *"A reduction of road collision fatalities on Irish roads to 25 per million population or less by 2020 is required to close the gap between Ireland and the safest countries. This means reducing deaths from 162 in 2012 to 124 or fewer by 2020.*
>
> *A provisional target for the reduction of serious injuries by 30% from 472 (2011) to 330 or fewer by 2020 or 61 per million population has also been set."*

The plan sets out strategies for engineering and infrastructure in terms of the benefits that they can have in terms of reducing collisions. The provision of the upgraded sections of National Roads proposed as part of this scheme will support this RSA strategy.

The policy which aims to extend measures in the EU Road Infrastructure Safety Management Directive 2008/96/EC relating to road safety inspection and traffic management, which currently apply to the TEN-T routes, to the entire National Roads network by 2016 has also been adopted for all National Routes since 2013. As this scheme is adjacent to the TEN-T network it fundamentally supports this objective and improves access to the TEN-T network.

3.3 Regional Policy

3.3.1 West Regional Planning Guidelines (2010-2022)

The West Regional Planning Guidelines (2010-2022) (RPG2010) identifies the following:

> *IO5: Identify the following works for priority completion in order to promote a balanced regional development. The following projects must be assessed as to their environmental impact, through relevant assessment, where necessary, including Habitats Directive Assessment in accordance with the requirements of the Habitats Directive, with preferred route options ensuring minimal impact, on the natural and built environment. 8. Upgrade and improve all National Secondary roads in Particular: (C) N63 Galway to Roscommon connecting the Gateway to the County town of Roscommon; minimising environmental impact.*

The West Regional Assembly was consumed into the Northern & Western Regional Assembly in January 2015 and are preparing a Regional Spatial Economic Strategy (RSES) for the region which will support the implementation of the NPF. The RSES will put in place policies and recommendations that will better manage regional planning and economic development throughout the region.

3.4 Local Policy

3.4.1 Galway County Development Plan (2015-2021)

The national and regional objectives identified above have been developed further and translated into local objectives through the Galway County Development Plan (2015-2021) (CDP). The CDP stated that the N/M6 and M17/M18 are the main access routes in the region and that the N59, N63, N83 and N84 are important inter-regional routes. The CDP makes specific reference to the wider N63 Leacht Seoirse-Ballygar route of which the N63 Liss to Abbey is a sub-section.

3.5 Policy Summary

Policy and planning documents have further identified the need for the scheme and support the objectives of an improved N63 corridor, particularly;

1. Sustaining economic growth through the provision of improved transport connectivity in this rural location
2. Enhanced regional and local accessibility, providing improved accessibility & social inclusion to school and community facilities
3. Enhanced environmental benefits, through a reduction in traffic queuing and journey time reliability
4. Improved safety through improved road alignment, pedestrian and cycle user segregation ultimately reducing accidents in line with the Road Safety Strategy.

3.6 Project Specific Need

The N63 forms part of the National Secondary Road network. The TII National Roads Network Indicators 2018 report describes the N63 as operating at a volume / capacity (V/C) ratio of below 80% in most areas but at a number of pinch points it is operating at a V/C of 100%-120%. Along one section, the N63 is operating at above 120% V/C. A review of the condition of the existing N63 within the study area was carried out, and is reported below.

The existing N63 within the study area is generally narrow with no hard shoulders. Alignment of the road is poor in both the horizontal and vertical planes. There is no off-carriageway provision for pedestrians or cyclists. The existing Liss Bridge is narrow and significantly restricts traffic flows, with two HGVs travelling in opposite directions unable to safely pass on the Liss Bridge. Given the rural nature of the study area, agricultural vehicles conflict with local road traffic on the Liss Bridge on a regular basis, which in turn generates localised traffic issues. There have been collisions at this location as identified in RSA collision data.

The Liss Bridge is significantly below standard both in terms of alignment and containment. During a site inspection a number of bridge strikes were apparent, with the existing sub-standard parapet walls repaired in several locations.

The N63 is a regional connector route connecting Roscommon to the M17 which leads on to Galway. Any proposed upgrade to the current sub-standard N63 alignment will improve the route consistency of the National Roads network. This will help with connectivity between these areas and improve journey times and reliability.

Outside of the study area the N63 is a relatively straight road with standard verges, no pedestrian/cyclist facilities and a number of overtaking areas when travelling from east to west towards Abbeyknockmoy. To the west of Abbeyknockmoy there is recently upgraded section of the N63 connecting to the M17 consisting of a Type 2 single carriageway cross-section; any proposed upgrade for this section of the N63 will aim to use the same cross-section which will help improve route consistency along the National Roads network offer an improved cross-section for all road users.

Figure 3-2: N63 Westbound at L3110 Junction

Figure 3-3: N63 Eastbound approaching Liss Bridge

The N63 Liss to Abbey Realignment Scheme is considered to be consistent with local and regional and national policy and guidance. The scheme is described as a specific objective within both the current development plan and local transport plan.

The proposed scheme is a multi-modal transport scheme, with a provision for both cyclists and pedestrians. The scheme will improve journeys across the Abbert River, with improved horizontal and vertical alignments. In addition, improved cross-sections, realignment and upgraded junctions will improve safety, particularly for pedestrians and cyclists.

The scheme also forms a key east / west transport link across the Abbert River, thus, providing a link to the National Roads network via the M17 Junction 19.

In addition, the N63 currently experiences traffic congestion issues in the vicinity of the Liss Bridge. This scheme will assist in the alleviation of these issues at the local level, while improving safety for both motorised and non-motorised users.

4 Scope, Constraints and Interfaces

4.1 Study Area and Scope

The proposed scheme will see approximately 2.4km of the N63 upgraded between Abbeyknockmoy and Derreen. An assessment of the capacity and operation of the four existing junctions on the N63 will also be undertaken.

The study area extends from the townlands of Derreen/Moyne in the north to 60km/h speed limits in the village of Abbeyknockmoy in the southwest. There is an old Abbey on the north bank of the Abbert River. The ruined Cistercian abbey at Abbeyknockmoy is a National Monument in the ownership of the State and enjoys the highest level of protection under the National Monuments Acts. The monument includes the standing masonry ruins and also extensive earthworks in the surrounding fields.

It is noted that the scheme will likely require the construction of a river crossing bridge over the Abbert River (Lough Corrib - SAC) and the upgrade of footpath/cycleway from Abbeyknockmoy village towards Dareen.

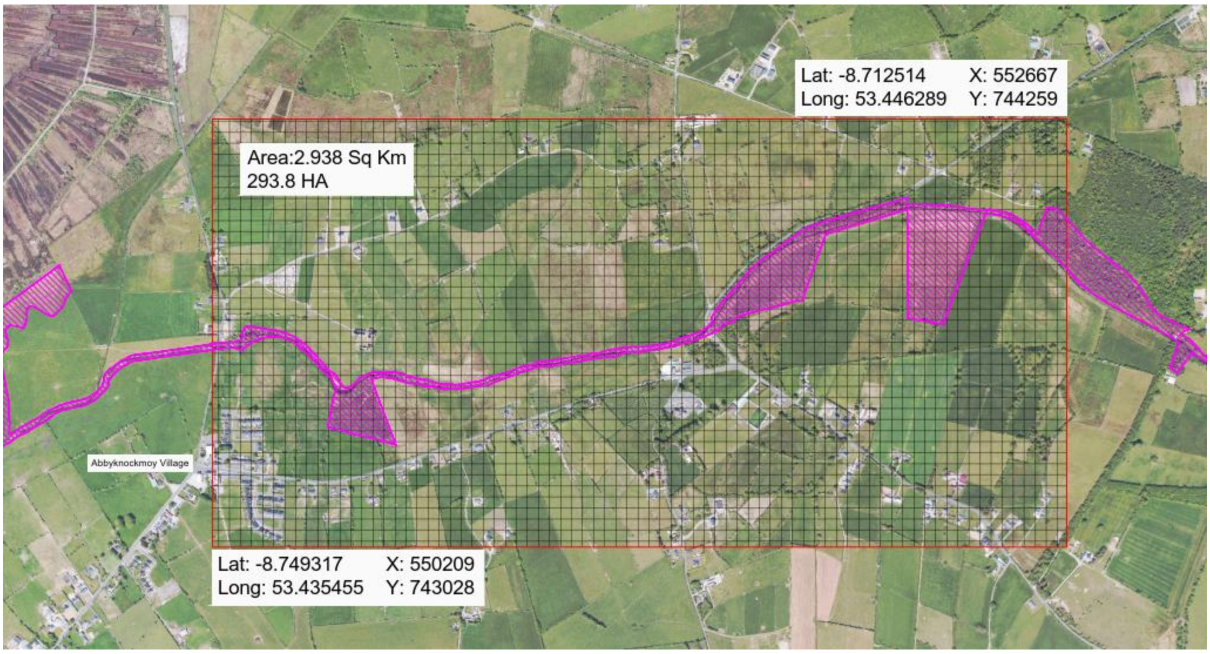


Figure 4-1 Study Area

The study area is mostly agricultural land with some areas of small woodland. The area to the south of the N63 has a significant stretch of fluvial woodland on the approach to the Liss Bridge, and the area to the east of Newtown National School is heavily wooded.

Mature trees and hedgerows are spread across the site typically along field boundaries and along the back of the verge.

The northern section of the study area includes the Abbert River and its flood plain which is part of the Lough Corrib SAC, along with the National Monument at Abbeyknockmoy and a graveyard. The Abbert is typically confined between its riverbanks with high banks and improved or semi-improved grassland stretching along the boundary length of the river within the study area.

In the immediate vicinity of the L3110 (towards Mullagh Hill) and N63 junction there are a number of community facilities and dwellings typically to the south of the N63. Outside the study area, Abbeyknockmoy village lies to the west, with individual residential housing typically lying along the other local roads connecting to the N63.

4.2 Constraints

In order to undertake the assessment of the scheme at the feasibility stage an initial route corridor option will need to be identified to inform the process. Initial constraints have been identified that may pose significant obstacles to the development of the route corridor and include:

1. Abbert River, its floodplain, and the Lough Corrib Special Area of Conservation (SAC);

2. Abbeyknockmoy Community Centre and Facilities near the L3110 junction;
3. Abbeyknockmoy Cistercian Abbey (National Monument);
4. The existing road network and key objective of realigning the N63 within the study area

The following key constraints have been identified:

4.2.1 Physical

- Existing road network
- Abbert River and Lough Corrib Special Area of Conservation (SAC)
- Existing Land Use – Residential/Agricultural/Community

4.2.2 Environmental

- Lough Corrib SAC
- Special Protection Areas (SPA)
- Treatment and eradication of Non-Native Invasive Species.

4.2.3 Financial / Appraisal

- Funding
- Project Appraisal

4.2.4 Archaeology

- The Cistercian Abbey setting and amenity to the Abbey

4.3 Interfaces

- Abbeyknockmoy Village;
- Abbeyknockmoy Community Centre, Schools and Community Facilities;
- Utilities (ESB/EIR/IW/Cuilliagh GWS etc.);
- NPWS (Lough Corrib SAC);
- OPW; and
- National Monument service

4.4 Key Issues

- Impact on designated sites/ environmental screening;
- Determination of on-line/offline construction type (i.e. overlay/dig out) and dealing with live traffic;
- Soils;
- Drainage;
- Visual Amenity;
- Archaeology; and
- Public awareness and acceptance of the project.

5 Scheme Objectives

The following are the objectives for any proposed intervention on this section of the N63. These may evolve as the project is developed, and the extent to which the project is capable of meeting them will emerge from the process of analysis.

The framing of scheme objectives has been undertaken in accordance with the guidance provided in the TII's PAG - *PAG Unit 3.0: Project Brief*. That document includes a recommendation that scheme objectives are established which fall under the criteria included in the Common Appraisal Framework, inter alia:

- Economy;
- Safety;
- Environment;
- Accessibility & Social Inclusion;
- Integration; and
- Physical Activity.

5.1 Economy

The key Economy objectives are:

- To reduce journey times and improve journey time reliability on the N63 for long distance trips between the West and North-West Regions and medium distance trips between Longford/Roscommon and Galway; and
- To assist in supporting the economic performance of the counties of Galway and Longford/Roscommon through the provision of improved transport infrastructure which will reduce the cost of travel for business and tourism and assist in reducing the overall cost of production thereby improving competitiveness.

5.2 Safety

The key Safety objectives are:

- To reduce the collision rate along the National Roads network between Abbeyknockmoy village and Derreen to below the national average rate;
- To reduce the severity of collisions along the National Roads network between Abbeyknockmoy village and Derreen;
- To improve safety for all road users including pedestrians and cyclists along both the National Roads network and on the surrounding road network between Abbeyknockmoy village and Derreen;
- To support the RSA Road Safety Strategy 2013-2020; and
- To improve the security of vulnerable road users by providing for non-motorised users.

5.3 Environment

Key environmental objectives of the scheme include:

- To avoid or minimise adverse impacts on the internationally important European Sites;
- To improve road drainage;
- To be sensitive to the visual amenity of the Abbey and surrounding areas; and
- To minimise any noise impacts on properties.

5.4 Accessibility & Social Inclusion

The principal Accessibility and Social Inclusion objectives are:

- To improve accessibility to key facilities, such as employment, education, transport, and healthcare for all road users, but in particular for vulnerable groups;
- To improve accessibility and reduce severance particularly within the community of Abbeyknockmoy village and in turn support social and economic development within the village and its hinterland; and
- To support the accessibility and social inclusion objectives of national, regional and local planning policy.

5.5 Integration

The proposed scheme is required to integrate with general policies and plans under the headings of Transport, Land Use, Geographical and Government Policy. The following objectives are outlined for integration:

- To support the integration objectives set out in European, National, Regional and Local planning policy by upgrading the N63 National Secondary between Abbeyknockmoy village and Derreen;
- To support initiatives to bring investment into the West Region; and to support transport integration within the wider region, maximising the benefits of previous investment in the N63 corridor, integrating with regional public transport facilities, and improving access to the main ports and airports.

5.6 Physical Activity

The following objectives are outlined for physical activity:

- To improve facilities and segregation between national strategic traffic and local non-motorised users' movements such as pedestrians and cyclists;
- To provide a dedicated route for amenity pedestrians and cyclists along the existing road network promoting healthy lifestyle choices, particularly in regard to children's movements to and from school; and
- To improve connectivity to the community facilities for all in the local in the area.

6 Functional & Operational outcomes

6.1 Design Standards

The project shall be delivered in accordance with the TII Project Management Guidelines 2019, NRA Project Appraisal Guidelines 2016, NRA Cost Management Manual 2010, NRA Environmental Assessment and Construction Guidelines, NRA Design Manual for Roads and Bridges and the National Cycle Manual (NCM).

6.2 Performance Targets

The following performance targets for the proposed scheme are set out below based on the current deficiencies of the network and the proposed scheme objectives:

- Improve journey times and journey time reliability along the N63 corridor; and
- Reduce the rate of collisions along the corridor to support the RSA Road Safety Strategy 2013-2020.
- To provide a dedicated route for pedestrians and cyclists along the existing road network promoting healthy lifestyle choices, particularly in regard to children’s movement to and from school; and
- To support the accessibility and social inclusion objectives of national, regional and local planning policy.

Appendix B – Traffic Modelling Report

N63 Liss to Abbey Realignment Scheme

Phase 3 – Traffic Modelling Report

Galway County Council

AECOM Project Number: 60571547
GCC Project Number: GC/16/13416

Document Reference: N63-ACM-PH03-ZZ-RP-ZZ-0002_Appendix B

7th February 2022

Quality information

Prepared by	Checked by	Verified by	Approved by
Cameron McBain Consultant	Philip Shiels Associate Director	-	Eoin Greene Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
Draft 1	14/07/2021	1st Draft Issue	Yes	Eoin Greene	Technical Director
Rev 0	07/02/2022	Final for Ph3 Close Out	Yes	Eoin Greene	Technical Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Galway County Council

Áras an Chontae,

Prospect Hill,

Galway

H91 H6KX

Prepared by:

AECOM-ROD

4th Floor

Adelphi Plaza

Georges Street Upper

Co. Dublin

Ireland

T: +353 1 238 3100

aecom.com

Prepared by:

All Rights Reserved.

This document has been prepared by AECOM Ireland Ltd and Roughan & O'Donovan Ltd ("AECOM-ROD) for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM-ROD and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM-ROD, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM-ROD.

Table of Contents

Figures

Tables

1 Introduction

1.1 Overview

This report forms the Phase 3 (Design and Environmental Evaluation) Traffic Modelling Report (TMR) for the N63 Liss to Abbey Realignment Scheme and has been undertaken in accordance with the Transport Infrastructure Ireland (TII) Project Management Guidelines (PMG) 2019 and TII Project Appraisal Guidelines (PAG) 2021[1].

The TII PAG are in compliance with the Department of Transport (DoT) Common Appraisal Framework (CAF) for Transport Projects and Programmes 2020 and Department of Public Expenditure and Reform (DPER) Public Spending Code (PSC) 2019.

1.2 Traffic Modelling Background

Traffic modelling forms one element of the appraisal process for road infrastructure projects. As part of the Phase 2 (Option Selection) appraisal process a Project Appraisal Report (PAR) was prepared in line with PAG Unit 12 – Minor Projects (€5m to €20m). Given the scale and nature of the proposed scheme the TII Simple Appraisal Tool was used to inform the appraisal process in line with the guidance set out in PAG Unit 12.

As the cost estimate of the project has increased at Phase 3 (Design and Environmental Evaluation) and is approaching the €20m appraisal threshold for Minor Projects, a full Preliminary Business Case has been developed to comply with PAG and the PSC if the costs were to exceed €20m in the future. However, the modelling approach is still proportionate to the scale of the project and the TII Simple Appraisal Tool has been used for Phase 3.

The TII Simple Appraisal Tool does not assess the impact of traffic re-routing and hence are only applicable for small networks where there is little to no change in the distribution of traffic flows resulting, as per the proposed scheme.

The traffic model used to inform the appraisal of the proposed scheme represent a base year of 2019.

The COVID-19 pandemic and the associated travel restrictions introduced by the Government to reduce the spread of the virus in Ireland have had a significant impact on travel patterns. Since March 2020, travel patterns in Ireland have not been representative of typical conditions. Currently there is no COVID sensitivity test for the TII Simple Appraisal Tool, but it is assumed that the impact on future travel will not be lower than the TII Low Growth sensitivity scenario.

1.3 Scheme Description

The N63 Liss to Abbey Realignment Scheme is a proposed road scheme in Abbeyknockmoy Co. Galway that will facilitate a number of objectives in the Galway County Development Plan (2015-2021), including the provision of higher-quality National Roads and the separation of regional/strategic and local traffic. The scheme will also meet a number of objectives of the Road Safety Authority's Road Safety Strategy. The proposed scheme will include the upgrade of approximately 2.4km of the existing road alignment.

The N63 is a National Secondary Road and a key strategic route, linking the M17 (10 km northeast of Galway) to the N5 in Longford, and it passes through Mountbellew, Roscommon Town and crosses the River Shannon at Lanesborough. It serves a wide geographic area with a dispersed population and is vital to the communities it serves as there are limited alternative routes to the N63.

The proposed scheme is located in the north east of County Galway along the N63 route, a National Secondary route, and directly to the east of the village of Abbeyknockmoy. The study area extends in a north easterly direction, from the eastern edge of Abbeyknockmoy, across the Abbert River, to the townland of Derreen and on towards the junction of the N63 with the L6234. The study area includes a National Monument to the west, the Cistercian Abbey.

The scheme generally runs from south west to north east across the Abbert River, which is part of the Lough Corrib Special Area of Conservation (SAC). The scheme location is characterised by the presence of open greenfield areas with some wooded areas in the section south of the Abbert River.

[1] PE-PAG-02033 – PAG for National Roads Unit 8.0 – Business Case

The scheme is located in close proximity to Abbeyknockmoy Abbey, a National Monument, enjoying the highest level of statutory protection under the National Monuments Acts 1930–2004. It is located to the north of Abbeyknockmoy.

The purpose of the scheme is to improve the efficiency, safety and reliability of a key link on the National Roads Network. There will be an improved link for regional/strategic traffic to the M17 motorway and reduced traffic congestion at the Liss Bridge and the community facilities. The existing N63 will be upgraded to provide facilities for both cyclists and pedestrians and will improve connectivity between the community facilities and residential properties.

Strategically, while the N63 itself does not form part of the EU Trans-European Transport (TEN-T) network, the proposed improvements will support the objectives of the TEN-T in broad terms by improving the connectivity to Junction 19 on the M17 motorway which is part of the comprehensive TEN-T road network and also part of the Atlantic Economic Corridor.

The location of the scheme can be seen in Figure 1-1 below.

Figure 1-1 Regional Location Plan

2 Data Collection

2.1 Introduction

This section of the Traffic Modelling Report describes the collection and collation of traffic data (volumes and turning movements) for the construction of the base year (2019) traffic model used to inform the appraisal process for the proposed scheme. The surveys undertaken included:

- Junction Turning Counts (JTC); and
- Automatic Traffic Counts (ATC).

The following sections describe the collation of traffic data collected in May 2019.

2.2 Traffic Surveys

2.2.1 Junction Turning Counts (JTC)

Classified JTC data gives an indication of the turning movements observed at key junctions in the network. These were commissioned at the 5 locations shown in Figure 2-1, and recorded in 15-minute intervals between 07:00 and 19:00 on Tuesday 21st May 2019.

2.2.2 Automatic Traffic Counts (ATC)

ATC data provides link count data over a longer time period, which smooths out any day-to-day variations that may not be picked up when undertaking a single day count. ATC data was collected at the 3 sites shown in Figure 2-1. Each site was active for two weeks, with the majority of sites actively collecting data between 21st May and 3rd June 2019.

Figure 2-1 JTC and ATC Locations Map

2.2.3 TII Traffic Monitoring Units

Transport Infrastructure Ireland (TII) maintains a network of traffic counters on the National Roads Network which are referred to as Traffic Monitoring Units (TMU). One such TMU (Ref. TMU N63 080.0W) is located on the N63 between Roscommon and Galway at Derreen, Co. Galway.

The location of the TMU is shown on Figure 2-1 and an extract of the collected traffic data is provided in Figure 2-2.

Figure 2-2 TII Traffic Counter data (TMU N63 080.0 W)

2.2.4 Analysis of the Traffic Survey Data

Traffic flow data is available for the TII TMU since 2014. Analysis of this data indicates that the Annual Average Daily Traffic (AADT) flow on the N63 at Derreen townland, North East of Abbeyknockmoy village, in 2019 was 3,654 vehicles per day with 3.7% Heavy Goods Vehicles (HGV). The percentage of HGV had previously increased from 3.1% in 2014 to 3.6% in 2018. Table 2-1 below summarises the AADT and % HGV at this TMU counter between 2014 and 2019.

Table 2-1 2014 - 2019 AADT & % HGV at TMU N63 080.0 W

Year	AADT	% HGV
2019	3,654	3.7%
2018	3,342	3.6%
2017	3,227	3.5%
2016	3,331	3.4%
2015	3,292	3.2%
2014	3,246	3.1%

The AADT for the last three years from the TII Traffic Counter along with existing traffic flows from automatic traffic counts are shown in Figure 2-3.

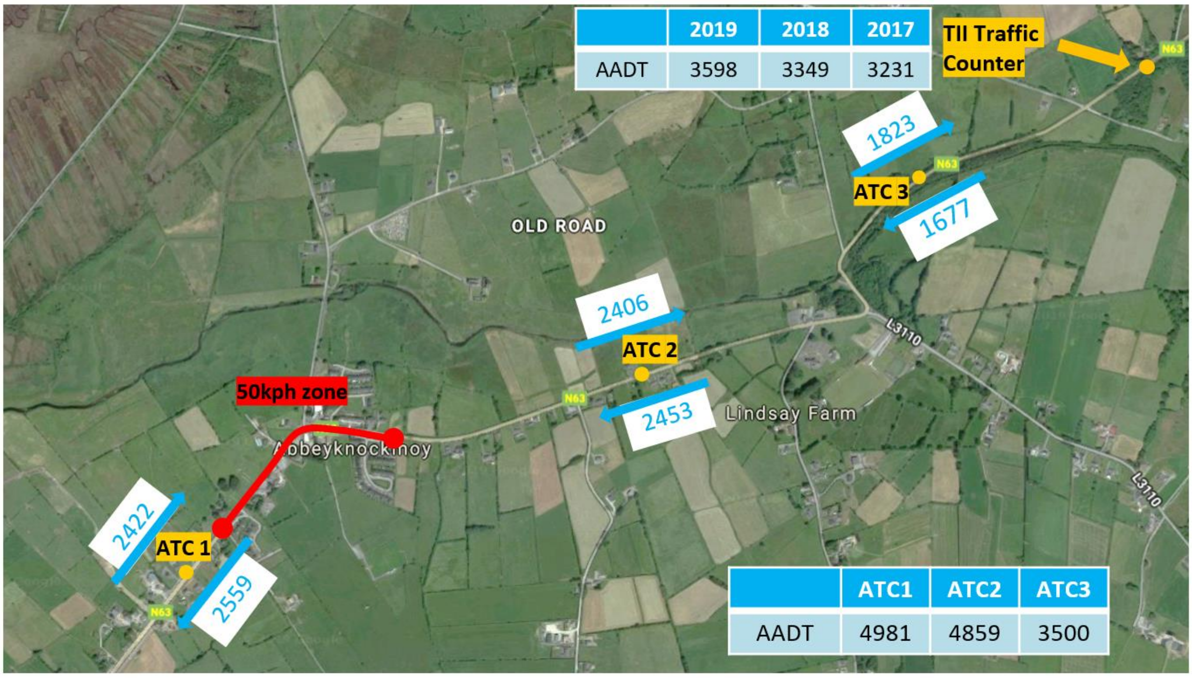


Figure 2-3 Existing Traffic Flows

2.2.5 Conclusions of the Traffic Surveys

A number of key conclusions can be drawn from the review of the traffic survey data which support the need to deliver the proposed scheme objectives. These include;

- Traffic volumes along the route have grown by 12.6% between 2014 and 2019 (based on the TII Permanent Traffic Count data).
- The existing community building and schools in close proximity to the road edge, the single lane bridge with substandard entry radii, and the significant number of road junctions and direct accesses, give rise to a safety concern when considered in conjunction with these high speeds. Figure 2-4 and Figure 2-5 demonstrate the poor horizontal alignment.
- The N63 is a key strategic link providing access to a wide geographical area and a key route between Galway and Roscommon, and has relatively high traffic volumes considering the existing sub-standard road alignment.
- There are a number of right turn movements along the route. The movement to the L3110 from the N63 has potential to generate shunt collisions, given the limited junction visibility and proximity to the community facilities and the Liss Bridge.

Figure 2-4 N63 Westbound

Figure 2-5 N63 Eastbound approaching Liss Bridge

2.3 Google Journey Times

Journey times have been collected on the N63 using Google API data (GPS data take anonymously from mobile phones) in October 2019 over a 2.28km section between just east of Abbeyknockmoy village and the junction with the L6234. The results have indicated an average journey time of 2 minutes 12 seconds, resulting in an average speed of 62kph. The section under consideration is shown in Figure 2-6.

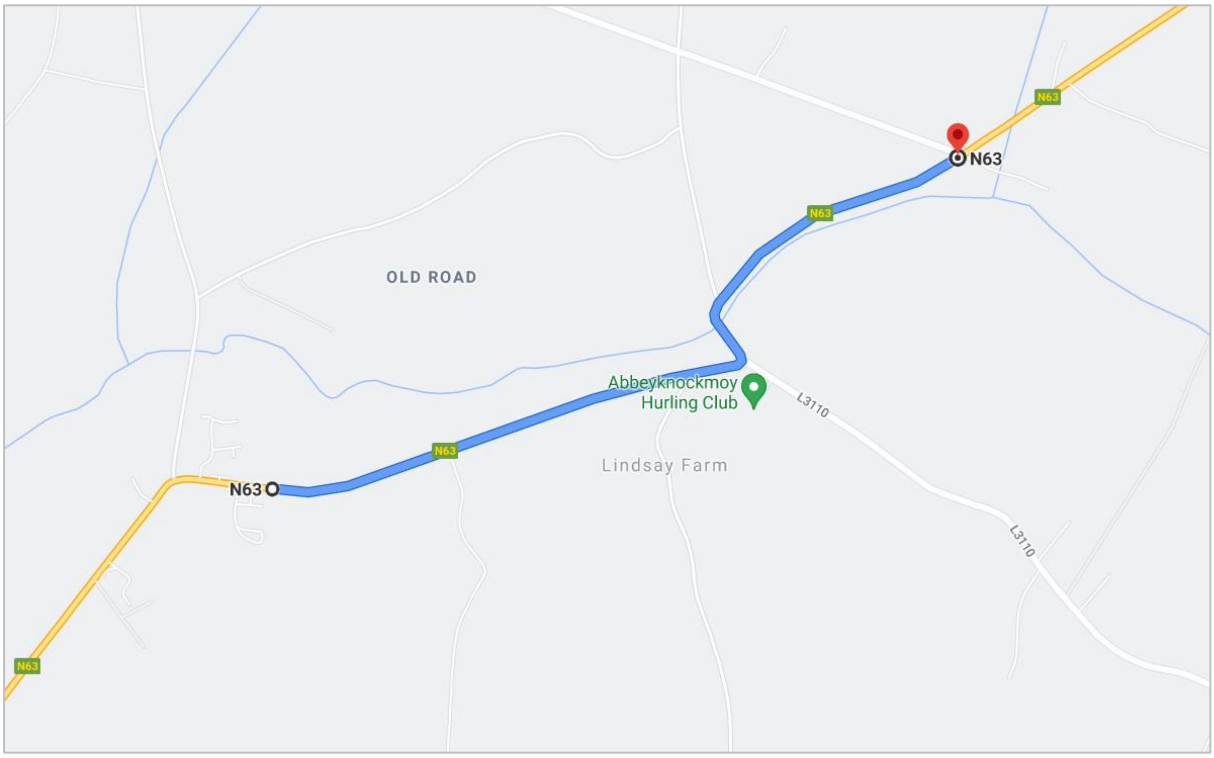


Figure 2-6 Section considered for Google Journey Time Analysis

The journey times collected from Google have little variation across the day, meaning that higher traffic volumes during the peak periods do not cause an increase in the journey times. This demonstrates that congestion is not the issue and that the issue is the sub-standard cross section and alignment of the road.

3 Model Development & Travel Demand Projections

3.1 Overview

For minor projects where significant re-routing does not take place (costing between €5m and €20m) the TII Simple Appraisal Tool can be used to inform the project appraisal process instead of building a full traffic assignment model. In order to use the TII Simple Appraisal Tool there are a number of assumptions that need to be considered as these are discussed in the following sections.

3.2 Traffic Reassignment Assumptions

The delivery of an alternative route for traffic to use will lead to the re-assignment (re-routing) of traffic away from the existing route. The level of re-assignment relates to the type of traffic using the existing route (local, regional/strategic etc.), with local traffic likely to remain on the existing route to access residential dwellings, commercial premises, schools etc. and regional/strategic traffic rerouting to the proposed scheme.

In order to calculate the number of vehicles which would use the proposed scheme (regional/strategic traffic), the number of vehicles that would remain on the existing route (local traffic) needed to be determined first. Based on the traffic survey data a simple spreadsheet model was created which calculated the percentage of local and regional/strategic traffic.

The simple model calculated that 75% of light vehicles and 76% of HGVs would be regional/strategic traffic and therefore assumed to use the proposed scheme, while the remaining 25% and 24% respectively would be local traffic and would use the existing N63 to access the village and the L3110, L7138 and L21821.

3.3 Travel Demand Projections

3.3.1 Forecast AADT

For the TII Simple Appraisal Tool, traffic flows are generally represented as vehicular traffic flows on links, with limited information on origin, destination or trip length. In such cases, future year traffic growth is projected using growth rates which describe likely traffic growth that may occur over the appraisal period of the scheme.

The derivation of link-based growth rates is based on an aggregate projection of growth in vehicle kilometres within a defined geographical area, with appropriate classifications by vehicle type and projected period. This allows the specification of a series of growth rates which can be applied directly to traffic flows on simple networks to generate an appropriate estimate of future traffic flows.

The growth rates for Galway from Table 6.2 of TII PAG Unit 5.3 - Travel Demand Projections (PE-PAG-02017 - May 2019) were applied to the base year (2019) traffic volumes. An extract from PAG Unit 5.3 can be seen in Table 3-1 below.

Table 3-1 Growth Rates (Galway) – From Table 6.2 of TII PE-PAG-02017

Area	2016-2030		2030-2040		2040-2050		2050+	
	LV	HV	LV	HV	LV	HV	LV	HV
Galway	**Central Growth**							
	1.0259	1.0446	1.0109	1.0198	1.0105	1.0236	1.0000	1.0000
	High Sensitivity Growth							
	1.0294	1.0480	1.0148	1.0236	1.0181	1.0336	1.0000	1.0000
	Low Sensitivity Growth							
	1.0243	1.0430	1.0087	1.0177	1.0088	1.0218	1.0000	1.0000

Using the link-based growth rates that have been provided for county Galway, the future AADT flow were determined, for both the proposed scheme Opening Year of 2023 and Design Year of 2038. The future AADT flow for the Do Minimum (Figure 3-1) and Do Something (Figure 3-2) can be seen below.

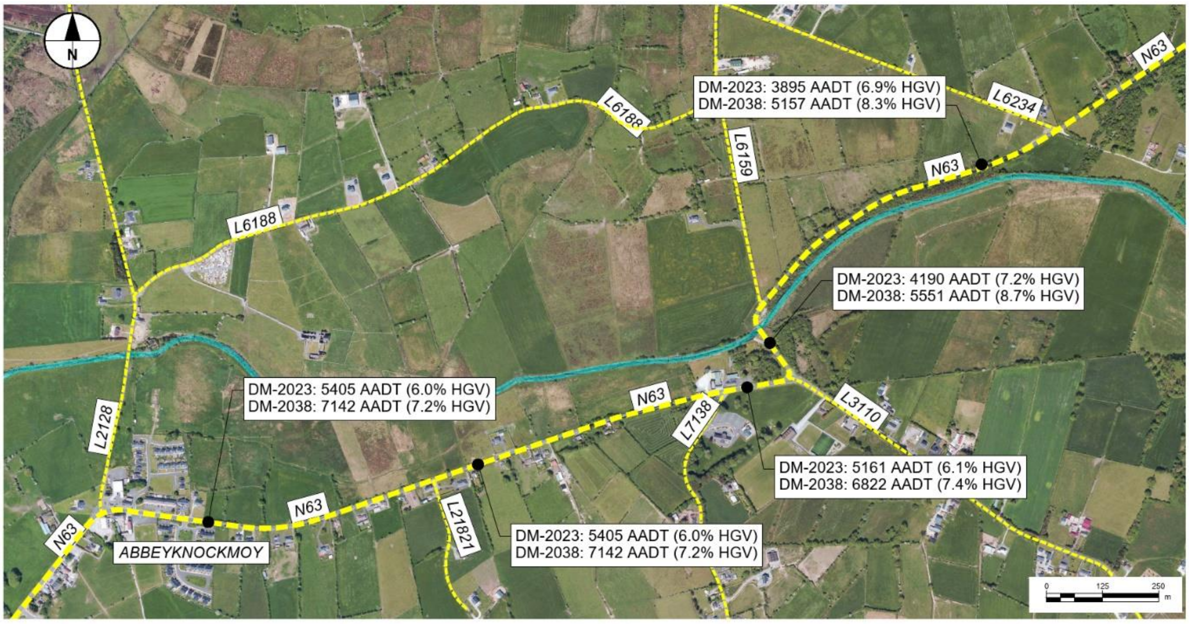


Figure 3-1 2023 and 2038 Do Minimum Central Growth AADT & HGV% Projections

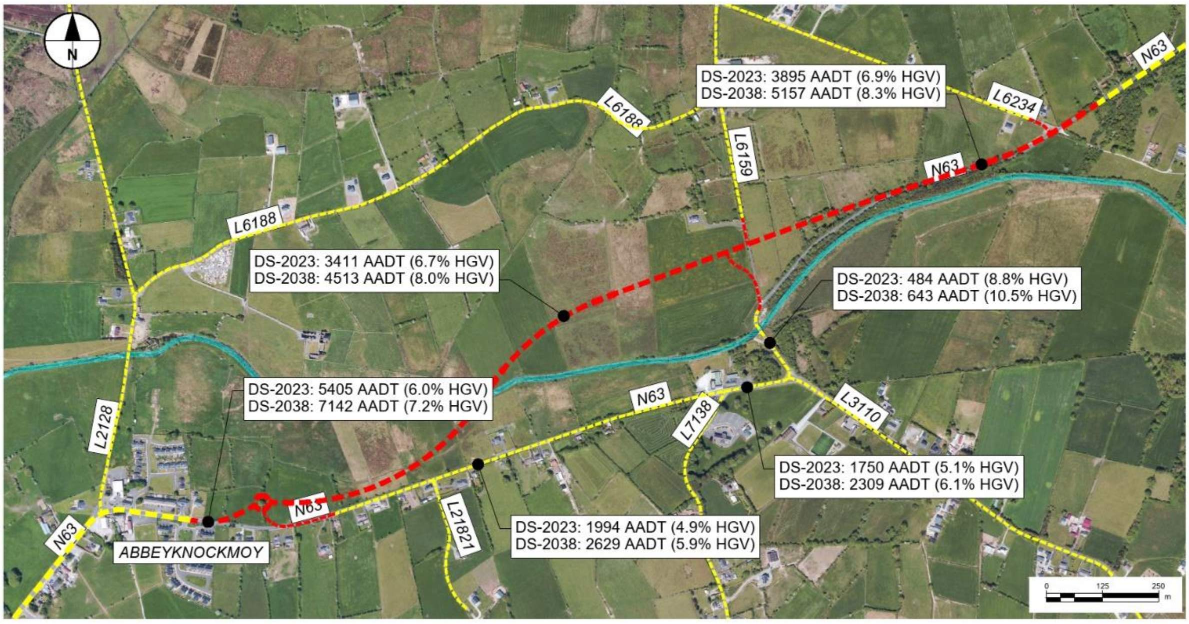


Figure 3-2 2023 and 2038 Do Something Central Growth AADT & HGV% Projections

3.3.2 Network Statistics

Network statistics were calculated from the simple traffic model for the Opening Year and Design Year and comparison was made between the Do-Minimum and Do-Something networks. The key network statistics comprise the following:

- Total Network Travel Time (hrs) for all vehicles;
- Total Network Vehicle Kilometres (vkms) for all vehicles; and
- Average Vehicle Speed (km/hr).

The network statistics outlined below in Table 3-2 and Table 3-3 for the Opening and Design Year respectively, illustrate that the proposed scheme would provide a reduction in total distance travelled, a reduction in travel time and an increase in average speed throughout the entire modelled road network.

Table 3-2 2023 Daily Network Statistics (All Vehicles)

Scenario	Total Network Vehicle Kilometres (vkm)	Total Network Travel Time (hours)	Average Vehicle Speed (kph)
2023 Do-Minimum	11,687	189	61.8
2023 Do-Something	11,169	150	74.5
Relative Difference	-4.4%	-20.6%	20.0%

Table 3-3 2038 Daily Network Statistics (All Vehicles)

Scenario	Total Network Vehicle Kilometres (vkm)	Total Network Travel Time (hours)	Average Vehicle Speed (kph)
2038 Do-Minimum	15,456	249	61.8
2038 Do-Something	14,769	198	74.5
Relative Difference	-4.4%	-20.6%	20.0%

3.4 Potential Scheme Benefits

There are numerous potential benefits of the scheme in terms of traffic. As mentioned earlier, 75% of light vehicles and 76% of HGVs are estimated to use the new road compared to the Do Minimum meaning reduced traffic along the existing road, providing benefits in terms of improved safety, air quality, noise and social benefits.

The network statistics demonstrate that total vehicle kilometres will reduce by over 4% and total travel time will also reduce by over 20%, with the average vehicle speed also increasing by 20%. The end to end average speed will be 92 kph, which comprises of a short section with a 50 kph speed limit and the remainder a 100 kph speed limit, where vehicles are assumed to travel at an average speed of 96 kph. This 96 kph value was obtained from the RSA Free Speed Study in 2018 for National Secondary Roads.[2]

[2] https://www.rsa.ie/Documents/Road%20Safety/Speed/RRD_Res_20190204_FreeSpeedSurvey2018FINAL.pdf

Appendix C – Cost Benefit Analysis Report

N63 Liss to Abbey Realignment Scheme

Phase 3 – Cost Benefit Analysis

Galway County Council

AECOM Project Number: 60571547
GCC Project Number: GC/16/13416

Document Reference: N63-ACM-PH03-ZZ-RP-ZZ-0002_Appendix C

10th February 2022

Quality information

Prepared by	Checked by	Verified by	Approved by
Cameron McBain Consultant	Philip Shiels Associate Director	-	Eoin Greene Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
Draft 1	14/07/2021	1st Draft Issue	Yes	Eoin Greene	Technical Director
Draft 2	10/12/2021	2nd Draft Issue	Yes	Eoin Greene	Technical Director
Rev 0	10/02/2022	Final for Ph3 Close Out	Yes	Eoin Greene	Technical Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Galway County Council

Áras an Chontae,

Prospect Hill,

Galway

H91 H6KX

Prepared by:

AECOM-ROD

4th Floor

Adelphi Plaza

Georges Street Upper

Co. Dublin

Ireland

T: +353 1 238 3100

aecom.com

Prepared by:

All Rights Reserved.

This document has been prepared by AECOM Ireland Ltd and Roughan & O'Donovan Ltd ("AECOM-ROD) for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM-ROD and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM-ROD, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM-ROD.

Table of Contents

Figures

Tables

1 Introduction

1.1 Overview

This report forms the Phase 3 (Design and Environmental Evaluation) Cost Benefit Analysis (CBA) for the N63 Liss to Abbey Realignment Scheme and has been undertaken in accordance with the Transport Infrastructure Ireland (TII) Project Management Guidelines (PMG) 2019 and TII Project Appraisal Guidelines (PAG) 2021.

The TII PAG are in compliance with the Department of Transport (DoT) Common Appraisal Framework (CAF) for Transport Projects and Programmes 2020 and Department of Public Expenditure and Reform (DPER) Public Spending Code (PSC) 2019.

1.2 Cost Benefit Analysis

Cost Benefit Analysis (CBA) forms one element of the appraisal process for road infrastructure projects. The benefits and costs of the proposed road development are assessed using agreed traffic growth scenarios and sensitivity assessments. The CBA process compares the “Do-Minimum” scenario (i.e. not to progress with the scheme) with the “Do-Something” scenario (i.e. to progress with the scheme) and determines whether benefits resulting from the provision of the road development will outweigh the costs of construction and future maintenance.

1.3 Appraisal Update

At Phase 2 (Option Selection) a Project Appraisal Report (PAR) was prepared in line with PAG Unit 12 – Minor Projects (€5m to €20m). Given the scale and nature of the proposed scheme the TII Simple Appraisal Tool was used to conduct the CBA as per the PAG guidance.

As the cost estimate of the project has increased since Phase 2 and is approaching the €20m appraisal threshold for Minor Projects, a full Preliminary Business Case has been developed for Phase 3 to comply with PAG and the PSC (if the costs were to exceed €20m in the future). However, the CBA approach is still proportionate to the scale of the project and the TII Simple Appraisal Tool has been used for Phase 3.

1.4 Scheme Description

The N63 Liss to Abbey Realignment Scheme is a proposed road scheme in Abbeyknockmoy Co. Galway that will facilitate a number of objectives in the Galway County Development Plan (2015-2021), including the provision of higher-quality national roads and the separation of regional and local traffic. The scheme will also meet a number of objectives of the Road Safety Authority’s Road Safety Strategy. The proposed scheme will include the upgrade of approximately 2.4km of the existing road alignment.

The N63 is a National Secondary Road and a key strategic route, linking the M17 (10 km northeast of Galway) to the N5 in Longford, and it passes through Mountbellew, Roscommon and crosses the River Shannon at Lanesborough. It serves a wide geographic area with a dispersed population and is vital to the communities it serves.

The proposed scheme is located in the north east of County Galway along the N63 Route, a National Secondary route, and directly to the east of the village of Abbeyknockmoy. The study area extends in a north easterly direction, from the eastern edge of Abbeyknockmoy, across the Abbert River, to the townland of Derreen and on towards the junction of the N63 with the L6234. The study area includes a National Monument to the west, the Cistercian Abbey.

The scheme generally runs from south west to north east across the Abbert River, which is part of the Lough Corrib Special Area of Conservation (SAC). The scheme location is characterised by the presence of open greenfield area with some wooded areas in the section south of the Abbert River.

The scheme is located in close proximity to Abbeyknockmoy Abbey, a National Monument, enjoying the highest level of statutory protection under the National Monuments Acts 1930–2004. It is located to the north of Abbeyknockmoy.

The purpose of the scheme is to provide an improved link for regional traffic to the M17 motorway and reduce traffic congestion at the Liss Bridge and the community facilities. The existing N63 will be upgraded to provide facilities for both cyclists and pedestrians and will improve connectivity between the community facilities and residential properties.

Strategically, while the N63 itself does not form part of the TEN-T Network, the proposed improvements will support the objectives of the TEN-T in broad terms by improving the connectivity to Junction 19 on the M17 TEN-T network.

The location of the scheme can be seen in Figure 1-1 below.

Figure 1-1 Regional Location Plan

2 Software Specification

This Phase 3 (Design and Environmental Evaluation) CBA assessment was undertaken using the TII Simple Appraisal Tool. The Simple Appraisal Tool calculates the change in journey time and vehicle operating cost as a result of the online and/or offline improvement and calculates the expected monetary benefits. Scheme benefits are compared against scheme costs to generate a Net Present Value (NPV) and Benefit to Cost Ratio (BCR) for the proposed scheme.

The automated spreadsheet specifies a number of questions to quantify the impact of the proposed upgrade in terms of economy and is made up of four sections as follows:

- **Part A (Overview)**: This section requests some general background on the project being assessed such as a brief project description and project management information;
- **Part B (Scheme Information)**: This section deals with the specific scheme information for inclusion as part of the economic appraisal;
- **Part C (Target Performance)**: In this section the analyst inputs either/both the average (daily) journey time (minutes) and average speed (kilometres/hour) for both the existing conditions and target projections from the implementation of the scheme; and
- **Part D (Projected Benefits)**: This section generates the outputs of the spreadsheet tool including the NPV and BCR of the proposed minor project.

3 Transport Modelling

3.1 Overview

For minor projects where significant re-routing does not take place (costing between €5m and €20m) the TII Simple Appraisal Tool can be used to inform the project appraisal process instead of building a full traffic assignment model. In order to use the TII Simple Appraisal Tool there are a number of assumptions that need to be considered as these are discussed in the following sections.

The delivery of an alternative route for traffic to use will lead to the re-assignment (re-routing) of traffic away from the existing route. The level of re-assignment relates to the type of traffic using the existing route (local, regional/strategic etc.), with local traffic likely to remain on the existing route to access residential dwellings, commercial premises, schools etc. and regional/strategic traffic rerouting to the proposed scheme.

In order to calculate the number of vehicles which would use the proposed scheme (regional/strategic traffic), the number of vehicles that would remain on the existing route (local traffic) needed to be determined first. Based on the traffic survey data a simple spreadsheet model was created which calculated the percentage of local and regional/strategic traffic.

The simple model calculated that 75% of light vehicles and 76% of HGVs would be regional/strategic traffic and therefore assumed to use the proposed scheme, while the remaining 25% and 24% respectively would be local traffic and would use the existing N63 to access the village and the L3110, L7138 and L21821.

4 Data Collection

The TII Simple Appraisal Tool uses traffic data extracted directly from the simple traffic model of the proposed scheme to calculate user benefits. Therefore, no additional data was required, and reference should be made to the Phase 3 Traffic Modelling Report (TMR) for details of data collected as part of the development of the traffic model.

5 CBA Input Assumptions

5.1 Simple Appraisal Tool Parameters

All general parameters such as value of time, value of time growth rates, discount rates, fuel cost changes, fuel consumption, vehicle operating costs fuel/non-fuel, trip purpose distribution, tax rates, change in tax rates, vehicle occupancy rates and vehicle proportions were taken from the TII *PAG Unit 6.11 - National Parameters Value Sheet*.

The CBA assessment assumes a Discount Rate of 4% (years 1-30) and 3.5% (years 31-60), with all costs and benefits discounted back to a common base year of 2011.

5.2 Scheme Information

The following information was used for the Scheme Information section of the Simple Appraisal Tool:

- County – Galway;
- Existing Route Length – 2.34 km;
- New Route Length – 2.17 km;
- Scheme Opening Year – 2023;
- Existing Route Standard – 2 Lane Single Carriageway;
- New Route Standard – 2 Lane Single Carriageway;
- Appraisal Period – 30 years;
- Residual Period – 30 years;
- Observed AADT – 3,065;
- HGV% – 6.2%; and
- Year of Observed AADT – 2019.

5.3 Scheme Costs

The Total Scheme Budget was determined in accordance with the TII Cost Management Manual under the following seven expenditure headings.

- Main Contract Construction;
- Main Contract Supervision;
- Archaeology;
- Advance Works & Other Contracts;
- Residual Network;
- Land & Property; and
- Planning & Design.

The Total Scheme Budget is prepared based on the Target Cost plus a TII Programme Risk and Total Inflation contingency. The Total Scheme Budget (inclusive of VAT) is outlined in Table 5-1.

Table 5-1 Total Scheme Budget (2021 Prices inclusive of VAT)

Cost Expenditure Heading	Base Cost	Risk Allocation to Cost	Un-Inflated Cost
Main Construction Contract	€12.58m	€1.04m	€13.61m
Main Contract Supervision	€0.41m	€0.08m	€0.49m
Archaeology	€0.33m	€0.05m	€0.38m
Advance Works & Other Contracts	€0.19m	€0.06m	€0.25m
Public Transport Connectivity/Asset Renewal	€0.98m	€0.06m	€1.04m
Land & Property	€2.54m	€0.21m	€2.76m
Planning & Design	€0.68m	€0.16m	€0.84m
Sub-Total	**€17.70m**	**€1.66m**	**€19.36m**
Total Inflation Allowance			**€1.22m**
TII Programme Risk			**€0.97m**
Total Scheme Budget			**€21.46m**

5.4 Target Performance

An existing average speed of 62 kph and a forecast average speed of 92 kph were used for the Target Performance section of the Simple Appraisal Tool. The existing average speed was calculated from data obtained from Google API data (GPS data taken anonymously from mobile phones), and the forecast average speed was obtained from a speed survey conducted by the Road Safety Authority in 2018.

The end to end average speed will be 92 kph, which comprises of a short section with a 50 kph speed limit and the remainder a 100 kph speed limit, where vehicles are assumed to travel at an average speed of 96 kph. This 96 kph value was obtained from the RSA Free Speed Study in 2018 for National Secondary Roads.[1]

[1] https://www.rsa.ie/Documents/Road%20Safety/Speed/RRD_Res_20190204_FreeSpeedSurvey2018FINAL.pdf

6 Safety CBA Results

6.1 Overview

The TII Simple Appraisal Tool does not calculate safety benefits. Therefore, an assessment of the potential safety benefits of the scheme has been undertaken using the TII software programme COBALT.

6.2 COBALT-Ireland

COBALT (COst and Benefit to Accidents – Light Touch) is a computer program developed by the UK Department for Transport (DfT) to undertake the analysis of the impact on collisions as part of the economic appraisal for a road scheme.

An Irish specific version of the COBALT program was developed by TII for use on road schemes in the Republic of Ireland and is referred to as COBALT – Ireland. COBALT assesses the safety aspects of road schemes using detailed inputs of links that may be impacted by the scheme.

The assessment is based on a comparison of collisions by severity and associated costs across an identified network in 'Without-Scheme' and 'With-Scheme' forecasts, using details of link characteristics, relevant collision rates and costs and projected traffic volumes. All parameters used in COBALT are taken from TII PAG Unit 6.11 – National Parameter Values Sheet. The COBALT economic input file and summary output file are provided in Appendix A and Appendix B respectively.

6.3 Use of Local Collision Rates

As part of a Phase 3 CBA, PAG stipulates that local collision rates can be calculated and input in to the COBALT model to refine the assessment of the potential safety benefits delivered by the proposed road development. Local collision rates along the N63 were therefore calculated using historic AADT data and collision data from the Road Safety Authority (RSA) Personal Injury Accident (PIA) database between 2005 and 2016. Figure 6-1 shows the location of all PIA along the relevant section of the N63 during this twelve-year period.

Figure 6-1 RSA Collision Map (2005-2016)

The calculation of a local collision rate is based on the number of observed collisions per million vehicle kilometres (mvkm) travelled. TII PAG Unit 6.11 – National Parameter Values Sheet provides national average collision rates for several road types and speeds (i.e. <60 km/h or >60 km/h), but as the local collision rate was higher than that from PAG Unit 6.11 (0.080 PIC/mvkm) the local collision rate was used for the existing N63 in the COBALT analysis.

A collision rate of 0.491 PIC/mvkm was used for the section of the existing N63 between the eastern end of Abbeyknockmoy and the L7138, and a rate of 2.003 PIC/mvkm was used between the L3110 and L6159 (at Liss Bridge). All other sections had a local collision rate of 0 PIC mvkm.

6.4 Results

The reduction in the total number of collisions and casualties by severity (Fatal, Serious and Minor) as a result of the proposed road development is presented in Table 6-1. The monetised benefits are presented in Table 6-2. All results presented in Table 6-1 and Table 6-2 are based on the TII Central traffic growth projections and are based on the standard 30-year appraisal period.

Table 6-1 Collision/Casualty Reduction (30 Year Appraisal Period – Central Traffic Growth)

Collision Reduction	Casualty Reduction		
	Fatal	Serious	Minor
15	1	2	24

Table 6-2 Discounted Safety Benefits (30 Year Appraisal Period – Central Traffic Growth)

Safety Benefits
€1.70m

7 Economic Appraisal

7.1 CBA Results Summary

The Benefit to Cost Ratio (BCR) is a function of the monetised benefits, Present Value of Benefits (PVB) versus the Present Value of Costs (PVC). In accordance with the DoT guidelines, a discount rate of 4% for the design life of the scheme (30 years), and falling to 3.5% after that, has been applied to the benefits. A shadow pricing for labour factor of 1.0, with a factor of 1.3 for public funds has been applied to the costs.

Table 7-1 below highlights the PVB and PVC and the associated BCR for the proposed scheme.

Table 7-1 CBA Summary (Central Growth)

CBA Breakdown	Total Scheme Budget	Target Cost
Journey Time Impacts	€8.24m	€8.24m
Vehicle Operating Costs Impacts	€0.67m	€0.67m
Safety Impacts	€1.70m	€1.70m
Active Travel Impacts	€0.89m	€0.89m
Residual Impacts	€6.63m	€6.63m
Present Value Benefits (PVB)	**€18.13m**	**€18.13m**
Present Value Costs (PVC)	**€16.00m**	**€15.24m**
Net Present Value (NPV)	**€2.13m**	**€2.89m**
Benefit to Cost Ratio (BCR)	**1.13**	**1.19**

7.2 Sensitivity CBA Results Summary

Sensitivity assessments were carried out using the TII Low and High traffic growth scenarios. The results of the Low and High sensitivity assessments are provided in Table 7-2 and Table 7-3 respectively.

The sensitivity assessment of alternative traffic growth scenarios indicates that the approved road development would have a BCR value in the range of 1.09 – 1.31, indicating that the road development provides a positive economic return under all of the traffic demand/cost scenarios.

Table 7-2 CBA Summary (Low Sensitivity)

CBA Breakdown	Total Scheme Budget	Target Cost
Journey Time Impacts	€7.98m	€7.98m
Vehicle Operating Costs Impacts	€0.65m	€0.65m
Safety Impacts	€1.65 m	€1.65 m
Active Travel Impacts	€0.89m	€0.89m
Residual Impacts	€6.27m	€6.27m
Present Value Benefits (PVB)	**€17.44 m**	**€17.44 m**
Present Value Costs (PVC)	**€16.00m**	**€15.24m**
Net Present Value (NPV)	**€1.44m**	**€2.20m**
Benefit to Cost Ratio (BCR)	**1.09**	**1.14**

Table 7-3 CBA Summary (High Sensitivity)

CBA Breakdown	Total Scheme Budget	Target Cost
Journey Time Impacts	€8.88m	€8.88m
Vehicle Operating Costs Impacts	€0.72m	€0.72m
Safety Impacts	€1.82 m	€1.82 m
Active Travel Impacts	€0.89m	€0.89m
Residual Impacts	€7.72m	€7.72m
Present Value Benefits (PVB)	**€20.03 m**	**€20.03 m**
Present Value Costs (PVC)	**€16.00m**	**€15.24m**
Net Present Value (NPV)	**€4.03m**	**€4.79m**
Benefit to Cost Ratio (BCR)	**1.25**	**1.31**

8 Financial Appraisal

8.1 Overview

The proposed road development was subjected to Financial Appraisal in accordance with the TII PAG and DoT Common Appraisal Framework. This appraisal includes:

- Financial Analysis; and
- Sources of Funding Analysis.

The purpose of this analysis is to determine the impact of project approval on monetary flows both from the perspective of the managing authority and the exchequer.

8.2 Financial Appraisal

The purpose of Financial Analysis is to understand how the implementation of the approved scheme impacts monetary flows. Financial Appraisal is carried out using net present value cash flows. The process itself is highly similar to that undertaken for economic appraisal. The primary difference between both approaches is that Financial Appraisal only considers monetary flows and does not consider economic costs and benefits. As such shadow costs are not applied.

Financial flows are measured net of VAT, this is carried out recognising that the fact that the VAT element returns to the exchequer in the short-term and can therefore be recycled. Table 8-1 illustrates the outcomes of the financial analysis. This table displays the cost of each variable exclusive of VAT, the VAT element removed (also in 2011 prices) and the discount value of the costs excluding VAT.

From this table we can see that the Financial Net Present Value (FNPV), the sum of discounted[2] cash flows excluding VAT for the approved road development is €14.38m. This road development therefore constitutes a loss for the exchequer, not unusual for government programmes typically justified on economic grounds. The Financial Rate of Return (FRR) is incalculable in this case as a positive cash flow is not observed in any time period due to the absence of inflows.

8.3 Sources of Funding Analysis

A Sources of Funding analysis has not been produced as all funding is expected to be received from the exchequer.

[2] *Discount Rate of 4.0% used in line with Economic Appraisal*

Table 8-1 Financial Analysis Summary

	N63 Liss to Abbey BC: Phase 3 Financial Appraisal											
	Parameters			Variables (Inflows and Outflows) incl. VAT							Outputs	
	Discount Coefficient	Period	Year	Main Construction Contract	Main Contract Supervision	Archaeology	Advance Works & Other Contracts	Residual Network	Land and Property	Planning and Design	Nominal Value	Financial Net Present Value
Construction Phase	98%	1	2019	€ -	€ -	€ -	€ -	€ -	€ -	€ 0.15	-€ 0.15	-€ 0.14
	97%	2	2020	€ -	€ -	€ 0.00	€ -	€ -	€ -	€ 0.16	-€ 0.16	-€ 0.15
	95%	3	2021	€ -	€ -	€ -	€ -	€ -	€ -	€ 0.15	-€ 0.15	-€ 0.14
	93%	4	2022	€ -	€ 0.02	€ -	€ 0.09	€ 0.10	€ 1.28	€ 0.16	-€ 1.65	-€ 1.54
	92%	5	2023	€ 5.05	€ 0.34	€ 0.28	€ 0.14	€ 0.68	€ 1.28	€ 0.16	-€ 7.92	-€ 7.26
	90%	6	2024	€ 7.57	€ 0.09	€ 0.07	€ -	€ 0.19	€ -	€ -	-€ 7.92	-€ 7.14
Outputs and Sensitivity	**Total**			**€ 12.62**	**€ 0.45**	**€ 0.35**	**€ 0.23**	**€ 0.96**	**€ 2.56**	**€ 0.78**	**-€ 17.95**	**-€ 16.38**
	10%			**€ 1.15**	**€ 0.04**	**€ 0.03**	**€ 0.02**	**€ 0.09**	**€ 0.24**	**€ 0.07**	**-€ 1.79**	**-€ 1.64**
	Sensitivity +10%			**-€ 17.53**	**-€ 16.42**	**-€ 16.41**	**-€ 16.40**	**-€ 16.47**	**-€ 16.62**	**-€ 16.45**		
	Sensitivity -10%			**-€ 15.24**	**-€ 16.34**	**-€ 16.35**	**-€ 16.36**	**-€ 16.29**	**-€ 16.14**	**-€ 16.31**		
Notes	**Note 1:** Outputs in €m **Note 2**: Maintenance cost of proposed scheme offset by the reduction in maintenance costs on the existing N63 **Note 3:** Costs used are exclusive of risk allocations **Note 4:** Discount Rate of 1.75% used in line with National Development Finance Agency (Q1 2022)											

Appendix A – COBALT Economic File

COBALT Parameter File
Version 2015.01

Cost Base Year
2011

Appraisal Period
30

Discount Rate

Years from Current Year	Discount Rate (%)
30	4
60	3.5

Cost per Casualty (€)

Severity	Cost
Fatal	2,310,500
Serious	331,400
Slight	31,100

Cost per Collision (€)

Severity		Insurance		Damage to Property			
	Administration		Urban	Rural	Motorway		
Fatal		375		13,952	13,952	13,952	
Serious		233		6,225	6,225	6,225	
Slight		142		3,713	3,713	3,713	
Damage			67		2,346	2,346	2,346
			Gardai Cost				
			Urban	Rural	Motorway		
Fatal				21,521	21,521	21,521	
Serious				2,519	2,519	2,519	
Slight				653	653	653	
Damage					42	42	42

Compound Annual Rates of Growth of Collision Values

Range of Years	Rate of Growth (%p.a.)
2011-2015	1.040
2015-2020	1.036
2020-2025	1.022
2025+	1.023

Number of Damage Only Collisions per PIA

			Urban	Rural	Motorway		
Damage					0.0	0.0	0.0

Link and Junction Combined Collision Proportions
Base Year
2011

Road Type	Speed Limit (km/h)	Collision Proportions Fatal	Serious	Slight	Road Description
1	>60	0.013	0.027	0.960	Motorway
2	>60	0.023	0.053	0.925	2 Lane Single Carriageway over 60 km/h
3	50/60	0.005	0.032	0.963	2 Lane Single Carriageway up to 60 km/h
4	>60	0.012	0.026	0.962	Dual Carriageway over 60 km/h
5	50/60	0.008	0.028	0.963	Dual Carriageway up to 60 km/h

6	>60	0.023	0.053	0.925	2+1 without Central Reserve Barrier over 60 km/h
7	50/60	0.005	0.032	0.963	2+1 without Central Reserve Barrier up to 60 km/h
8	>60	0.012	0.026	0.962	2+1 with Central Reserve Barrier over 60 km/h
9	50/60	0.008	0.028	0.963	2+1 with Central Reserve Barrier up to 60 km/h
10	30-60	0.005	0.032	0.963	1 Way up to 60 km/h
11	50/60	0.000	0.000	0.000	Vacant 1
12	50/60	0.000	0.000	0.000	Vacant 2
13	50/60	0.000	0.000	0.000	Vacant 3
14	50/60	0.000	0.000	0.000	Vacant 4
15	50/60	0.000	0.000	0.000	Vacant 5

Link and Junction Combined Collision Rates and Change Factors
Base Year
2011

Road Type	Speed Limit (km/h)	Collision Rate	Beta Factor	Road Description
1	>60	0.057	0.956	Motorway
2	>60	0.219	0.955	2 Lane Single Carriageway over 60 km/h
3	50/60	0.613	0.959	2 Lane Single Carriageway up to 60 km/h
4	>60	0.094	0.956	Dual Carriageway over 60 km/h
5	50/60	0.402	0.967	Dual Carriageway up to 60 km/h
6	>60	0.219	0.955	2+1 without Central Reserve Barrier over 60 km/h
7	50/60	0.613	0.959	2+1 without Central Reserve Barrier up to 60 km/h
8	>60	0.094	0.955	2+1 with Central Reserve Barrier over 60 km/h
9	50/60	0.402	0.959	2+1 with Central Reserve Barrier up to 60 km/h
10	30-60	0.449	0.959	1 Way up to 60 km/h
11	50/60	0	0	Vacant 1
12	50/60	0	0	Vacant 2
13	50/60	0	0	Vacant 3
14	50/60	0	0	Vacant 4
15	50/60	0	0	Vacant 5

Link Only and Link and Junction Combined Collision Beta Factor Changes over Time

Range of Years	Change to Beta Factor
2011-2016	1
2017-2026	0.5
2027-2036	0.25
2037+	0

Link and Junction Combined Casualty Rates
Base Year
2011

Road Type	Speed Limit (km/h)	Casualties per P.I.A. Fatal	Serious	Slight	Road Description
1	>60	0.025	0.033	1.393	
2	>60	0.050	0.106	1.451	
3	50/60	0.007	0.051	1.325	
4	>60	0.018	0.043	1.342	
5	50/60	0.008	0.045	1.233	
6	>60	0.050	0.106	1.451	
7	50/60	0.007	0.051	1.325	
8	>60	0.018	0.043	1.342	
9	50/60	0.008	0.045	1.233	
10	30-60	0.007	0.051	1.325	
11	50/60	0	0	0	Vacant 1
12	50/60	0	0	0	Vacant 2
13	50/60	0	0	0	Vacant 3
14	50/60	0	0	0	Vacant 4
15	50/60	0	0	0	Vacant 5

Link and Junction Combined Casualty Change Factors
Base Year
2011

Road Type	Speed Limit (km/h)	Beta Factor Fatal	Serious	Slight	Road Description
1	>60	0.978	0.979	1.002	Motorway
2	>60	0.979	0.983	1.002	2 Lane Single Carriageway over 60 km/h
3	50/60	0.971	0.995	1.001	2 Lane Single Carriageway up to 60 km/h
4	>60	0.984	0.985	0.998	Dual Carriageway over 60 km/h
5	50/60	0.998	0.990	1.002	Dual Carriageway up to 60 km/h
6	>60	0.979	0.983	1.002	2+1 without Central Reserve Barrier over 60 km/h
7	50/60	0.971	0.995	1.001	2+1 without Central Reserve Barrier up to 60 km/h
8	>60	0.979	0.983	1.002	2+1 with Central Reserve Barrier over 60 km/h
9	50/60	0.971	0.995	1.001	2+1 with Central Reserve Barrier up to 60 km/h
10	30-60	0.971	0.995	1.001	1 Way up to 60 km/h
11	50/60	0	0	0	Vacant 1
12	50/60	0	0	0	Vacant 2
13	50/60	0	0	0	Vacant 3
14	50/60	0	0	0	Vacant 4
15	50/60	0	0	0	Vacant 5

Link Only and Link and Junction Combined Casualty Beta Factor Changes over Time

Range of Years	Change to Beta Factor
2011-2016	1
2017-2026	0.5
2027-2036	0.25
2037+	0

Appendix B – COBALT Summary Output File

15/04/2021 13:18:12

```
****************************************************************************
*                                                                          *
*       CCC     OOO    BBBB     AAA          L       TTTTT                *
*      C   C   O   O   B   B   A   A         L         T                  *
*      C       O   O   B   B   A   A         L         T                  *
*      C       O   O   BBBB    AAAAA   ----  L         T                  *
*      C       O   O   B   B   A   A         L         T                  *
*      C   C   O   O   B   B   A   A         L         T                  *
*       CCC     OOO    BBBB    A   A         LLLLL     T                  *
*                                                                          *
*                                                                          *
*      IIIII   RRRR    EEEEE   L        AAA    N   N   DDDD               *
*        I     R   R   E       L       A   A   N   N   D   D              *
*        I     R   R   E       L       A   A   NN  N   D   D              *
*        I     RRRR    EEEEE   L       AAAAA   N N N   D   D              *
*        I     R R     E       L       A   A   N  NN   D   D              *
*        I     R  R    E       L       A   A   N   N   D   D              *
*      IIIII   R   R   EEEEE   LLLLL   A   A   N   N   DDDD               *
*                                                                          *
****************************************************************************
*                                                                          *
*                        Version TII 2015.01                               *
*                                                                          *
*                     Strategic Planning Unit,                             *
*                Transport Infrastructure Ireland,                         *
*                    Parkgate Business Centre,                             *
*                        Parkgate Street,                                  *
*                           Dublin 8,                                      *
*                            Ireland                                       *
*                                                                          *
*                                                                          *
****************************************************************************
```

Originally developed by © UK Department for Transport, 2013
Written by Roger Himlin
Ireland version 2015

Contents

[Section 1] Summary Statistics

[Section 1.1] Economic Summary

Total Without-Scheme Collision Costs = 3,213.2
Total With-Scheme Collision Costs = 1,517.8

Total Collision Benefits Saved by Scheme = 1,695.4

Year	W/o-scheme	With-Scheme
2023	151.9	71.1
2024	146.3	68.6
2025	140.8	66.1
2026	135.5	63.7
2027	132.3	62.3
2028	129.2	60.8
2029	126.0	59.4
2030	122.9	58.0
2031	119.9	56.6
2032	116.8	55.2
2033	113.9	53.8
2034	110.9	52.5
2035	108.0	51.1
2036	105.1	49.8
2037	103.9	49.2
2038	102.5	48.6
2039	100.6	47.7
2040	98.7	46.7
2041	96.8	45.8
2042	94.9	45.0
2043	93.1	44.1
2044	91.3	43.2
2045	89.5	42.4
2046	87.7	41.6
2047	86.0	40.7
2048	84.3	39.9
2049	83.0	39.3
2050	81.7	38.7
2051	80.5	38.1
2052	79.3	37.5

Costs and benefits discounted to 2011 in multiples of a thousand euros.

[Section 1.2] Collision Summary

Total Without-Scheme Collisions = 40.0
Total With-Scheme Collisions = 24.6

Total Collisions Saved by Scheme = 15.4

Year	W/o-scheme	With-Scheme
2023	1.2	0.7
2024	1.2	0.7
2025	1.2	0.7
2026	1.2	0.7
2027	1.2	0.7
2028	1.2	0.8
2029	1.2	0.8

2030	1.2	0.8
2031	1.2	0.8
2032	1.3	0.8
2033	1.3	0.8
2034	1.3	0.8
2035	1.3	0.8
2036	1.3	0.8
2037	1.3	0.8
2038	1.3	0.8
2039	1.3	0.8
2040	1.4	0.8
2041	1.4	0.8
2042	1.4	0.9
2043	1.4	0.9
2044	1.4	0.9
2045	1.4	0.9
2046	1.4	0.9
2047	1.5	0.9
2048	1.5	0.9
2049	1.5	0.9
2050	1.5	0.9
2051	1.5	0.9
2052	1.5	0.9

This analysis includes 1 warning(s).
These results should be considered carefully before using.

[Section 1.3] Casualty Summary

Total Without-Scheme Casualties (Fatal) = 1.6
(Serious) = 3.5
(Slight) = 59.5
Total With-Scheme Casualties (Fatal) = 0.6
(Serious) = 1.7
(Slight) = 35.1

Total Casualties Saved by Scheme (Fatal) = 0.9
(Serious) = 1.7
(Slight) = 24.3

Year	-----Without-Scheme-----			------With-Scheme-------		
Year	Fatal	Serious	Slight	Fatal	Serious	Slight
2023	0.1	0.1	1.8	0.0	0.1	1.0
2024	0.0	0.1	1.8	0.0	0.1	1.0
2025	0.0	0.1	1.8	0.0	0.1	1.0
2026	0.0	0.1	1.8	0.0	0.1	1.0
2027	0.0	0.1	1.8	0.0	0.1	1.1
2028	0.0	0.1	1.8	0.0	0.1	1.1
2029	0.0	0.1	1.8	0.0	0.1	1.1
2030	0.0	0.1	1.8	0.0	0.1	1.1
2031	0.0	0.1	1.9	0.0	0.1	1.1
2032	0.0	0.1	1.9	0.0	0.1	1.1
2033	0.0	0.1	1.9	0.0	0.1	1.1
2034	0.0	0.1	1.9	0.0	0.1	1.1
2035	0.0	0.1	1.9	0.0	0.1	1.1
2036	0.0	0.1	1.9	0.0	0.1	1.1
2037	0.1	0.1	1.9	0.0	0.1	1.2
2038	0.1	0.1	2.0	0.0	0.1	1.2
2039	0.1	0.1	2.0	0.0	0.1	1.2
2040	0.1	0.1	2.0	0.0	0.1	1.2

2041	0.1	0.1	2.0	0.0	0.1	1.2
2042	0.1	0.1	2.1	0.0	0.1	1.2
2043	0.1	0.1	2.1	0.0	0.1	1.2
2044	0.1	0.1	2.1	0.0	0.1	1.2
2045	0.1	0.1	2.1	0.0	0.1	1.3
2046	0.1	0.1	2.1	0.0	0.1	1.3
2047	0.1	0.1	2.2	0.0	0.1	1.3
2048	0.1	0.1	2.2	0.0	0.1	1.3
2049	0.1	0.1	2.2	0.0	0.1	1.3
2050	0.1	0.1	2.2	0.0	0.1	1.3
2051	0.1	0.1	2.2	0.0	0.1	1.3
2052	0.1	0.1	2.3	0.0	0.1	1.3

This analysis includes 1 warning(s).
These results should be considered carefully before using.

[Section 2] Combined Link and Junction Collision Statistics

Link Name	*------------ Without-Scheme ---------* *-- Number of Collisions -* 2023	2038	Total*	Total* Cost*	*------------ With-Scheme -----------* *-- Number of Collisions -* 2023	2038	Total*	Total* Cost*	*------------- Benefits -------------* *-- Number of Collisions -* 2023	2038	Total*	Total* Benefit*
1	0.8	0.9	26.9	2,162.8	0.0	0.0	0.0	0.0	0.8	0.9	26.9	2,162.8
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.4	0.4	13.1	1,050.4	0.0	0.0	0.0	0.0	0.4	0.4	13.1	1,050.4
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.1	1.6	132.3	0.0	-0.1	-1.6	-132.3
6	0.0	0.0	0.0	0.0	0.2	0.3	7.7	614.4	-0.2	-0.3	-7.7	-614.4
7	0.0	0.0	0.0	0.0	0.2	0.2	5.2	421.2	-0.2	-0.2	-5.2	-421.2
8	0.0	0.0	0.0	0.0	0.3	0.3	9.2	320.6	-0.3	-0.3	-9.2	-320.6
9	0.0	0.0	0.0	0.0	0.0	0.0	0.8	29.3	0.0	0.0	-0.8	-29.3
Total	1.2	1.3	40.0	3,213.2	0.7	0.8	24.6	1,517.8	0.5	0.5	15.4	1,695.4

Costs and benefits discounted to 2011 in multiples of a thousand euros.

collisions in year

WITHOUT-SCHEME

LinkName	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
1	0.8136	0.8124	0.8107	0.8088	0.8158	0.8225	0.8290	0.8352	0.8412	0.8470	0.8525	0.8578	0.8628	0.8677	0.8822

LinkName	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052
1	0.8967	0.9056	0.9144	0.9232	0.9320	0.9408	0.9496	0.9584	0.9673	0.9761	0.9849	0.9937	1.0025	1.0113	1.0201

2 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
3 0.3943 0.3937 0.3930 0.3922 0.3956 0.3990 0.4022 0.4053
0.4083 0.4111 0.4139 0.4165 0.4190 0.4214 0.4285 0.4357 0.4400
0.4444 0.4487 0.4531 0.4575 0.4618 0.4662 0.4705 0.4749 0.4792
0.4836 0.4880 0.4923 0.4967
4 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
5 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
6 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
7 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
8 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
9 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
2 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
3 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
4 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
5 0.0498 0.0497 0.0496 0.0495 0.0499 0.0503 0.0507 0.0511
0.0514 0.0518 0.0521 0.0525 0.0528 0.0531 0.0539 0.0548 0.0554
0.0559 0.0565 0.0570 0.0575 0.0581 0.0586 0.0591 0.0597 0.0602
0.0608 0.0613 0.0618 0.0624
6 0.2309 0.2305 0.2301 0.2296 0.2316 0.2335 0.2354 0.2372
0.2389 0.2405 0.2421 0.2436 0.2451 0.2465 0.2506 0.2548 0.2573

0.2598 0.2624 0.2649 0.2674 0.2700 0.2725 0.2750 0.2775 0.2801
0.2826 0.2851 0.2877 0.2902
7 0.1582 0.1580 0.1577 0.1573 0.1587 0.1600 0.1613 0.1626
0.1637 0.1649 0.1660 0.1670 0.1680 0.1690 0.1718 0.1747 0.1764
0.1782 0.1799 0.1816 0.1834 0.1851 0.1869 0.1886 0.1903 0.1921
0.1938 0.1955 0.1973 0.1990
8 0.2758 0.2759 0.2759 0.2757 0.2783 0.2809 0.2833 0.2857
0.2880 0.2902 0.2924 0.2944 0.2964 0.2984 0.3033 0.3083 0.3113
0.3142 0.3172 0.3202 0.3232 0.3262 0.3291 0.3321 0.3351 0.3381
0.3410 0.3440 0.3470 0.3500
9 0.0251 0.0251 0.0251 0.0251 0.0254 0.0256 0.0258 0.0261
0.0263 0.0265 0.0267 0.0269 0.0271 0.0273 0.0278 0.0282 0.0285
0.0288 0.0291 0.0294 0.0297 0.0300 0.0303 0.0306 0.0308 0.0311
0.0314 0.0317 0.0320 0.0323

proportion of fatal collisions in year

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.01558 0.01523 0.01489 0.01455 0.01439 0.01423 0.01407 0.01391
0.01375 0.01360 0.01344 0.01329 0.01314 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300
2 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000
3 0.01558 0.01523 0.01489 0.01455 0.01439 0.01423 0.01407 0.01391
0.01375 0.01360 0.01344 0.01329 0.01314 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300
4 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000
5 0.01558 0.01523 0.01489 0.01455 0.01439 0.01423 0.01407 0.01391
0.01375 0.01360 0.01344 0.01329 0.01314 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300
6 0.01558 0.01523 0.01489 0.01455 0.01439 0.01423 0.01407 0.01391
0.01375 0.01360 0.01344 0.01329 0.01314 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300
7 0.01558 0.01523 0.01489 0.01455 0.01439 0.01423 0.01407 0.01391
0.01375 0.01360 0.01344 0.01329 0.01314 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300
8 0.00351 0.00344 0.00337 0.00330 0.00326 0.00323 0.00320 0.00316
0.00313 0.00310 0.00307 0.00304 0.00300 0.00297 0.00297 0.00297 0.00297
0.00297 0.00297 0.00297 0.00297 0.00297 0.00297 0.00297 0.00297 0.00297
0.00297 0.00297 0.00297 0.00297
9 0.00351 0.00344 0.00337 0.00330 0.00326 0.00323 0.00320 0.00316
0.00313 0.00310 0.00307 0.00304 0.00300 0.00297 0.00297 0.00297 0.00297
0.00297 0.00297 0.00297 0.00297 0.00297 0.00297 0.00297 0.00297 0.00297
0.00297 0.00297 0.00297 0.00297

WITH-SCHEME

LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.01558 0.01523 0.01489 0.01455 0.01439 0.01423 0.01407 0.01391
0.01375 0.01360 0.01344 0.01329 0.01314 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300
2 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000
3 0.01558 0.01523 0.01489 0.01455 0.01439 0.01423 0.01407 0.01391
0.01375 0.01360 0.01344 0.01329 0.01314 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300
4 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000
5 0.01558 0.01523 0.01489 0.01455 0.01439 0.01423 0.01407 0.01391
0.01375 0.01360 0.01344 0.01329 0.01314 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300
6 0.01558 0.01523 0.01489 0.01455 0.01439 0.01423 0.01407 0.01391
0.01375 0.01360 0.01344 0.01329 0.01314 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300
7 0.01558 0.01523 0.01489 0.01455 0.01439 0.01423 0.01407 0.01391
0.01375 0.01360 0.01344 0.01329 0.01314 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300 0.01300
0.01300 0.01300 0.01300 0.01300
8 0.00351 0.00344 0.00337 0.00330 0.00326 0.00323 0.00320 0.00316
0.00313 0.00310 0.00307 0.00304 0.00300 0.00297 0.00297 0.00297 0.00297
0.00297 0.00297 0.00297 0.00297 0.00297 0.00297 0.00297 0.00297 0.00297
0.00297 0.00297 0.00297 0.00297
9 0.00351 0.00344 0.00337 0.00330 0.00326 0.00323 0.00320 0.00316
0.00313 0.00310 0.00307 0.00304 0.00300 0.00297 0.00297 0.00297 0.00297
0.00297 0.00297 0.00297 0.00297 0.00297 0.00297 0.00297 0.00297 0.00297
0.00297 0.00297 0.00297 0.00297

proportion of serious collisions in year

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.03590 0.03509 0.03430 0.03353 0.03315 0.03278 0.03241 0.03205
0.03169 0.03133 0.03098 0.03063 0.03029 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995
2 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000
3 0.03590 0.03509 0.03430 0.03353 0.03315 0.03278 0.03241 0.03205
0.03169 0.03133 0.03098 0.03063 0.03029 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995

4 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000
5 0.03590 0.03509 0.03430 0.03353 0.03315 0.03278 0.03241 0.03205
0.03169 0.03133 0.03098 0.03063 0.03029 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995
6 0.03590 0.03509 0.03430 0.03353 0.03315 0.03278 0.03241 0.03205
0.03169 0.03133 0.03098 0.03063 0.03029 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995
7 0.03590 0.03509 0.03430 0.03353 0.03315 0.03278 0.03241 0.03205
0.03169 0.03133 0.03098 0.03063 0.03029 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995
8 0.02245 0.02199 0.02154 0.02110 0.02088 0.02067 0.02046 0.02025
0.02004 0.01984 0.01963 0.01943 0.01923 0.01903 0.01903 0.01903 0.01903
0.01903 0.01903 0.01903 0.01903 0.01903 0.01903 0.01903 0.01903 0.01903
0.01903 0.01903 0.01903 0.01903
9 0.02245 0.02199 0.02154 0.02110 0.02088 0.02067 0.02046 0.02025
0.02004 0.01984 0.01963 0.01943 0.01923 0.01903 0.01903 0.01903 0.01903
0.01903 0.01903 0.01903 0.01903 0.01903 0.01903 0.01903 0.01903 0.01903
0.01903 0.01903 0.01903 0.01903

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.03590 0.03509 0.03430 0.03353 0.03315 0.03278 0.03241 0.03205
0.03169 0.03133 0.03098 0.03063 0.03029 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995
2 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000
3 0.03590 0.03509 0.03430 0.03353 0.03315 0.03278 0.03241 0.03205
0.03169 0.03133 0.03098 0.03063 0.03029 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995
4 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000
5 0.03590 0.03509 0.03430 0.03353 0.03315 0.03278 0.03241 0.03205
0.03169 0.03133 0.03098 0.03063 0.03029 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995
6 0.03590 0.03509 0.03430 0.03353 0.03315 0.03278 0.03241 0.03205
0.03169 0.03133 0.03098 0.03063 0.03029 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995
7 0.03590 0.03509 0.03430 0.03353 0.03315 0.03278 0.03241 0.03205
0.03169 0.03133 0.03098 0.03063 0.03029 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995 0.02995
0.02995 0.02995 0.02995 0.02995
8 0.02245 0.02199 0.02154 0.02110 0.02088 0.02067 0.02046 0.02025
0.02004 0.01984 0.01963 0.01943 0.01923 0.01903 0.01903 0.01903 0.01903

0.01903 0.01903 0.01903 0.01903 0.01903 0.01903 0.01903 0.01903 0.01903
0.01903 0.01903 0.01903 0.01903
9 0.02245 0.02199 0.02154 0.02110 0.02088 0.02067 0.02046 0.02025
0.02004 0.01984 0.01963 0.01943 0.01923 0.01903 0.01903 0.01903 0.01903
0.01903 0.01903 0.01903 0.01903 0.01903 0.01903 0.01903 0.01903 0.01903
0.01903 0.01903 0.01903 0.01903

proportion of slight collisions in year

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.94852 0.94968 0.95081 0.95192 0.95246 0.95299 0.95352 0.95404
0.95456 0.95507 0.95558 0.95608 0.95657 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706
2 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000
3 0.94852 0.94968 0.95081 0.95192 0.95246 0.95299 0.95352 0.95404
0.95456 0.95507 0.95558 0.95608 0.95657 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706
4 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000
5 0.94852 0.94968 0.95081 0.95192 0.95246 0.95299 0.95352 0.95404
0.95456 0.95507 0.95558 0.95608 0.95657 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706
6 0.94852 0.94968 0.95081 0.95192 0.95246 0.95299 0.95352 0.95404
0.95456 0.95507 0.95558 0.95608 0.95657 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706
7 0.94852 0.94968 0.95081 0.95192 0.95246 0.95299 0.95352 0.95404
0.95456 0.95507 0.95558 0.95608 0.95657 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706
8 0.97404 0.97457 0.97509 0.97560 0.97585 0.97610 0.97635 0.97659
0.97683 0.97707 0.97730 0.97753 0.97776 0.97799 0.97799 0.97799 0.97799
0.97799 0.97799 0.97799 0.97799 0.97799 0.97799 0.97799 0.97799 0.97799
0.97799 0.97799 0.97799 0.97799
9 0.97404 0.97457 0.97509 0.97560 0.97585 0.97610 0.97635 0.97659
0.97683 0.97707 0.97730 0.97753 0.97776 0.97799 0.97799 0.97799 0.97799
0.97799 0.97799 0.97799 0.97799 0.97799 0.97799 0.97799 0.97799 0.97799
0.97799 0.97799 0.97799 0.97799

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.94852 0.94968 0.95081 0.95192 0.95246 0.95299 0.95352 0.95404
0.95456 0.95507 0.95558 0.95608 0.95657 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706

2 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000
3 0.94852 0.94968 0.95081 0.95192 0.95246 0.95299 0.95352 0.95404
0.95456 0.95507 0.95558 0.95608 0.95657 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706
4 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000
0.00000 0.00000 0.00000 0.00000
5 0.94852 0.94968 0.95081 0.95192 0.95246 0.95299 0.95352 0.95404
0.95456 0.95507 0.95558 0.95608 0.95657 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706
6 0.94852 0.94968 0.95081 0.95192 0.95246 0.95299 0.95352 0.95404
0.95456 0.95507 0.95558 0.95608 0.95657 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706
7 0.94852 0.94968 0.95081 0.95192 0.95246 0.95299 0.95352 0.95404
0.95456 0.95507 0.95558 0.95608 0.95657 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706 0.95706
0.95706 0.95706 0.95706 0.95706
8 0.97404 0.97457 0.97509 0.97560 0.97585 0.97610 0.97635 0.97659
0.97683 0.97707 0.97730 0.97753 0.97776 0.97799 0.97799 0.97799 0.97799
0.97799 0.97799 0.97799 0.97799 0.97799 0.97799 0.97799 0.97799 0.97799
0.97799 0.97799 0.97799 0.97799
9 0.97404 0.97457 0.97509 0.97560 0.97585 0.97610 0.97635 0.97659
0.97683 0.97707 0.97730 0.97753 0.97776 0.97799 0.97799 0.97799 0.97799
0.97799 0.97799 0.97799 0.97799 0.97799 0.97799 0.97799 0.97799 0.97799
0.97799 0.97799 0.97799 0.97799

Total costs (including casualty costs)

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 102,295.7 98,520.3 94,844.9 91,271.4 89,117.9 86,981.8 84,865.8 82,771.9
80,702.2 78,658.4 76,642.2 74,654.9 72,697.7 70,771.8 69,897.9 69,016.1 67,699.5
66,401.7 65,122.7 63,862.5 62,621.2 61,398.5 60,194.6 59,009.2 57,842.4 56,694.1
55,832.5 54,979.7 54,135.7 53,300.6
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 49,568.6 47,750.0 45,978.5 44,255.4 43,219.8 42,191.9 41,173.1 40,164.3
39,166.7 38,181.1 37,208.3 36,249.1 35,304.0 34,373.6 33,953.8 33,530.0 32,896.0
32,270.9 31,654.6 31,047.1 30,448.5 29,858.7 29,277.7 28,705.6 28,142.1 27,587.5
27,172.1 26,760.9 26,353.7 25,950.7
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
9 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 6,255.3 6,024.4 5,799.7 5,581.2 5,449.5 5,318.9 5,189.5 5,061.4
4,934.9 4,809.9 4,686.6 4,565.1 4,445.4 4,327.6 4,274.2 4,220.3 4,139.8
4,060.4 3,982.2 3,905.1 3,829.2 3,754.5 3,680.8 3,608.4 3,537.0 3,466.8
3,414.1 3,362.0 3,310.3 3,259.3
6 29,026.5 27,958.3 26,918.2 25,906.6 25,297.8 24,693.8 24,095.3 23,502.8
22,917.1 22,338.5 21,767.6 21,204.8 20,650.4 20,104.7 19,857.8 19,608.6 19,236.4
18,869.4 18,507.7 18,151.2 17,800.0 17,454.0 17,113.2 16,777.6 16,447.3 16,122.0
15,878.3 15,637.0 15,398.2 15,161.8
7 19,887.1 19,156.4 18,444.8 17,752.7 17,336.4 16,923.4 16,514.0 16,108.7
15,708.0 15,312.1 14,921.4 14,536.2 14,156.7 13,783.2 13,614.4 13,444.0 13,189.2
12,937.9 12,690.2 12,446.1 12,205.6 11,968.6 11,735.2 11,505.4 11,279.1 11,056.3
10,889.4 10,724.2 10,560.6 10,398.7
8 14,632.9 14,178.9 13,733.5 13,297.1 13,021.9 12,747.6 12,474.5 12,203.1
11,933.6 11,666.2 11,401.3 11,139.1 10,879.8 10,623.6 10,491.2 10,357.6 10,158.4
9,962.0 9,768.6 9,578.0 9,390.4 9,205.7 9,023.8 8,844.8 8,668.7 8,495.4
8,365.1 8,236.3 8,108.7 7,982.6
9 1,330.3 1,289.9 1,250.1 1,211.2 1,186.8 1,162.4 1,138.1 1,113.9
1,089.9 1,066.0 1,042.2 1,018.7 995.4 972.4 960.7 948.8 931.1 913.7
896.4 879.4 862.7 846.2 829.9 813.9 798.1 782.5 770.9 759.4
748.0 736.7

Total costs (excluding casualty costs)

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 2,964.8 2,867.3 2,771.9 2,678.8 2,621.1 2,563.7 2,506.7 2,450.1
2,393.9 2,338.3 2,283.3 2,228.9 2,175.2 2,122.2 2,096.0 2,069.5 2,030.1
1,991.1 1,952.8 1,915.0 1,877.8 1,841.1 1,805.0 1,769.5 1,734.5 1,700.1
1,674.2 1,648.6 1,623.3 1,598.3

2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 1,436.6 1,389.7 1,343.8 1,298.9 1,271.2 1,243.6 1,216.1 1,188.9
1,161.8 1,135.0 1,108.5 1,082.3 1,056.3 1,030.7 1,018.2 1,005.4 986.4
967.7 949.2 931.0 913.0 895.4 877.9 860.8 843.9 827.2 814.8
802.5 790.3 778.2
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
9 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 181.3 175.3 169.5 163.8 160.3 156.8 153.3 149.8 146.4
143.0 139.6 136.3 133.0 129.8 128.2 126.6 124.1 121.8 119.4
117.1 114.8 112.6 110.4 108.2 106.1 104.0 102.4 100.8 99.3
97.7
6 841.3 813.7 786.7 760.3 744.1 727.8 711.7 695.7 679.8
664.1 648.5 633.1 617.9 602.9 595.5 588.0 576.8 565.8 555.0
544.3 533.8 523.4 513.2 503.1 493.2 483.4 476.1 468.9 461.7
454.6
7 576.4 557.5 539.1 521.0 509.9 498.8 487.8 476.8 466.0
455.2 444.5 434.0 423.6 413.3 408.2 403.1 395.5 388.0 380.5
373.2 366.0 358.9 351.9 345.0 338.2 331.5 326.5 321.6 316.7
311.8
8 919.6 892.7 866.3 840.3 823.6 807.0 790.4 773.9 757.5
741.2 725.0 708.9 693.0 677.3 668.9 660.4 647.6 635.1 622.8
610.6 598.7 586.9 575.3 563.9 552.7 541.6 533.3 525.1 517.0
508.9

9 83.6 81.2 78.9 76.5 75.1 73.6 72.1 70.6 69.2
67.7 66.3 64.8 63.4 62.0 61.2 60.5 59.4 58.2 57.2 56.1
55.0 53.9 52.9 51.9 50.9 49.9 49.1 48.4 47.7 47.0

Insurance costs

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 85.6 82.9 80.3 77.8 76.1 74.5 72.9 71.4 69.8
68.2 66.7 65.1 63.6 62.1 61.3 60.6 59.4 58.3 57.1 56.0
55.0 53.9 52.8 51.8 50.8 49.7 49.0 48.2 47.5 46.8
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 41.5 40.2 38.9 37.7 36.9 36.2 35.4 34.6 33.9
33.1 32.4 31.6 30.9 30.2 29.8 29.4 28.9 28.3 27.8 27.2
26.7 26.2 25.7 25.2 24.7 24.2 23.8 23.5 23.1 22.8
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
9 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 5.2 5.1 4.9 4.8 4.7 4.6 4.5 4.4 4.3 4.2
4.1 4.0 3.9 3.8 3.8 3.7 3.6 3.6 3.5 3.4 3.4 3.3
3.2 3.2 3.1 3.0 3.0 3.0 2.9 2.9

6 24.3 23.5 22.8 22.1 21.6 21.2 20.7 20.3 19.8
19.4 18.9 18.5 18.1 17.6 17.4 17.2 16.9 16.6 16.2 15.9
15.6 15.3 15.0 14.7 14.4 14.1 13.9 13.7 13.5 13.3
7 16.6 16.1 15.6 15.1 14.8 14.5 14.2 13.9 13.6
13.3 13.0 12.7 12.4 12.1 11.9 11.8 11.6 11.4 11.1 10.9
10.7 10.5 10.3 10.1 9.9 9.7 9.6 9.4 9.3 9.1
8 28.2 27.4 26.6 25.8 25.3 24.8 24.3 23.8 23.3
22.8 22.3 21.8 21.4 20.9 20.6 20.4 20.0 19.6 19.2 18.8
18.5 18.1 17.7 17.4 17.0 16.7 16.4 16.2 15.9 15.7
9 2.6 2.5 2.4 2.4 2.3 2.3 2.2 2.2 2.1 2.1
2.0 2.0 2.0 1.9 1.9 1.9 1.8 1.8 1.8 1.7 1.7 1.7
1.6 1.6 1.6 1.5 1.5 1.5 1.5 1.4

Damage costs

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 2,278.3 2,206.5 2,136.1 2,067.1 2,024.0 1,981.0 1,938.2 1,895.6
1,853.4 1,811.5 1,770.0 1,728.9 1,688.3 1,648.2 1,627.8 1,607.3 1,576.6
1,546.4 1,516.6 1,487.3 1,458.3 1,429.9 1,401.8 1,374.2 1,347.1 1,320.3
1,300.2 1,280.4 1,260.7 1,241.3
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 1,104.0 1,069.4 1,035.5 1,002.3 981.6 960.9 940.3 919.8 899.5
879.3 859.3 839.5 819.9 800.5 790.7 780.9 766.1 751.5 737.2
723.0 709.1 695.4 681.8 668.5 655.4 642.5 632.8 623.2 613.7
604.4
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
9 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 139.3 134.9 130.6 126.4 123.8 121.1 118.5 115.9 113.3
110.8 108.2 105.7 103.2 100.8 99.5 98.3 96.4 94.6 92.7
90.9 89.2 87.4 85.7 84.0 82.4 80.7 79.5 78.3 77.1 75.9
6 646.5 626.2 606.3 586.7 574.5 562.4 550.3 538.3 526.3
514.5 502.7 491.1 479.6 468.2 462.5 456.7 448.0 439.4 431.0
422.7 414.5 406.5 398.5 390.7 383.0 375.5 369.8 364.2 358.6
353.1
7 442.9 429.0 415.4 402.1 393.7 385.4 377.2 368.9 360.7
352.6 344.6 336.6 328.8 321.0 317.1 313.1 307.2 301.3 295.5
289.9 284.2 278.7 273.3 267.9 262.7 257.5 253.6 249.7 245.9
242.2
8 741.7 720.3 699.2 678.5 665.2 651.9 638.6 625.4 612.3
599.2 586.2 573.3 560.6 548.0 541.1 534.2 524.0 513.8 503.8
494.0 484.3 474.8 465.4 456.2 447.1 438.2 431.5 424.8 418.2
411.7
9 67.4 65.5 63.6 61.8 60.6 59.4 58.3 57.1 55.9
54.7 53.6 52.4 51.3 50.2 49.6 48.9 48.0 47.1 46.2 45.4
44.5 43.6 42.8 42.0 41.2 40.4 39.8 39.2 38.6 38.0

Gardai costs

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 600.9 577.8 555.5 533.9 521.0 508.2 495.6 483.1 470.8
458.6 446.7 434.9 423.3 411.9 406.8 401.7 394.0 386.5 379.0
371.7 364.5 357.4 350.4 343.5 336.7 330.0 325.0 320.0 315.1
310.2
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 291.2 280.1 269.3 258.9 252.7 246.5 240.4 234.4 228.5
222.6 216.8 211.2 205.6 200.1 197.6 195.2 191.5 187.8 184.2
180.7 177.2 173.8 170.4 167.1 163.8 160.6 158.2 155.8 153.4
151.0
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
9 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 36.7 35.3 34.0 32.6 31.9 31.1 30.3 29.5 28.8
28.0 27.3 26.6 25.9 25.2 24.9 24.6 24.1 23.6 23.2 22.7
22.3 21.9 21.4 21.0 20.6 20.2 19.9 19.6 19.3 19.0
6 170.5 164.0 157.7 151.5 147.9 144.3 140.7 137.2 133.7
130.2 126.9 123.5 120.2 117.0 115.6 114.1 112.0 109.8 107.7
105.6 103.6 101.6 99.6 97.7 95.7 93.8 92.4 91.0 89.6 88.2
7 116.8 112.4 108.0 103.8 101.3 98.9 96.4 94.0 91.6
89.3 87.0 84.7 82.4 80.2 79.2 78.3 76.8 75.3 73.9 72.4
71.0 69.7 68.3 67.0 65.7 64.4 63.4 62.4 61.5 60.5
8 149.7 145.0 140.4 135.9 133.1 130.3 127.5 124.7 121.9
119.2 116.5 113.8 111.1 108.5 107.1 105.8 103.7 101.7 99.8
97.8 95.9 94.0 92.1 90.3 88.5 86.7 85.4 84.1 82.8 81.5
9 13.6 13.2 12.8 12.4 12.1 11.9 11.6 11.4 11.1 10.9
10.6 10.4 10.2 9.9 9.8 9.7 9.5 9.3 9.2 9.0 8.8
8.6 8.5 8.3 8.1 8.0 7.9 7.8 7.6 7.5

fatal casualties

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0340 0.0336 0.0332 0.0327 0.0328 0.0329 0.0330 0.0331
0.0332 0.0332 0.0332 0.0333 0.0333 0.0333 0.0339 0.0344 0.0348
0.0351 0.0354 0.0358 0.0361 0.0365 0.0368 0.0371 0.0375 0.0378
0.0381 0.0385 0.0388 0.0392
2 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
3 0.0165 0.0163 0.0161 0.0159 0.0159 0.0160 0.0160 0.0161
0.0161 0.0161 0.0161 0.0162 0.0162 0.0162 0.0165 0.0167 0.0169
0.0171 0.0172 0.0174 0.0176 0.0177 0.0179 0.0181 0.0182 0.0184
0.0186 0.0187 0.0189 0.0191

4 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
5 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
6 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
7 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
8 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
9 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
2 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
3 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
4 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
5 0.0021 0.0021 0.0020 0.0020 0.0020 0.0020 0.0020 0.0020
0.0020 0.0020 0.0020 0.0020 0.0020 0.0020 0.0021 0.0021 0.0021
0.0021 0.0022 0.0022 0.0022 0.0022 0.0022 0.0023 0.0023 0.0023
0.0023 0.0024 0.0024 0.0024
6 0.0096 0.0095 0.0094 0.0093 0.0093 0.0093 0.0094 0.0094
0.0094 0.0094 0.0094 0.0095 0.0095 0.0095 0.0096 0.0098 0.0099
0.0100 0.0101 0.0102 0.0103 0.0104 0.0105 0.0106 0.0107 0.0108
0.0108 0.0109 0.0110 0.0111
7 0.0066 0.0065 0.0064 0.0064 0.0064 0.0064 0.0064 0.0064
0.0065 0.0065 0.0065 0.0065 0.0065 0.0065 0.0066 0.0067 0.0068
0.0068 0.0069 0.0070 0.0070 0.0071 0.0072 0.0072 0.0073 0.0074
0.0074 0.0075 0.0076 0.0076
8 0.0015 0.0015 0.0015 0.0014 0.0014 0.0014 0.0014 0.0014
0.0014 0.0015 0.0015 0.0015 0.0014 0.0014 0.0015 0.0015 0.0015

0.0015 0.0015 0.0016 0.0016 0.0016 0.0016 0.0016 0.0016 0.0016
0.0017 0.0017 0.0017 0.0017
9 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001
0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001
0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001 0.0002
0.0002 0.0002 0.0002 0.0002

serious casualties

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0746 0.0738 0.0730 0.0722 0.0726 0.0729 0.0731 0.0734
0.0736 0.0738 0.0739 0.0741 0.0742 0.0743 0.0755 0.0768 0.0775
0.0783 0.0790 0.0798 0.0805 0.0813 0.0820 0.0828 0.0836 0.0843
0.0851 0.0858 0.0866 0.0873
2 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
3 0.0361 0.0358 0.0354 0.0350 0.0352 0.0353 0.0355 0.0356
0.0357 0.0358 0.0359 0.0360 0.0360 0.0361 0.0367 0.0373 0.0377
0.0380 0.0384 0.0388 0.0392 0.0395 0.0399 0.0403 0.0407 0.0410
0.0414 0.0418 0.0421 0.0425
4 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
5 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
6 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
7 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
8 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
9 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000

2 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
3 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
4 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
5 0.0046 0.0045 0.0045 0.0044 0.0044 0.0045 0.0045 0.0045
0.0045 0.0045 0.0045 0.0045 0.0045 0.0045 0.0046 0.0047 0.0047
0.0048 0.0048 0.0049 0.0049 0.0050 0.0050 0.0051 0.0051 0.0052
0.0052 0.0052 0.0053 0.0053
6 0.0212 0.0209 0.0207 0.0205 0.0206 0.0207 0.0208 0.0208
0.0209 0.0209 0.0210 0.0210 0.0211 0.0211 0.0215 0.0218 0.0220
0.0222 0.0225 0.0227 0.0229 0.0231 0.0233 0.0235 0.0238 0.0240
0.0242 0.0244 0.0246 0.0248
7 0.0145 0.0144 0.0142 0.0141 0.0141 0.0142 0.0142 0.0143
0.0143 0.0144 0.0144 0.0144 0.0144 0.0145 0.0147 0.0150 0.0151
0.0153 0.0154 0.0155 0.0157 0.0158 0.0160 0.0161 0.0163 0.0164
0.0166 0.0167 0.0169 0.0170
8 0.0135 0.0135 0.0134 0.0134 0.0135 0.0136 0.0137 0.0138
0.0139 0.0140 0.0141 0.0141 0.0142 0.0143 0.0145 0.0148 0.0149
0.0151 0.0152 0.0153 0.0155 0.0156 0.0158 0.0159 0.0161 0.0162
0.0163 0.0165 0.0166 0.0168
9 0.0012 0.0012 0.0012 0.0012 0.0012 0.0012 0.0012 0.0013
0.0013 0.0013 0.0013 0.0013 0.0013 0.0013 0.0013 0.0014 0.0014
0.0014 0.0014 0.0014 0.0014 0.0014 0.0015 0.0015 0.0015 0.0015
0.0015 0.0015 0.0015 0.0015

slight casualties

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 1.2008 1.2001 1.1989 1.1972 1.2082 1.2188 1.2290 1.2389
1.2484 1.2575 1.2664 1.2748 1.2830 1.2908 1.3125 1.3341 1.3472
1.3603 1.3734 1.3865 1.3996 1.4128 1.4259 1.4390 1.4521 1.4652
1.4783 1.4914 1.5046 1.5177
2 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
3 0.5819 0.5817 0.5812 0.5805 0.5859 0.5912 0.5963 0.6011
0.6059 0.6104 0.6148 0.6190 0.6231 0.6269 0.6375 0.6481 0.6546
0.6611 0.6676 0.6741 0.6806 0.6870 0.6935 0.7000 0.7065 0.7130
0.7195 0.7259 0.7324 0.7389
4 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
5 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000

6 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
7 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
8 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
9 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
2 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
3 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
4 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000
5 0.0734 0.0734 0.0733 0.0732 0.0739 0.0745 0.0752 0.0758
0.0763 0.0769 0.0774 0.0780 0.0785 0.0789 0.0803 0.0816 0.0824
0.0832 0.0840 0.0848 0.0856 0.0864 0.0872 0.0880 0.0888 0.0896
0.0904 0.0912 0.0920 0.0928
6 0.3407 0.3406 0.3403 0.3398 0.3430 0.3460 0.3489 0.3518
0.3545 0.3571 0.3597 0.3621 0.3644 0.3667 0.3729 0.3790 0.3828
0.3866 0.3903 0.3941 0.3978 0.4016 0.4054 0.4091 0.4129 0.4167
0.4204 0.4242 0.4279 0.4317
7 0.2334 0.2334 0.2332 0.2329 0.2350 0.2371 0.2392 0.2411
0.2430 0.2448 0.2465 0.2482 0.2498 0.2514 0.2556 0.2599 0.2625
0.2650 0.2676 0.2702 0.2728 0.2754 0.2780 0.2806 0.2832 0.2857
0.2883 0.2909 0.2935 0.2961
8 0.3686 0.3689 0.3690 0.3690 0.3726 0.3761 0.3795 0.3827
0.3859 0.3890 0.3920 0.3948 0.3976 0.4003 0.4070 0.4136 0.4176
0.4216 0.4256 0.4296 0.4336 0.4376 0.4416 0.4456 0.4496 0.4536
0.4576 0.4616 0.4656 0.4696
9 0.0335 0.0336 0.0336 0.0336 0.0340 0.0343 0.0346 0.0349
0.0352 0.0355 0.0358 0.0361 0.0364 0.0366 0.0373 0.0379 0.0383
0.0387 0.0391 0.0394 0.0398 0.0402 0.0406 0.0410 0.0414 0.0418
0.0422 0.0426 0.0429 0.0433

Fatal costs

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 55,478.9 53,241.4 51,071.6 48,970.1 47,728.1 46,499.5 45,285.6 44,087.4
42,906.1 41,742.4 40,597.2 39,471.1 38,364.7 37,278.5 36,818.2 36,353.8 35,660.2
34,976.6 34,302.9 33,639.1 32,985.2 32,341.2 31,707.1 31,082.7 30,468.1 29,863.2
29,409.4 28,960.1 28,515.6 28,075.7
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 26,883.0 25,804.6 24,758.3 23,744.5 23,146.9 22,555.3 21,970.5 21,393.0
20,823.3 20,261.9 19,709.2 19,165.4 18,630.9 18,106.0 17,884.9 17,661.7 17,327.7
16,998.5 16,673.8 16,353.9 16,038.5 15,727.9 15,421.8 15,120.4 14,823.7 14,531.5
14,312.7 14,096.1 13,881.6 13,669.4
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
9 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 3,392.5 3,255.7 3,123.0 2,994.5 2,918.5 2,843.4 2,769.2 2,695.9
2,623.7 2,552.5 2,482.5 2,413.6 2,346.0 2,279.5 2,251.4 2,223.0 2,180.6
2,138.8 2,097.6 2,057.0 2,017.0 1,977.6 1,938.9 1,900.7 1,863.1 1,826.1
1,798.4 1,770.9 1,743.7 1,716.8
6 15,742.2 15,109.0 14,494.8 13,899.7 13,548.5 13,201.0 12,857.6 12,518.5
12,184.1 11,854.6 11,530.3 11,211.3 10,897.8 10,590.0 10,460.0 10,328.7 10,132.6
9,939.3 9,748.8 9,561.0 9,376.0 9,193.8 9,014.3 8,837.5 8,663.5 8,492.2
8,363.8 8,236.7 8,110.9 7,986.4

7 10,785.5 10,352.3 9,932.1 9,524.9 9,284.7 9,047.0 8,812.1 8,580.1
8,351.3 8,125.8 7,903.8 7,685.5 7,470.9 7,260.2 7,171.3 7,081.6 6,947.3
6,815.0 6,684.5 6,555.9 6,429.2 6,304.4 6,181.5 6,060.4 5,941.2 5,823.8
5,735.9 5,648.9 5,562.7 5,477.4
8 2,456.5 2,352.2 2,251.4 2,154.1 2,097.0 2,040.7 1,985.1 1,930.3
1,876.5 1,823.5 1,771.4 1,720.4 1,670.3 1,621.1 1,600.9 1,580.6 1,550.2
1,520.2 1,490.7 1,461.6 1,433.0 1,404.8 1,377.0 1,349.7 1,322.8 1,296.4
1,276.5 1,256.8 1,237.4 1,218.1
9 223.3 214.0 204.9 196.2 191.1 186.1 181.1 176.2 171.4
166.6 161.9 157.3 152.8 148.4 146.6 144.8 142.1 139.4 136.8
134.2 131.6 129.1 126.6 124.2 121.8 119.4 117.6 115.9 114.1
112.4

Serious costs

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 17,462.4 16,791.9 16,140.2 15,507.3 15,129.2 14,754.6 14,383.8 14,017.3
13,655.5 13,298.5 12,946.6 12,600.2 12,259.3 11,924.2 11,776.9 11,628.4 11,406.5
11,187.9 10,972.4 10,760.1 10,550.9 10,344.9 10,142.0 9,942.3 9,745.7 9,552.2
9,407.1 9,263.4 9,121.2 8,980.5
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 8,461.6 8,138.6 7,824.4 7,519.1 7,337.3 7,156.9 6,978.4 6,801.8
6,627.3 6,455.1 6,285.3 6,118.1 5,953.4 5,791.5 5,720.8 5,649.4 5,542.6
5,437.2 5,333.4 5,231.1 5,130.2 5,030.8 4,932.9 4,836.5 4,741.6 4,648.1
4,578.2 4,508.9 4,440.3 4,372.4
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
9 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 1,067.8 1,026.8 987.0 948.3 925.1 902.2 879.6 857.1 835.0
813.2 791.7 770.5 749.6 729.2 720.1 711.1 697.5 684.1 671.0
658.0 645.2 632.6 620.2 608.0 595.9 584.1 575.2 566.4 557.8
549.1
6 4,955.0 4,765.3 4,580.8 4,401.6 4,294.7 4,188.8 4,083.9 3,980.2
3,877.7 3,776.7 3,677.0 3,578.9 3,482.4 3,387.4 3,345.8 3,303.8 3,241.1
3,179.3 3,118.3 3,058.3 2,999.1 2,940.8 2,883.4 2,826.8 2,771.2 2,716.4
2,675.3 2,634.6 2,594.4 2,554.6
7 3,394.8 3,265.0 3,138.8 3,016.2 2,943.1 2,870.7 2,798.9 2,728.0
2,657.9 2,588.8 2,520.6 2,453.4 2,387.3 2,322.3 2,293.9 2,265.2 2,222.2
2,179.9 2,138.1 2,097.0 2,056.5 2,016.6 1,977.2 1,938.5 1,900.4 1,862.9
1,834.7 1,806.9 1,779.3 1,752.1
8 3,156.8 3,059.6 2,964.2 2,870.6 2,811.4 2,752.4 2,693.6 2,635.1
2,577.1 2,519.4 2,462.3 2,405.8 2,349.8 2,294.5 2,265.9 2,237.1 2,194.0
2,151.6 2,109.9 2,068.7 2,028.2 1,988.3 1,949.0 1,910.3 1,872.3 1,834.9
1,806.7 1,778.9 1,751.4 1,724.1
9 287.0 278.3 269.8 261.5 256.2 251.0 245.8 240.5 235.4
230.2 225.1 220.0 215.0 210.0 207.5 204.9 201.1 197.3 193.6
189.9 186.3 182.8 179.2 175.8 172.4 169.0 166.5 164.0 161.6
159.1

Slight costs

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 26,389.6 25,619.6 24,861.2 24,115.2 23,639.4 23,164.0 22,689.7 22,217.1
21,746.7 21,279.2 20,815.1 20,354.7 19,898.5 19,446.9 19,206.8 18,964.5 18,602.7
18,246.1 17,894.6 17,548.3 17,207.2 16,871.3 16,540.4 16,214.7 15,894.1 15,578.6
15,341.8 15,107.5 14,875.6 14,646.1
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 12,787.4 12,417.1 12,052.1 11,692.9 11,464.5 11,236.1 11,008.0 10,780.6
10,554.2 10,329.0 10,105.3 9,883.3 9,663.2 9,445.3 9,329.9 9,213.5 9,039.3
8,867.5 8,698.1 8,531.2 8,366.7 8,204.7 8,045.0 7,887.8 7,733.0 7,580.6
7,466.4 7,353.4 7,241.6 7,130.8
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
9 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 1,613.7 1,566.6 1,520.2 1,474.6 1,445.5 1,416.5 1,387.5 1,358.6
1,329.8 1,301.2 1,272.8 1,244.7 1,216.8 1,189.2 1,174.5 1,159.7 1,137.5
1,115.7 1,094.2 1,073.1 1,052.2 1,031.7 1,011.4 991.5 971.9 952.6 938.1
923.8 909.6 895.6
6 7,488.1 7,270.4 7,055.9 6,844.9 6,710.5 6,576.2 6,442.1 6,308.5
6,175.4 6,043.2 5,911.8 5,781.5 5,652.3 5,524.4 5,456.6 5,388.1 5,285.8
5,185.0 5,085.6 4,987.6 4,891.1 4,796.1 4,702.4 4,610.2 4,519.4 4,430.1
4,363.1 4,296.8 4,231.2 4,166.2
7 5,130.3 4,981.5 4,834.8 4,690.5 4,598.7 4,506.8 4,415.2 4,323.8
4,232.8 4,142.3 4,052.5 3,963.3 3,874.9 3,787.4 3,741.0 3,694.2 3,624.2
3,555.1 3,487.1 3,420.0 3,353.9 3,288.8 3,224.6 3,161.5 3,099.3 3,038.1
2,992.2 2,946.8 2,901.9 2,857.4
8 8,100.0 7,874.3 7,651.6 7,432.2 7,289.9 7,147.6 7,005.4 6,863.7
6,722.5 6,582.1 6,442.6 6,304.1 6,166.7 6,030.6 5,955.4 5,879.6 5,766.5
5,655.1 5,545.2 5,437.1 5,330.6 5,225.7 5,122.5 5,020.9 4,920.9 4,822.5
4,748.6 4,675.4 4,603.0 4,531.4
9 736.4 716.3 696.5 677.0 664.4 651.8 639.2 626.5 614.0
601.4 588.9 576.5 564.2 552.0 545.3 538.6 528.6 518.6 508.9
499.2 489.7 480.3 471.1 462.0 453.0 444.2 437.6 431.1 424.6
418.2

damage only collisions

WITHOUT-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
9 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

WITH-SCHEME
LinkName 2023 2024 2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036 2037 2038 2039 2040
2041 2042 2043 2044 2045 2046 2047 2048 2049 2050
2051 2052
1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
9 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

[Section 3] Combined Link and Junction Collision Rates

----- Collision Rate ----

Link Name	* 2023	2038 *
1	0.332595	0.277416
2	0.000000	0.000000
3	1.356798	1.131698
4	0.000000	0.000000
5	0.148347	0.123735
6	0.148347	0.123735
7	0.148347	0.123735
8	0.344513	0.292061
9	0.430115	0.364630

Collision rates are in collisions per million vehicle kilometres.

[Section 4] Input Data - Scheme File

Scheme Name
N63 Abbey to Liss - Option B1

Years Subsection
Current Year 2019
Base Year 2011
Without-Scheme
Year 1 2023
Year 2 2038
Year 3 2053
Year 4 0
Year 5 0
With-Scheme
Year 1 2023
Year 2 2038
Year 3 2053
Year 4 0
Year 5 0

Scheme Opening Year 2023

Link and Junction Combined Input Section

Combined Classification Subsection

Link Name	Road Type	Length (km)	Speed Limit (km/h)	Error/Warning Summary (!=Error, #=Warning)
1	2	1.24	100	
2	2	0.14	100	
3	2	0.19	100	#Observed collision rate in 2011 appears high. Care should be taken using the results of the calculation for this link.
4	2	0.77	100	
5	2	0.17	100	
6	2	1.25	100	
7	2	0.75	100	
8	3	1.10	50	
9	3	0.33	50	

Combined Flow Subsection

Link Name	Base Year Flows	Without-Scheme Flows Year 1	Year 2	Year 3	Year 4	Year 5	With-Scheme Flows Year 1	Year 2	Year 3	Year 4	Year 5
1	5,405	5,405	7,142	8,195	0	0	0	0	0	0	0
2	5,161	5,161	6,822	7,829	0	0	1,750	2,309	2,744	0	0

3	4,190	4,190	5,551	6,384	0	0	0	0	0	0	0
4	3,895	3,895	5,157	5,927	0	0	0	0	0	0	0
5	0	0	0	0	0	0	5,405	7,142	8,195	0	0
6	0	0	0	0	0	0	3,411	4,513	5,185	0	0
7	0	0	0	0	0	0	3,895	5,157	5,927	0	0
8	0	0	0	0	0	0	1,994	2,629	3,010	0	0
9	0	0	0	0	0	0	484	643	742	0	0

Combined Local Collision Rate Subsection

Link Name	Observed Collisions	First Observed Collision Year	Local Severity Split Ratio	Year
1	0.491R	2011		
2	0R	2011		
3	2.003R	2011		
4	0R	2011		
8	0.491R	2011		

[Section 5] Input Data - Parameter File

COBALT Parameter File
Version 2,015.01

Cost Base Year
2011

Appraisal Period
30

Discount Rate

Years from Current Year	Discount Rate (%)
30	4.00
60	3.50

Cost per Casualty

Severity	Cost
Fatal	2,310,500
Serious	331,400
Slight	31,100

Cost per Collision

Severity	Insurance Administration	Damage to Property Urban	Rural	Motorway
Fatal	375	13,952	13,952	13,952
Serious	233	6,225	6,225	6,225
Slight	142	3,713	3,713	3,713
Damage	67	2,346	2,346	2,346

	Gardai Cost Urban	Rural	Motorway
Fatal	21,521	21,521	21,521
Serious	2,519	2,519	2,519
Slight	653	653	653
Damage	42	42	42

Compound Annual Rates of Growth of Collision Values

Range of Years	Rate of Growth (%p.a.)
2011-2015	1.040
2015-2020	1.036
2020-2025	1.022
2025-2111	1.023

Number of Damage Only Collisions per PIA

	Urban	Rural	Motorway
Damage	0.0	0.0	0.0

Link and Junction Combined Collision Proportions
Base Year
2011

Road Type	Speed Limit (km/h)	Collision Proportions Fatal	Serious	Slight
1	70	0.013	0.027	0.960
1	80	0.013	0.027	0.960
1	90	0.013	0.027	0.960
1	100	0.013	0.027	0.960
1	110	0.013	0.027	0.960
1	120	0.013	0.027	0.960
1	130	0.013	0.027	0.960
2	70	0.023	0.053	0.925
2	80	0.023	0.053	0.925
2	90	0.023	0.053	0.925
2	100	0.023	0.053	0.925
2	110	0.023	0.053	0.925
2	120	0.023	0.053	0.925
2	130	0.023	0.053	0.925
3	50	0.005	0.032	0.963
3	60	0.005	0.032	0.963
4	70	0.012	0.026	0.962
4	80	0.012	0.026	0.962
4	90	0.012	0.026	0.962
4	100	0.012	0.026	0.962
4	110	0.012	0.026	0.962
4	120	0.012	0.026	0.962
4	130	0.012	0.026	0.962
5	50	0.008	0.028	0.963
5	60	0.008	0.028	0.963
6	70	0.023	0.053	0.925
6	80	0.023	0.053	0.925
6	90	0.023	0.053	0.925
6	100	0.023	0.053	0.925
6	110	0.023	0.053	0.925
6	120	0.023	0.053	0.925
6	130	0.023	0.053	0.925
7	50	0.005	0.032	0.963
7	60	0.005	0.032	0.963
8	70	0.012	0.026	0.962
8	80	0.012	0.026	0.962
8	90	0.012	0.026	0.962
8	100	0.012	0.026	0.962
8	110	0.012	0.026	0.962
8	120	0.012	0.026	0.962
8	130	0.012	0.026	0.962
9	50	0.008	0.028	0.963
9	60	0.008	0.028	0.963
10	30	0.005	0.032	0.963
10	40	0.005	0.032	0.963
10	50	0.005	0.032	0.963
10	60	0.005	0.032	0.963

Link and Junction Combined Collision Rates and Change Factors
Base Year
2011

Road Type	Speed Limit (km/h)	Collision Rate	Beta Factor
1	70	0.057	0.956
1	80	0.057	0.956
1	90	0.057	0.956
1	100	0.057	0.956
1	110	0.057	0.956
1	120	0.057	0.956
1	130	0.057	0.956
2	70	0.219	0.955
2	80	0.219	0.955
2	90	0.219	0.955
2	100	0.219	0.955
2	110	0.219	0.955
2	120	0.219	0.955
2	130	0.219	0.955
3	50	0.613	0.959
3	60	0.613	0.959
4	70	0.094	0.956
4	80	0.094	0.956
4	90	0.094	0.956
4	100	0.094	0.956
4	110	0.094	0.956
4	120	0.094	0.956
4	130	0.094	0.956
5	50	0.402	0.967
5	60	0.402	0.967
6	70	0.219	0.955
6	80	0.219	0.955
6	90	0.219	0.955
6	100	0.219	0.955
6	110	0.219	0.955
6	120	0.219	0.955
6	130	0.219	0.955
7	50	0.613	0.959
7	60	0.613	0.959
8	70	0.094	0.955
8	80	0.094	0.955
8	90	0.094	0.955
8	100	0.094	0.955
8	110	0.094	0.955
8	120	0.094	0.955
8	130	0.094	0.955
9	50	0.402	0.959
9	60	0.402	0.959
10	30	0.449	0.959
10	40	0.449	0.959
10	50	0.449	0.959
10	60	0.449	0.959

Link and Junction Combined Collision Beta Factor Changes over Time

Range of Years	Change to Beta Factor
2011-2016	1.000
2017-2026	0.500
2027-2036	0.250
2037-2160	0.000

Link and Junction Combined Casualty Rates
Base Year
2011

Road Type	Speed Limit	Casualties per P.I.A.

	(km/h)	Fatal	Serious	Slight
1	70	0.025	0.033	1.393
1	80	0.025	0.033	1.393
1	90	0.025	0.033	1.393
1	100	0.025	0.033	1.393
1	110	0.025	0.033	1.393
1	120	0.025	0.033	1.393
1	130	0.025	0.033	1.393
2	70	0.050	0.106	1.451
2	80	0.050	0.106	1.451
2	90	0.050	0.106	1.451
2	100	0.050	0.106	1.451
2	110	0.050	0.106	1.451
2	120	0.050	0.106	1.451
2	130	0.050	0.106	1.451
3	50	0.007	0.051	1.325
3	60	0.007	0.051	1.325
4	70	0.018	0.043	1.342
4	80	0.018	0.043	1.342
4	90	0.018	0.043	1.342
4	100	0.018	0.043	1.342
4	110	0.018	0.043	1.342
4	120	0.018	0.043	1.342
4	130	0.018	0.043	1.342
5	50	0.008	0.045	1.233
5	60	0.008	0.045	1.233
6	70	0.050	0.106	1.451
6	80	0.050	0.106	1.451
6	90	0.050	0.106	1.451
6	100	0.050	0.106	1.451
6	110	0.050	0.106	1.451
6	120	0.050	0.106	1.451
6	130	0.050	0.106	1.451
7	50	0.007	0.051	1.325
7	60	0.007	0.051	1.325
8	70	0.018	0.043	1.342
8	80	0.018	0.043	1.342
8	90	0.018	0.043	1.342
8	100	0.018	0.043	1.342
8	110	0.018	0.043	1.342
8	120	0.018	0.043	1.342
8	130	0.018	0.043	1.342
9	50	0.008	0.045	1.233
9	60	0.008	0.045	1.233
10	30	0.007	0.051	1.325
10	40	0.007	0.051	1.325
10	50	0.007	0.051	1.325
10	60	0.007	0.051	1.325

Link and Junction Combined Casualty Change Factors
Base Year
2011

Road Type	Speed Limit	Beta Factor		
	(km/h)	Fatal	Serious	Slight
1	70	0.978	0.979	1.002
1	80	0.978	0.979	1.002
1	90	0.978	0.979	1.002
1	100	0.978	0.979	1.002
1	110	0.978	0.979	1.002
1	120	0.978	0.979	1.002
1	130	0.978	0.979	1.002

2	70	0.979	0.983	1.002
2	80	0.979	0.983	1.002
2	90	0.979	0.983	1.002
2	100	0.979	0.983	1.002
2	110	0.979	0.983	1.002
2	120	0.979	0.983	1.002
2	130	0.979	0.983	1.002
3	50	0.971	0.995	1.001
3	60	0.971	0.995	1.001
4	70	0.984	0.985	0.998
4	80	0.984	0.985	0.998
4	90	0.984	0.985	0.998
4	100	0.984	0.985	0.998
4	110	0.984	0.985	0.998
4	120	0.984	0.985	0.998
4	130	0.984	0.985	0.998
5	50	0.998	0.990	1.002
5	60	0.998	0.990	1.002
6	70	0.979	0.983	1.002
6	80	0.979	0.983	1.002
6	90	0.979	0.983	1.002
6	100	0.979	0.983	1.002
6	110	0.979	0.983	1.002
6	120	0.979	0.983	1.002
6	130	0.979	0.983	1.002
7	50	0.971	0.995	1.001
7	60	0.971	0.995	1.001
8	70	0.979	0.983	1.002
8	80	0.979	0.983	1.002
8	90	0.979	0.983	1.002
8	100	0.979	0.983	1.002
8	110	0.979	0.983	1.002
8	120	0.979	0.983	1.002
8	130	0.979	0.983	1.002
9	50	0.971	0.995	1.001
9	60	0.971	0.995	1.001
10	30	0.971	0.995	1.001
10	40	0.971	0.995	1.001
10	50	0.971	0.995	1.001
10	60	0.971	0.995	1.001

Link and Junction Combined Casualty Beta Factor Changes over Time

Range of Years	Change to Beta Factor
2011-2016	1.000
2017-2026	0.500
2027-2036	0.250
2037-2160	0.000

Appendix D – Project Appraisal Balance Sheet

N63 Liss to Abbey Realignment Scheme

Phase 3 – Project Appraisal Balance Sheet

Galway County Council

AECOM Project Number: 60571547
GCC Project Number: GC/16/13416

Document Reference: N63-ACM-PH03-ZZ-RP-ZZ-0002_Appendix D

7th February 2022

Quality information

Prepared by	Checked by	Verified by	Approved by
Cameron McBain Consultant	Neil Caughey Associate Director	Philip Shiels Associate Director	Eoin Greene Technical Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
Draft 1	10/08/2021	1st Draft Issue	Yes	Eoin Greene	Technical Director
Rev 0	07/02/2022	Final for Ph3 Close Out	Yes	Eoin Greene	Technical Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Galway County Council

Áras an Chontae,

Prospect Hill,

Galway

H91 H6KX

Prepared by:

AECOM-ROD

4th Floor

Adelphi Plaza

Georges Street Upper

Co. Dublin

Ireland

T: +353 1 238 3100

aecom.com

Prepared by:

All Rights Reserved.

This document has been prepared by AECOM Ireland Ltd and Roughan & O'Donovan Ltd ("AECOM-ROD) for sole use of our client (the "Client") in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM-ROD and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM-ROD, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM-ROD.

Table of Contents

1 Introduction

1.1 Overview

This report forms the Phase 3 (Design and Environmental Evaluation) Project Brief (PB) for the N63 Liss to Abbey Realignment Scheme and has been undertaken in accordance with the Transport Infrastructure Ireland (TII) Project Management Guidelines (PMG) 2019 and TII Project Appraisal Guidelines (PAG) 2021[1].

The TII PAG are in compliance with the Department of Transport (DoT) Common Appraisal Framework (CAF) for Transport Projects and Programmes 2020 and Department of Public Expenditure and Reform (DPER) Public Spending Code (PSC) 2019.

1.2 PABS Structure

The PABS is based on a qualitative and quantitative evaluation of a range of criteria and elements as outlined in the PAG Unit 7.1 – Project Appraisal Balance Sheet. The evaluation of the scheme is based on the 6 multi-criteria appraisal headings:

- Economy;
- Safety;
- Physical Activity;
- Environment;
- Accessibility and Social Inclusion; and
- Integration.

The PABS which is based on an automated spreadsheet is made up of four sections as follows: -

- Part A: This section outlines the general background on the project being assessed such as a brief project description, funding possibilities, project cost and project management information;
- Part B: This section deals only with the environmental impacts of the project. The assessment is broken down into 12 categories, reflecting the NRA Environmental Assessment and Construction Guidelines (NRA EACG). The environmental assessment for the project is used to assist in quantifying the required environmental impacts;
- Part C: Includes an assessment of each of the remaining five appraisal criteria; and
- Part D: Is the PABS Summary Sheet which is based on Part A, B and C inputs.

[1] PE-PAG-02033 – PAG for National Roads Unit 8.0 – Business Case

2 Project Appraisal Balance Sheet

Project Appraisal Balance Sheet

Part A: Project Context

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Date	28/07/2021
Version No.	0

Project Title	**N63 Liss to Abbey Realignment Scheme**
PRS Reference Number	
Project Phase	**Phase 3: Design & Environmental Evaluation**
National Roads Office	
TII Project Manager	**Kieran Kelly**
Project Description	**Upgrade and realignment of approximately 2.4km of the existing N63 (National Secondary Road) in Abbeyknockmoy Co. Galway**
Scheme Cost €m (TSB)	**€19.21m**
What Are The Likely Sources of Non-Exchequer Funding	**None**
TII Growth Scenario	**TII Central Growth**
Appraisal Team Author	**Cameron McBain**
Design Team Reviewer	**Luca Bellini**
TII Engineering Inspector	**Virginia Kangley**
External Auditor	
Modelling Base Year	**2019**
Scheme Opening Year	**2023**
Reference Number of Nearest TII Traffic Monitoring Unit(s)	**TMU N63 080.0 W**

Note - This PABS should be completed with reference to the latest version of TII PAG Unit 7.1. Users should always check that the correct version is followed prior to undertaking the PABS.

PABS Version 4 16.03.2021

Project Appraisal Balance Sheet

Part B: Environment

Air Quality & Climate

Climate - Carbon Dioxide (CO_2)	Quantitative Statement Parameter
Tonnes of CO_2 produced in the Do Minimum Scenario?	N/A
Tonnes of CO_2 produced in the Do Something Scenario?	N/A
Ratio of CO_2 produced in Do Something Scenario to Do Minimum Scenario	#VALUE!
Greenhouse Gasses	**Monetised Benefits (€m)**
Value of change in emissions	N/A

Significance Criteria	Substantial Beneficial	Moderate Beneficial	Slight Beneficial	Negligible	Slight Adverse	Moderate Adverse	Substantial Adverse
Number of Sensitive Locations Experiencing Impacts That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Index of Overall Change in Exposure	Large Negative Index	Medium Negative Index	Small Negative Index	Small Positive Index	Medium Positive Index	Large Positive Index
Nitrogen Dioxide (NO_2)	○	○	○	●	○	○
Particulate Matter (PM_{10})	○	○	○	●	○	○

Quantitative Statement	Qualitative Statement
Slightly Positive	Based on the Index of Overall Change in Exposure Calculations, there is likely to be an improvement in air quality with the preferred option. The sensitive ecosystems assessment has shown a minor improvement/no change in air quality with the preferred option. Local air quality will improve for the majority of properties on the existing N63 but deteriorate for those few properties which are now introduced to proximal traffic.

Noise & Vibration

Sensitive Receptors	Quantitative Statement Parameter
Number of Sensitive Receptors Requiring Mitigation (i.e. the three conditions have been satisfied) Per Kilometre	N/A
Number of Sensitive Receptors Requiring Mitigation (i.e. the three conditions have been satisfied), But It Is Not Feasible To Mitigate Noise To The Required Level Per Kilometre	N/A

Quantitative Statement	Qualitative Statement
Slightly Negative	The preferred option received a score of 'Minor or Slightly Negative.' It was determined that with the inclusion of appropriate mitigation measures, it will have greater potential to result in the least noise impact upon noise sensitive receptors.

Waste

Unacceptable Material	Quantitative Statement Parameter No. (m^3)
Quantity Of Unacceptable Material Class U1 To Be Disposed Of Off Site?	N/A
Quantity Of Unacceptable Material Class U2 To Be Disposed Of Off Site?	N/A
Quantity Of Unacceptable Material and Contaminated Land/Hazardous Waste To Be Left In Situ?	N/A

Quantitative Statement	Qualitative Statement
Neutral	During the construction phase a range of waste materials will be generated, including excavated material. It is anticipated that the majority of the waste, where reasonably possible, will be reused and recycled, with the remaining waste materials being disposed of by licensed waste contractors in accordance with the relevant national and EU legislation.

Landscape & Visual Amenity (incl. Light)

Landscape & Visual Amenity (incl. Light)	Profound Positive	Significant Positive	Moderate Positive	Slightly Positive	Imperceptible	Slightly Negative	Moderate Negative	Significant Negative	Profound Negative
Number of Impacts That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	National Landscape Designation / Listing	County Landscape Designation / Listing	Other Areas of Significant Landscape Value/Amenity
Number of Profound / Significant Impacts On Sites Of:	N/A	N/A	N/A

Quantitative Statement	Qualitative Statement
Slightly Negative	The preferred option received a score of 'Minor or Slightly Nnegative.' It was determined that with the inclusion of appropriate mitigation measures, it has greater potential to result in the least noise impact upon noise sensitive receptors.

Biodiversity - Flora & Fauna

Impact on Ecological Receptors	International Importance	National Importance	County Importance	Local Importance (Higher value)	Local Importance (Lower value)
Number of Significant Positive Impacts On Ecological Receptors Of:	N/A	N/A	N/A	N/A	N/A
Number of Significant Negative Impacts On Ecological Receptors Of:	N/A	N/A	N/A	N/A	N/A

Quantitative Statement	Qualitative Statement
Moderately Negative	The preferred option is considered 'Moderately Negative' from a Biodiversity point of view. This will require a crossing over the Abbert River which is part of the Lough Corrib SAC. It will also require the acquisition of greenfield lands and would likely result in the loss of treelines and hedgerows between agricultural fields. The removal of trees and hedgerows could impact upon bat roosts, and foraging success and could also impact upon breeding birds.

Agriculture

Impact on Agriculture Holdings	Significant Positive Impact	Moderate Positive Impact	Slightly Positive Impact	Imperceptible Impact	Slightly Negative Impact	Moderate Negative Impact	Significant Negative Impact	Profound Negative Impact
Impacts On An Agricultural Holdings That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Quantitative Statement	Qualitative Statement
Moderately Negative	The preferred option has received a score of 'Moderately Negative' as it has high potential land take.

Non-Agricultural Properties

Impact on Non-Agriculture Properties	Significant Positive Impact	Moderate Positive Impact	Slightly Positive Impact	Imperceptible Impact	Slightly Negative Impact	Moderate Negative Impact	Significant Negative Impact	Profound Negative Impact
Number of Impacts That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Quantitative Statement	Qualitative Statement
Slightly Negative	The preferred option was scored as 'Minor or Slightly Negative' as it could potentially result in temporary, negative impact of slight significance to existing services in the area during the construction phase due to possible service suspensions. In addition to this, it is anticipated that there may be potential negative vibration impacts to residential and commercial properties, as well as community facilities. The southern section of all Options may require minor acquisition of land at the ties in.

Architectural Heritage

Impact on Architectural Heritage	Significant Positive Impact	Moderate Positive Impact	Slightly Positive Impact	Imperceptible Impact	Slightly Negative Impact	Moderate Negative Impact	Significant Negative Impact	Profound Negative Impact
Number of Impacts That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of Impacts On Sites Of National Importance That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Quantitative Statement	Qualitative Statement
Moderately Negative	The preferred option received a score of 'Moderately Negative' as it passes in close proximity to the Cistercian Abbey (NM No. 166 & GA058-004001) and an associated medieval field system (NM No. 166; PO No. 4/1989; GA058-004004) which are both protected National Monuments. Any large development project in a greenfield setting is likely to discover some new archaeological sites, objects or deposits. The same can be said for any development over a river, though as the Abbert River is part of the Corrib SAC, a clear-span bridge will be required for this project, and consequently it will not be envisaged that there

Archaeological & Cultural Heritage	Impact on Archaeological & Cultural Heritage	Significant Positive Impact	Moderate Positive Impact	Slightly Positive Impact	Imperceptible Impact	Slightly Negative Impact	Moderate Negative Impact	Significant Negative Impact	Profound Negative Impact
	Number of Impacts That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Number Of Impacts On Sites Of National Importance That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Quantitative Statement	Qualitative Statement							
	Moderately Negative	The preferred option received a score of 'Moderately Negative' as it passes in close proximity to the Cistercian Abbey (NM No. 166 & GA058-004001) and an associated medieval field system (NM No. 166; PO No. 4/1989; GA058-004004) which are both protected National Monuments. Any large development project in a greenfield setting is likely to discover some new archaeological sites, objects or deposits. The same can be said for any development over a river, though as the Abbert River is part of the Corrib SAC, a clear-span bridge will be required for this project, and consequently it will not be envisaged that there							

Soils & Geology	Soils & Geology	Profound Positive	Significant Positive	Moderate Positive	Slightly Positive	Imperceptible	Slightly Negative	Moderate Negative	Significant Negative	Profound Negative
	Number of Impacts That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Quantitative Statement	Qualitative Statement								
	Moderately Negative	The preferred option was ranked as 'Moderately Negative' as it will require the development of sections of offline road over a 'Regionally Important aquifer'. The groundwater vulnerability beneath each Option consists of a mix of 'Moderate', 'High' and 'Extreme' vulnerability.								

Hydrology	Hydrology	Profound Positive	Significant Positive	Moderate Positive	Slightly Positive	Imperceptible	Slightly Negative	Moderate Negative	Significant Negative	Profound Negative
	Number of Impacts That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Quantitative Statement	Qualitative Statement								
	Moderately Negative	The preferred option received a score of 'Moderately Negative'. It requires one crossing over the Abbert River, a designated SAC of 'Extremely High' Importance. The provision for a bridge over Abbert River, which forms part of Lough Corrib SAC, could cause potential impacts to upon aquatic fauna and flora both at the construction site and downstream related to instream works or works in close proximity to the SAC. In addition to this, there is potential for temporary, negative impacts to the amenity value of the Abbert River during the construction phase. However, given the scale, and its low importance value (i.e. locally important amenity								

Hydrogeology	Hydrogeology	Profound Positive	Significant Positive	Moderate Positive	Slightly Positive	Imperceptible	Slightly Negative	Moderate Negative	Significant Negative	Profound Negative
	Number of Impacts That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Quantitative Statement	Qualitative Statement								
	Moderately Negative	The preferred option was ranked as 'Moderately Negative' as it will require the development of sections of offline road over a 'Regionally Important aquifer'. The groundwater vulnerability beneath each Option consists of a mix of 'Moderate', 'High' and 'Extreme' vulnerability.								

Overall Scale of Impact	Amended Scale of Impact
Moderately Negative	

Project Appraisal Balance Sheet

Part C: Safety, Physical Activity, Economy, Accessibility and Social Inclusion and Integration Input Sheet

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Safety

Collision Reduction

	Total Collision Reduction	Casualty Reduction: Fatal	Casualty Reduction: Serious	Casualty Reduction: Minor	Value Of Accident Reduction (€m)
What is the Collision/Casualty Reduction Over 30 Years?	17	1	2	33	€ 1.4

Quantitative Statement	Qualitative Statement
Highly Positive	The scheme will reduce the levels of traffic congestion on the road network in the proximity of the existing Liss Bridge, likely providing a corresponding reduction in collisions along this link. By segregating the high-speed regional traffic and the slower local traffic there will be less of a chance of conflict between these two types of road users. In addition to that, the

Security

	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
What is the Expected Impact Of The Project On The Security Of Road Users?	○	○	○	○	○	○	◉	○

Quantitative Statement	Qualitative Statement
Moderately Positive	The new route affords the opportunity to reallocate road space on the existing N61 to provide for non-motorised users. The removal of the majority of the traffic will improve the security of vulnerable road users.

Safety - Overall Scale of Impact	Safety - Amended Scale of Impact
Highly Positive	

Physical Activity

Ambience

	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
What is the expected impact of the project upon journey ambience?	○	○	○	○	○	○	◉	○

Quantitative Statement	Value of Benefit (€m)	Qualitatve Statement
Moderately Positive		The removal of a large proportion of traffic from the existing N63 will improve the ambience for those within these settings and facilities.

Absenteeism

	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
What is the impact of the project on absenteeism?	○	○	○	○	○	○	◉	○

Quantitative Statement	Value of Benefit (€m)	Qualitative Statement
Moderately Positive		A modal shift for shorter trips to non-motorised forms of transport will improve the health of the local population.

Reduced Health Risk

	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
What is the impact of the project on the reduction in relative risk for cyclists and walkers?	○	○	○	○	○	○	◉	○

Quantitative Statement	Value of Benefit (€m)	Qualitatve Statement
Moderately Positive		The upgrade will afford the opportunity to reallocate road space on the existing N63 for pedestrians and cyclists, promoting an increase in walking can cycling, particularly for shorter journeys

Physical Activity - Overall Scale of Impact	Physical Activity - Amended Scale of Impact
Moderately Positive	

Economy

Efficiency and Effectiveness

	Commuting (€m)	Business (€m)	Other (€m)	Indirect Tax (€m)	Residual Value (€m)	Total Benefits (€m)
What Are The Benefits Of The Scheme?			€ 8.2		€ 6.6	€ 14.9

Quantitative Statement
Moderately Positive

Wider Economic Impacts

What Impact Will The Project Have On….	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
Increase Competition In Markets?	○	○	○	○	◉	○	○	○
Lead To Efficiencies In Clustering Of Economic Activity? (Agglomeration Benefits)	○	○	○	○	◉	○	○	○
Attract Inward Investment?	○	○	○	○	◉	○	○	○
Expand Local Labour Supply?	○	○	○	○	◉	○	○	○
Contribute To Urban Regeneration	○	○	○	○	◉	○	○	○

Quantitative Statement	Qualitative Statement
Neutral	Not Assessed

Funding Impacts

What Impact Will The Project Have On….	Don't Know / NA	None	< 10%	10%-30%	> 30%
What Percentage Of Non-Exchequer Funding Is The Project Expected To Receive?	◉	○	○	○	○

Quantitative Statement	Qualitative Statement
Neutral	Not Assessed

Economy - Overall Scale of Impact	Economy - Amended Scale of Impact
Neutral	

Accessibility and Social Inclusion

Deprived Areas

What Impact Will The Project Have On…..	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
Area Based Childhood Programme?	○	○	○	○	◉	○	○	○
Rural Social Scheme?	○	○	○	○	◉	○	○	○

Quantitative Statement	Qualitative Statement
Neutral	Not Assessed

Vulnerable Groups

What Impact Will The Project Have On…..	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
Access To Employment or Vital Infrastructure?	○	○	○	○	○	◉	○	○

Quantitative Statement	Qualitative Statement
Slightly Positive	The preferred option will provide improved access to services, for example, to schools, hospitals, Galway town centre, and onward connectivity.

Accessibility & Social Inclusion - Overall Scale of Impact	Accessibility & Social Inclusion - Amended Scale of Impact
Slightly Positive	

Integration

Transport Integration

What Impact Will The Project Have On…..	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
Connectivity of the Strategic Road Network?	○	○	○	○	○	○	◉	○
Connectivity Between Transport Modes?	○	○	○	○	◉	○	○	○
Sustainable Transport Networks?	○	○	○	○	○	◉	○	○
Access to Other Transport Infrastructure Such As Ports and Airports?	○	○	○	○	○	◉	○	○

Quantitative Statement	Qualitative Statement
Slightly Positive	The preferred option will support transport integration within the wider region, maximising the benefits of previous investment in the N63 corridor, integrating with regional public transport facilities, and improving access to the main ports and airports.

Land Use Integration

What Impact Will The Project Have On…..	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
Objectives of Local and County Development Plans?	○	○	○	○	○	○	◉	○
Strategic Connectivity for High Value Trips?	○	○	○	○	○	○	◉	○
Urban Sprawl?	○	○	○	○	○	○	◉	○

Quantitative Statement	Qualitative Statement
Moderately Positive	The N63 is identified in both the West Regional Planning Guidelines (2010-2022) and the Galway County Development Plan (2015-2021) as a key route.

Geographic Integration

What Impact Will The Project Have On…..	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
Cross Border Connectivity?	○	○	○	○	◉	○	○	○
The Trans European Transport network?	○	○	○	○	○	◉	○	○

Quantitative Statement	Qualitative Statement
Slightly Positive	While the N63 does not form part of the comprehensive TEN-T Network, the proposed improvements will support the objectives of the TEN-T in broad terms by improving the connection to Junction 19 on the M17 TEN-T network.

Other Government Policy Integration

How Will This Project Impact On The Wider Objectives of….	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
National Spatial Strategy/National Planning Framework	○	○	○	○	○	○	◉	○

Quantitative Statement	Qualitative Statement
Moderately Positive	The preferred option directly supports 'Enhanced Regional Accessibility', 'Strengthened Rural Economies and Communities' and 'Sustainable Mobility' which are National Strategic Outcomes of the NPF.

Integration - Overall Scale of Impact	Integration - Amended Scale of Impact
Moderately Positive	

Project Appraisal Balance Sheet

Part D: PABS Summary Table

Project Title	PRS Reference Number	0	Project Description	Scheme Cost (€m)	Date
N63 Liss to Abbey Realignment Scheme	**Modelling Base Year**	2019	Upgrade and realignment of approximately 2.4km of the existing N63 (National Secondary Road) in Abbeyknockmoy Co. Galway	€19.21m	28/07/2021
	Scheme Opening Year	2023			

	Criteria	Quantitative Statement	Summary of Keys Impacts (Qualitative Assessment)	Quantitative Assessment	Monetised (€m over 30 yrs)
Environment	**Air Quality and Climate**	Slightly Positive	Based on the Index of Overall Change in Exposure Calculations, there is likely to be an improvement in air quality with the preferred option. The sensitive ecosystems assessment has shown a minor improvement/no change in air quality with the preferred option. Local air quality will improve for the majority of properties on the existing N63 but deteriorate for those few properties which are now introduced to proximal traffic.	Additional CO_2 (Tonnes): #VALUE! Ratio of CO_2 Do-Min/Do-Some: #VALUE! Index of Overall Change in Exposure NO_2: Small Postive Index Index of Overall Change in Exposure PM_{10}: Small Postive Index *No. of Sensitive Locations Experiencing Impacts That Are:* Sub Ben.: N/A; Mod Ben: N/A; Sli Ben.: N/A; Negligible: N/A; Sli Adv.: N/A; Mod Adv.: N/A; Sub Adv.: N/A	Value of Change in Emissions (€m): N/A
Environment	**Noise and vibration**	Slightly Negative	The preferred option received a score of 'Minor or Slightly Negative.' It was determined that with the inclusion of appropriate mitigation measures, it will have greater potential to result in the least noise impact upon noise sensitive receptors.	No. of Sensitive Receptors Requiring Mitigation: N/A No. of Sensitive Receptors Requiring Mitigation (Not Feasible): N/A	
Environment	**Waste**	Neutral	During the construction phase a range of waste materials will be generated, including excavated material. It is anticipated that the majority of the waste, where reasonably possible, will be reused and recycled, with the remaining waste materials being disposed of by licensed waste contractors in accordance with the relevant national and EU legislation. Exact quantities of waste volumes are no known at this stage; however given the scale, no significant effects from the generation and management of solid waste streams arising from the preferred option, in the context of the existing local and national resource and waste management environment, are anticipated.	Unacceptable Material/Contaminated Land/Hazardous Waste to be ... Disposed of Off Site: U1 [m^3]: N/A; U2 [m^3]: N/A Left in Situ [m^3 land waste]: N/A	
Environment	**Landscape & Visual Amenity (incl. Light)**	Slightly Negative	The preferred option received a score of 'Minor or Slightly Nnegative.' It was determined that with the inclusion of appropriate mitigation measures, it has greater potential to result in the least noise impact upon noise sensitive receptors.	*No. Of Impacts That Are:* PP: N/A; Sig P: N/A; Mod P: N/A; Sli P: N/A; I: N/A; Sli N: N/A; Mod N: N/A; Sig N: N/A; PN: N/A *No. of Profound/Significant Impacts on Sites Of:* National: N/A; County: N/A; Other: N/A	
Environment	**Biodiversity, Flora & Fauna**	Moderately Negative	The preferred option is considered 'Moderately Negative' from a Biodiversity point of view. This will require a crossing over the Abbert River which is part of the Lough Corrib SAC. It will also require the acquisition of greenfield lands and would likely result in the loss of treelines and hedgerows between agricultural fields. The removal of trees and hedgerows could impact upon bat roosts, and foraging success and could also impact upon breeding birds should trees be removed during the breeding season. The provision for a bridge over Abbert River, part of Lough Corrib SAC, could also cause potential impacts related to instream works or works in close proximity to the SAC. This could impact protected species such as the Freshwater White-clawed Crayfish should they be present and could also impact upon aquatic fauna and flora both at the construction site and downstream.	Number of Positive Impacts: II: N/A; NI: N/A; CI: N/A; LI (H): N/A; LI (L): N/A Number of Negative Impacts: II: N/A; NI: N/A; CI: N/A; LI (H): N/A; LI (L): N/A	
Environment	**Agriculture**	Moderately Negative	The preferred option has received a score of 'Moderately Negative' as it has high potential land take.	Impact on Agricultural Holdings that are: Sig P; Mod P; Sli P; I; Sli N; Mod N; Sig N; PN	

Group	Criterion	Rating	Description											Value of Change (€m)
					N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
	Non-Agricultural Properties	Slightly Negative	The preferred option was scored as 'Minor or Slightly Negative' as it could potentially result in temporary, negative impact of slight significance to existing services in the area during the construction phase due to possible service suspensions. In addition to this, it is anticipated that there may be potential negative vibration impacts to residential and commercial properties, as well as community facilities. The southern section of all Options may require minor acquisition of land at the ties in.		Impact on Non-Agricultural Properties									
					Sig P	Mod P	Sli P	I	Sli N	Mod N	Sig N	PN		
					N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
	Architectural Heritage	Moderately Negative	The preferred option received a score of 'Moderately Negative' as it passes in close proximity to the Cistercian Abbey (NM No. 166 & GA058-004001) and an associated medieval field system (NM No. 166; PO No. 4/1989; GA058-004004) which are both protected National Monuments. Any large development project in a greenfield setting is likely to discover some new archaeological sites, objects or deposits. The same can be said for any development over a river, though as the Abbert River is part of the Corrib SAC, a clear-span bridge will be required for this project, and consequently it will not be envisaged that there be in-stream works, either temporary or permanent. If the project proceeds the proposed mitigation of the impacts described above would include archaeological surveys and test excavations, followed by full and detailed investigations of whatever archaeological sites might be discovered by test excavations, along with all analyses, reporting and publication of the results. There will be a need for sensitive landscaping and design for the project as it will involve the construction of embankments and a bridge crossing through a relatively flat river valley with known archaeological and built heritage sites in the vicinity.		Sig P	Mod P	Sli P	I	Sli N	Mod N	Sig N	PN		
				No. of Impacts That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
				No. of Impacts on Sites of National Importance That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
	Archaeological and Cultural Heritage	Moderately Negative	The preferred option received a score of 'Moderately Negative' as it passes in close proximity to the Cistercian Abbey (NM No. 166 & GA058-004001) and an associated medieval field system (NM No. 166; PO No. 4/1989; GA058-004004) which are both protected National Monuments. Any large development project in a greenfield setting is likely to discover some new archaeological sites, objects or deposits. The same can be said for any development over a river, though as the Abbert River is part of the Corrib SAC, a clear-span bridge will be required for this project, and consequently it will not be envisaged that there be in-stream works, either temporary or permanent. If the project proceeds the proposed mitigation of the impacts described above would include archaeological surveys and test excavations, followed by full and detailed investigations of whatever archaeological sites might be discovered by test excavations, along with all analyses, reporting and publication of the results. There will be a need for sensitive landscaping and design for the project as it will involve the construction of embankments and a bridge crossing through a relatively flat river valley with known archaeological and built heritage sites in the vicinity.		Sig P	Mod P	Sli P	I	Sli N	Mod N	Sig N	PN		
				No. of Impacts That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
				No. of Impacts on Sites of National Importance That Are:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
	Soils & Geology	Moderately Negative	The preferred option was ranked as 'Moderately Negative' as it will require the development of sections of offline road over a 'Regionally Important aquifer'. The groundwater vulnerability beneath each Option consists of a mix of 'Moderate', 'High' and 'Extreme' vulnerability.		Number Of Impacts That Are:									
					PP	Sig P	Mod P	Sli P	I	Sli N	Mod N	Sig N	PN	
					N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	Hydrology	Moderately Negative	The preferred option received a score of 'Moderately Negative'. It requires one crossing over the Abbert River, a designated SAC of 'Extremely High' importance. The provision for a bridge over Abbert River, which forms part of Lough Corrib SAC, could cause potential impacts to upon aquatic fauna and flora both at the construction site and downstream related to instream works or works in close proximity to the SAC. In addition to this, there is potential for temporary, negative impacts to the amenity value of the Abbert River during the construction phase . However, given the scale and its low importance value (i.e. locally important amenity site) it is likely to result in an imperceptible impact to the overall amenity value of the river. With respect to flood risk, it is considered unlikely that it would potentially increase flood risk to existing properties. However, further assessments will be required to determine the hydrological effects caused by any new structures or changes to the drainage system.		Number Of Impacts That Are:									
					PP	Sig P	Mod P	Sli P	I	Sli N	Mod N	Sig N	PN	
					N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	Hydrogeology	Moderately Negative	The preferred option was ranked as 'Moderately Negative' as it will require the development of sections of offline road over a 'Regionally Important aquifer'. The groundwater vulnerability beneath each Option consists of a mix of 'Moderate', 'High' and 'Extreme' vulnerability.		Number Of Impacts That Are:									
					PP	Sig P	Mod P	Sli P	I	Sli N	Mod N	Sig N	PN	
					N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Safety	**Collision Reduction**	Highly Positive	The scheme will reduce the levels of traffic congestion on the road network in the proximity of the existing Liss Bridge, likely providing a corresponding reduction in collisions along this link. By segregating the high-speed regional traffic and the slower local traffic there will be less of a chance of conflict between these two types of road users. In addition to that, the scheme will be complaint with the current design standards, this will ensure to achieve the maximum level of road safety. Providing a standard alignment for regional traffic it will offer better safety opportunities as it removes the risk of sub-standard horizontal and vertical alignments.		Collision Reduction Over 30 Years									**Value of Change (€m)**
					Collisions	Casualties	Fatal	Serious	Minor					
					17	36	1	2	33					€1.4
	Security	Moderately Positive	The new route affords the opportunity to reallocate road space on the existing N61 to provide for non-motorised users. The removal of the majority of the traffic will improve the security of vulnerable road users.											
Phy	**Ambience**	Moderately Positive	The removal of a large proportion of traffic from the existing N63 will improve the ambience for those within these settings and facilities.											€0.0

	Absenteeism	Moderately Positive	A modal shift for shorter trips to non-motorised forms of transport will improve the health of the local population.		€0.0
	Reduced Health Risk	Moderately Positive	The upgrade will afford the opportunity to reallocate road space on the existing N63 for pedestrians and cyclists, promoting an increase in walking can cycling, particularly for shorter journeys.		€0.0
Economy	**Transport Efficiency and Effectiveness**		Moderately Positive		**Commute** €0.0; **Business** €0.0; **Other** €8.2; **Value of Change** €14.9; **Indirect Tax** €0.0; **Res. Value** €6.6
	Wider Economic Impact	Neutral	Not Assessed	Neutral	
	Funding	Neutral	Not Assessed	**Expected Percentage of Non-Exchequer Funding** Neutral	
Accessibility	**Deprived Geographic Areas**	Neutral	Not Assessed	**Impact on Deprived Areas** Neutral	
	Vulnerable Groups	Slightly Positive	The preferred option will provide improved access to services, for example, to schools, hospitals, Galway town centre, and onward connectivity.	**Impact on Access to Employment or Vital Infrastructure** Slightly Positive	
Integration	**Transport Integration**	Slightly Positive	The preferred option will support transport integration within the wider region, maximising the benefits of previous investment in the N63 corridor, integrating with regional public transport facilities, and improving access to the main ports and airports.	Slightly Positive	
	Land-Use Integration	Moderately Positive	The N63 is identified in both the West Regional Planning Guidelines (2010-2022) and the Galway County Development Plan (2015-2021) as a key route.	Moderately Positive	
	Geographical Integration	Slightly Positive	While the N63 does not form part of the comprehensive TEN-T Network, the proposed improvements will support the objectives of the TEN-T in broad terms by improving the connection to Junction 19 on the M17 TEN-T network.	Slightly Positive	
	Integration with Other Government Policies	Moderately Positive	The preferred option directly supports 'Enhanced Regional Accessibility', 'Strengthened Rural Economies and Communities' and 'Sustainable Mobility' which are National Strategic Outcomes of the NPF.	Moderately Positive	

Overall Scale of Impact	**Environmental**	Moderately Negative	**Economy**	Neutral	
	Safety	Highly Positive	**Accessibility & Social Incl.**	Slightly Positive	
	Physical Activity	Moderately Positive	**Integration**	Moderately Positive	

Summary of Benefits

Present Value of Benefits (PVB)	€18.13m	**Net Present Value (NPV)**	€3.25m
Present Value of Costs (PVC)	€14.88m	**Benefit to Cost Ratio (BCR)**	1.22

aecom.com