Bonneagar Iompair Éireann
Transport Infrastructure Ireland

# Design Report
# for
# Galway County Council

## N59 Kentfield
## Road Safety Junction Improvement Scheme

*GC/19/18753*

Comhairle Chontae na Gaillimhe
Galway County Council

GALWAY
NATIONAL ROADS
PROJECT OFFICE

Project
Ireland 2040
Building Ireland's
Future

Bonneagar Iompair Éireann
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**Revision History**

| Revision | Date | Comments |
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| | | |

# N59 Kentfield Road Safety Junction Improvement Scheme

# Design Report

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## Executive Summary

The N59 National Secondary Route linking Galway to Clifden via the towns of Moycullen and Oughterard. The section of N59 between Galway City and Moycullen is approximately 7.4km in length and it is along this stretch that the proposed scheme is located. The scheme commences at the townland of Kentfield in the north and extends approximately 245m south where it ties in approximately 65m south of the priority T junction with local road L-5381 known as the Gortacleva junction.

The scheme has been assessed under the AM-STY-06044 Road Safety Inspection and was identified as a Type B, Road Safety Inspection Scheme (RSIS). It was considered as a site having road safety problems needing further assessment to identify a treatable engineering solution. Galway County Council endeavour to implement an engineering solution designed by the Engineering Departments in National Roads Project Office. The design has incorporated TII design standards and technical guidance to develop a scheme that is fit for purpose and satisfies the schemes objectives.

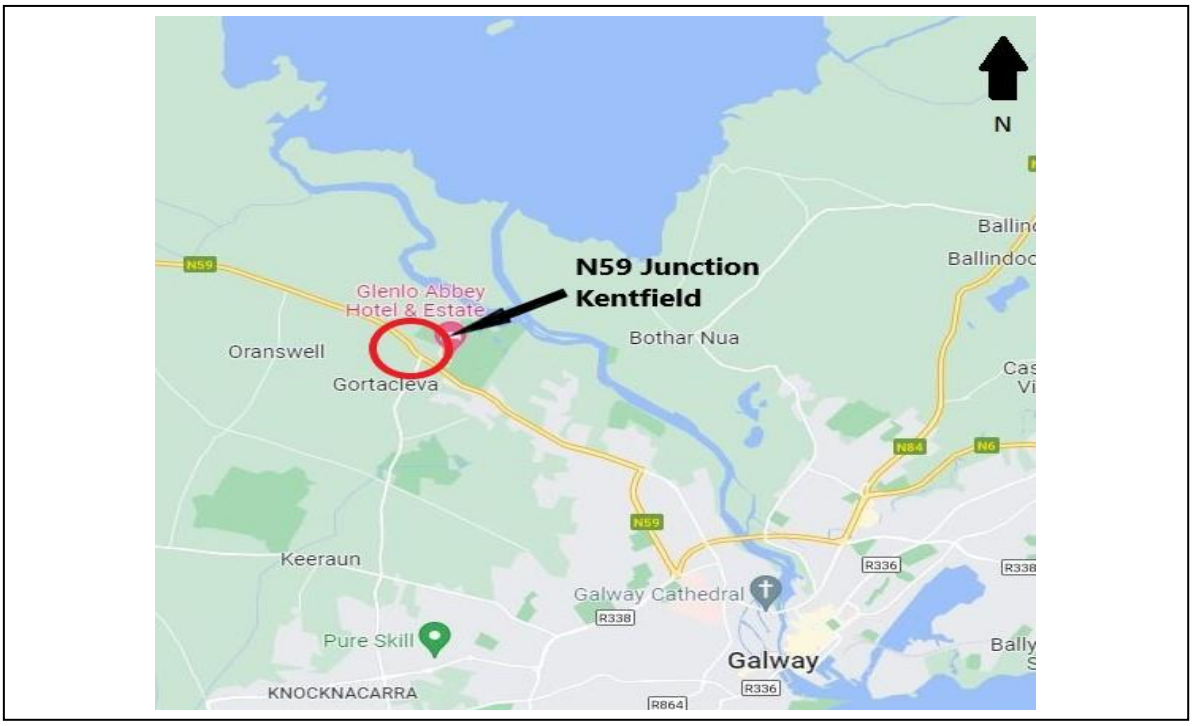
# 1 Introduction & Description

## 1.1 Scheme Description

This design report has been prepared by National Roads Project Office for the proposed N59 Kentfield Junction Improvement Scheme. It has been prepared to meet the requirements of TII DN-GEO-03030 'Guidance on Minor Improvements to Existing Roads'.

This scheme follows on from the submission to and approval of a Feasibility and Options report by Transport Infrastructure Ireland (TII) for the proposed upgrade of the existing N59 Junction. The proposed scheme is located approximately 7km Southeast of Moycullen on the N59. The scheme is approximately 0.245 km long and involves the reconstruction of existing sections of the N59 as well as online realignment to improve sections of sub-standard alignment and provide a new improved intersection with L-5381. The existing alignment has a sub-standard cross section and there are no overtaking opportunities. The scheme was identified as a Type B Road Safety Inspection Scheme (RSIS Scheme) and received Gateway Approval 1 in accordance with TII Publication GE-STY-01037 on 31st August 2022. The preferred option in the Feasibility and Options Report was Option 2 which was 0.350km long, however the Gateway Approval 1 was given to Option 1 which was 0.245km long. Option 1 N59 Kentfield Design Report has been designed in accordance with the relevant standards. This report has been prepared in accordance with the guidance provided in TII Publication DN-GEO-03030 and approval is sought to proceed to Phase 4, Statutory Procedures. A site location map is provided below showing the indicative location of the proposed scheme.

**Figure 1.1: Location of the Scheme**



## Figure 1.2: Kentfield Junction - Eastbound


## Figure 1.3: Kentfield Junction – Westbound

**Figure 1.4: Aerial view of N59 Kentfield Junction & Proposed Scheme Extents**


## 1.2 Existing Road Conditions and Constraints

This section of the N59 falls below the standard of the TII Publications (Standards) in terms of horizontal and vertical alignment, visibility, cross-section, and safety on the route is compromised as a result. In terms of the cross-section, the existing road is sub-standard for the existing 80km/h speed limit. The average lane widths in each direction are approximately 3.0m with no hard shoulder, little or no hard strip, limited verge space and unforgiving roadsides. This makes it unsuitable for use by non-motorised users (pedestrians and cyclists).A selection of photographs of the existing road is provided below in **Figure 1.5 & Figure 1.6**:

## Figure 1.5: Existing Alignment


## Figure 1.6: Existing Alignment

# 2 Collision History

## 2.1 Identification of Problem & Objective

A Network Safety Analysis was carried out by TII as described in TII Publications under TII GE-STY-01022 to identify high collision locations on national road network. An assessment was carried out by the HCL review team of HD15 Site N59GY_295.5. The site description identifies an unimproved legacy road with junction in sag curve with limited forward visibility. Stone walls/trees on either side of road. The identified collision pattern was associated with the junction layout and the hidden dip on approach to the junction. The proposal is an engineering solution with focus on vertical design. The assessment also concluded the identified site is a Type B Road Safety Inspection Scheme (RSIS) that requires design.

**Figure 2.1: Site Location Assessment**

**Assessment of HD15 site N59GY_295.5**

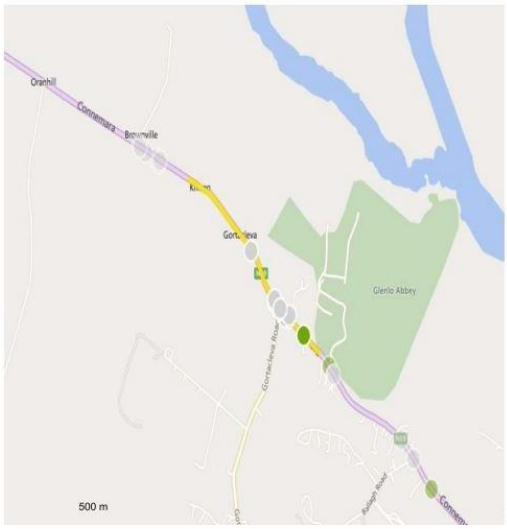
**Site Description**

Unimproved legacy road with junction in sag curve with limited forward visibility. Stone walls/trees on either side of road.

| | |
|---|---|
| **Site ID** | N59GY_295.5 |
| **Local Authority** | Galway County |
| **Route No** | N59 |
| **Chainage** | 294.608 to 295.468 |
| **Length (km)** | 0.9 |
| **Estimated AADT** | 18715 |
| **Injury Collision Rate** | 11.3 |
| **Material Damage Collision Rate** | 39.7 |
| **Threshold** | Above Rate |
| **HCL** | |

Collision Data

| | |
|---|---|
| **Count of Collisions** | 9 |
| **Fatal Collisions** | 0 |
| **Serious Injury Collisions** | 0 |
| **Minor Injury Collisions** | 2 |
| **Material Damage Only Collisions** | 7 |




The latest available recorded collision data supplied by TII is over a 3-year period 2018 -2020. A total of 9 collisions were examined in the site assessment. The analysis showed two minor injury collisions and seven material damage only collisions occurred within this timeframe. The details of both are illustrated below in **Table 2.1 and Table 2.2**. The assessment concluded that an engineering solution was to be implemented by Galway County Council to improve safety for all road users as illustrated in **Table 2.3** below.

### Table 2.1: Non-Serious Injury

| Date & Time Occurred | Collision Severity | Primary Collision Type | Weather Condition | Light Condition | Road Surface Condition |
|---|---|---|---|---|---|
| 21/01/2019 @ 1:25pm | Non-Serious Injury | Rear end, straight | Wet | Day Light | Wet |
| 02/01/2019 @ 11:15am | Non-Serious Injury | Rear end, straight | Dry | Day Light | Wet |

### Table 2.2: Material Damage Only

| Date & Time Occurred | Collision Severity | Primary Collision Type | Weather Condition | Light Condition | Road Surface Condition |
|---|---|---|---|---|---|
| 26/06/2020 @ 5:55pm | Material Damage Only | Rear end, straight | Dry | Day Light | Dry |
| 05/03/2020 @ 1:45pm | Material Damage Only | Head-On | Dry | Day Light | Dry |
| 29/06/2020 @ 5:48pm | Material Damage Only | Tree | Dry | Day Light | Dry |
| 29/12/2018 @ 3:30pm | Material Damage Only | Rear end, straight | Wet | Dark | Wet |
| 15/11/2018 @ 10:03pm | Material Damage Only | Angle, Right Turn | Dry | Dark | Dry |
| 26/07/2018 @ 1:10pm | Material Damage Only | Rear end, straight | Wet | Day Light | Wet |
| 13/02/2018 @10:57pm | Material Damage Only | Wall-Stone | Dry | Dark | Dry |

### Table 2.3: Site Assessment Results

| General Collision Pattern Description | Problem Types | Problem Description | Solution Types | Solution Description |
|---|---|---|---|---|
| Junction | Layout | Hidden Dip | Engineering | Vertical Design |

### 2.1.1 Existing Network

The N59 is part of a strategic link servicing Connemara and the Northwest, currently providing a poor level of service for users and has sections of sub-standard road with a poor safety record.

Following a desktop study of the AADT from the nearest TII traffic counter on the N59 between Oughterard and Moycullen, Knockannranny, Co. Galway (TMU N59 280.0 S) there has been an 8.5% increase in the volume of traffic travelling on this section of the N59 from 2015 to 2019 with an average 2% increase year on year. These results do not incorporate traffic flows from all the local roads between this traffic counter in Roscahill and Galway City. These increases in traffic flows are likely to impact on the number of accidents with future travel demands.

As stated previously, the existing road has several issues which make it substandard regarding horizontal and vertical alignment, sightlines, and cross-section. There are also a multitude of hazards within the clear zone of the road resulting in unforgiving roadsides that can significantly increase the level of injury severity should a vehicle leave the road.

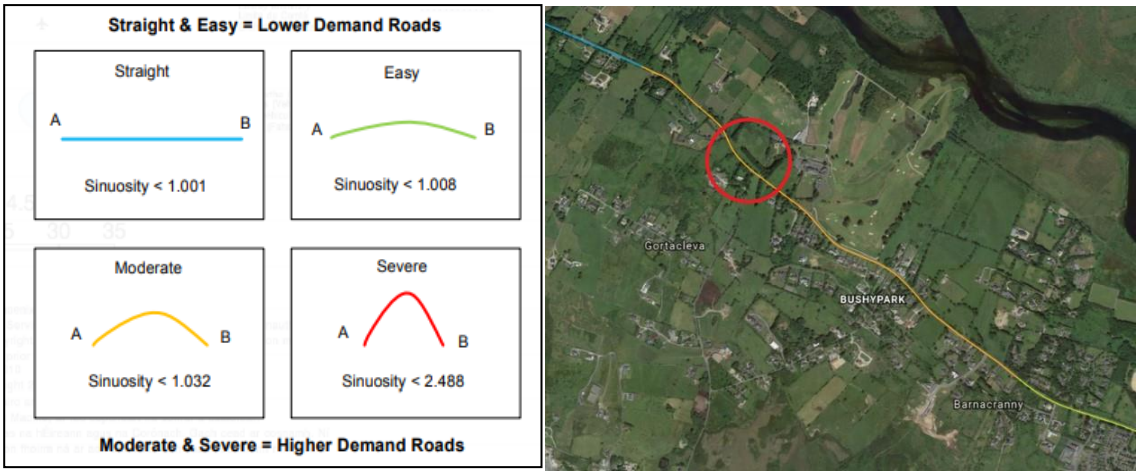
Safety is also compromised by the number of private accesses with insufficient sightlines and below standard dwell area gradients. There is one T- junction known as Gortacleva junction connecting the L-5381 local road with the N59, also along the scheme are three direct accesses connecting properties onto the N59 road. The overriding principle in TII publication DN-GEO-03060, Geometric Design of Junctions (priority junctions, direct accesses, roundabouts, grade separated, and compact grade separated junctions) is that direct access onto national roads should be avoided. The L-5381 junction does not have an adequate dwell area, below standard gradient coupled with poor sight distance which makes this junction a safety hazard.

## 2.2 Road Safety Performance

This section of the N59 falls below the standard of the TII Publications (Standards) in terms of horizontal and vertical alignment, visibility and cross-section, and safety on the route is compromised as a result. Transport Infrastructure Ireland (TII) has carried out a Sinuosity Analysis of the National Road Network and prepared a Sinuosity Map showing the results. Sinuosity has been shown to be a good indicator of horizontal road bendiness and by extension an approximate indicator of the standard of the horizontal alignment. The results for the N59 at Kentfield are shown below in **Figure 2.2** an extract from the TII Sinuosity Map. This analysis shows that the whole of the section of the N59 under consideration has a moderate sinuosity indicating the substandard horizontal alignment of the existing road.

The average lane widths in each direction are approximately 3.0m with no hard shoulder, little or no hard strip, limited verge space and unforgiving roadsides. This makes it unsuitable for use by non-motorised users (pedestrians and cyclists).

**Figure 2.2: TII Sinuosity Map & Legend (data.tii.ie)**




## 2.3 Collision History

Information on collisions that have occurred on this section of road was taken from two sources:

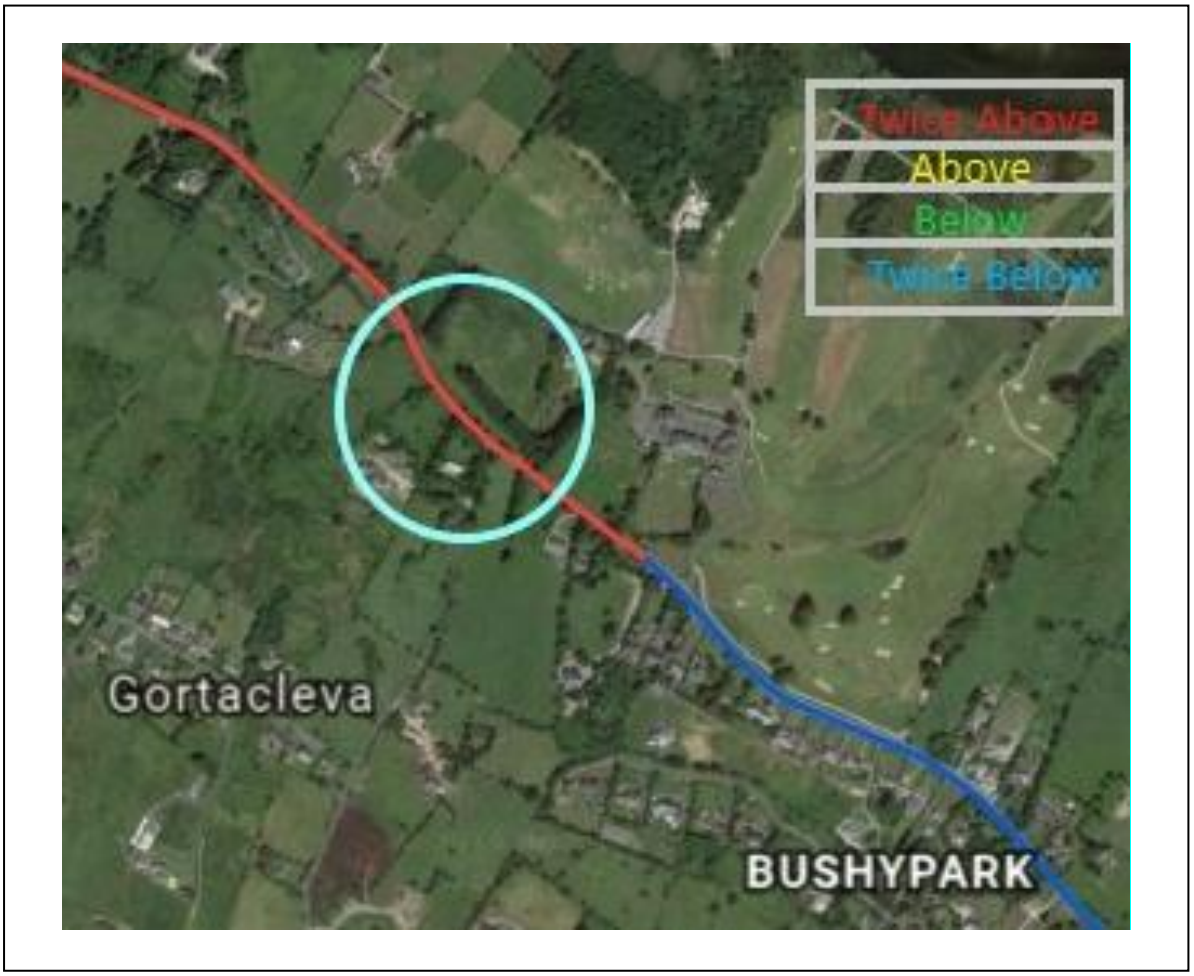
- TII Database,
- RSA Collision Map Viewer.

### 2.3.1 TII Database

Over the period, 2018 to 2020 nine counts of collisions have been recorded on the TII Database along the N59 at the junction. It's clear from the assessment of HD15 that the primary collision types were related to the junction on the N59 with local road L-5381.

Road safety is an important issue, particularly on national primary single carriageway roads. TII produce collision rate analysis for all national routes, with the latest data available for 2015 – 2017. This data indicates that the accident rate on the N59 is twice the expected collision rate through the whole of the scheme. See **Figure 2.3** below.

**Figure 2.3: TII Collision Maps 2015 – 2017 (data.tii.ie)**




### 2.3.2 Road Safety Authority

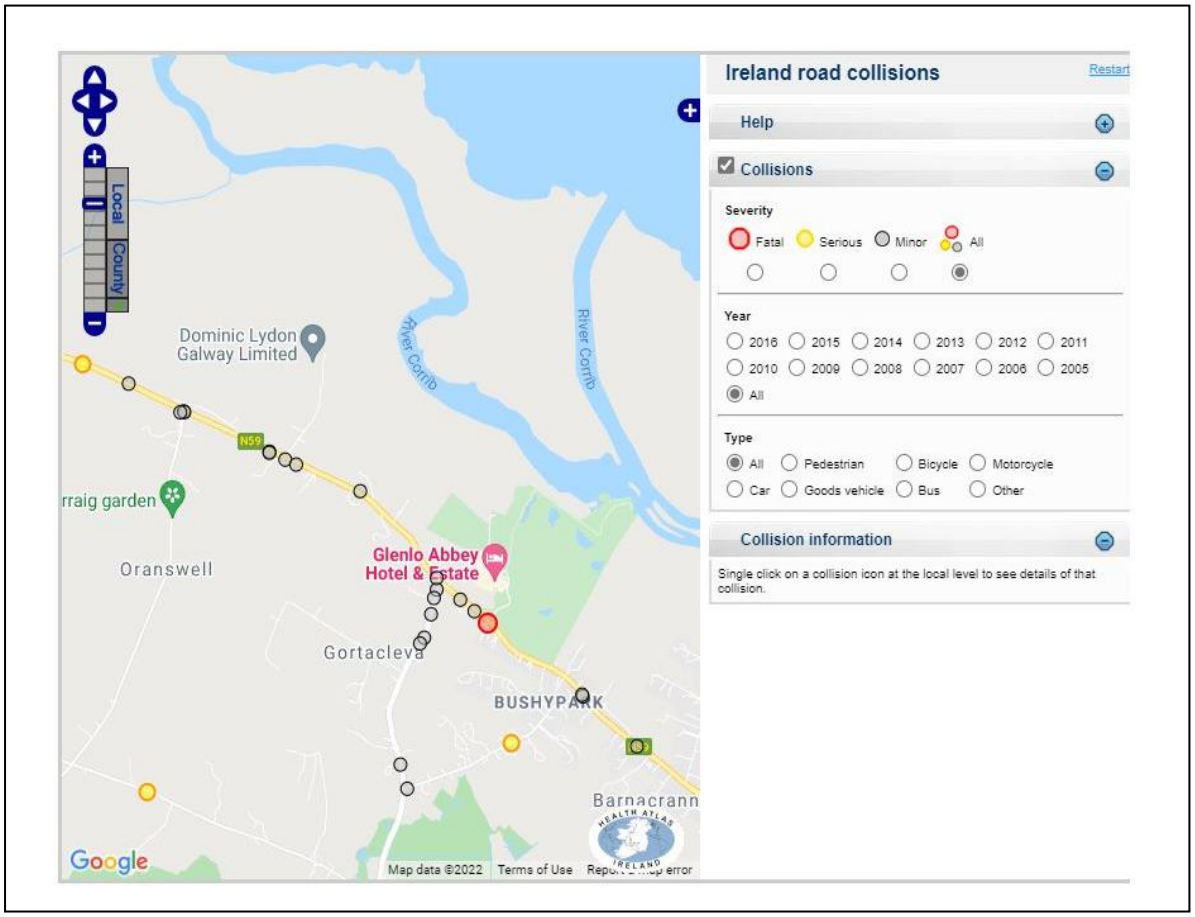
The RSA online collision map viewer records multiply injury collisions at the junction on the N59 between the years 2005 to 2016 inclusive. An overview of the collisions near the N59 Kentfield/Gortacleva junction are illustrated in **Figure 2.4** below in relation to the location, number and type of collisions associated with the junction.

**Table 2.4: TII Mapped Collisions between 2005 - 2016.**

| Fatal | Serious Injury | Minor Accidents |
|---|---|---|
| 1 (2009) | 0 | 9 |

There was another fatal collision on this section of N59 road in 1997 where 3 members of the same family were killed when their car lost control, left the N59 road and struck the entrance pillar of Killeen House.

## Figure 2.4: Road Safety Authority Road Collisions 2005 - 2016




Data post 2016 has not yet being verified by the RSA, however review of the TII 2017 – 2020 collisions suggest that there were two minor collisions in 2019 and seven minor collisions with material damage between 2018 and 2020. As shown in **Table 2.5** above, details of all recorded collisions on this section of the N59.

### Table 2.5: Summary of Recorded Collisions

| Year | Fatal | Serious | Minor | Total |
|---|---|---|---|---|
| 1999 | 3 | 0 | 0 | 3 |
| 2005 | 0 | 0 | 0 | 0 |
| 2006 | 0 | 0 | 0 | 0 |
| 2007 | 0 | 0 | 0 | 0 |
| 2008 | 0 | 0 | 0 | 0 |
| 2009 | 1 | 0 | 0 | 1 |
| 2010 | 0 | 0 | 3 | 3 |
| 2011 | 0 | 0 | 0 | 0 |
| 2012 | 0 | 0 | 2 | 2 |
| 2013 | 0 | 0 | 1 | 1 |
| 2014 | 0 | 0 | 1 | 1 |
| 2015 | 0 | 0 | 1 | 1 |
| 2016 | 0 | 0 | 0 | 0 |
| 2017 | 0 | 0 | 0 | 0 |
| 2018 | 0 | 0 | 4 | 4 |
| 2019 | 0 | 0 | 2 | 2 |
| 2020 | 0 | 0 | 3 | 3 |
| **Total** | **4** | **0** | **17** | **21** |

# 3 Scheme/Safety Objectives

## 3.1 Scheme Need

The N59 is a National Primary Route linking Galway to Clifden via the towns of Moycullen and Oughterard. The proposed scheme is located within the townland of Kentfield along the N59 road at the priority T junction with local road L-5381 known as the Gortacleva junction. The scheme has been assessed under the AM-STY-06044 Road Safety Inspection and was identified as a Type B, Road Safety Inspection Scheme (RSIS). It's considered as a site having road safety problems needing further assessment to identify a treatable engineering solution.

In addition, the existing N59/L-5381 priority T junction is particularly a contributing factor to the high number of rear end collisions at this location. The existing road on this section of the N59 has a restricted capacity due to its limited cross section and sub-standard alignment. These constraints contribute to the absence of full stopping sight distances and no overtaking opportunities. The provision of an improved section of road, designed to contemporary standards and providing safe stopping sight distances, will increase the overall consistency and efficiency of the route and provide safer journeys as well as more reliable and reduced journey times. Access, in terms of Vulnerable Road Users such as pedestrians and cyclists is quite limited, due to the existing road cross section, with little or no verges and no hard shoulders. The provision of an improved section of road, designed to contemporary standards will provide safer access for Vulnerable Road Users (VRUs).

Contributing factors to the collision rates at the existing junction are:

- Inconspicuous junction due to restrictions to driver visibility on the approaches, associated with dense hedgerow bounding relatively narrow roads,
- In rural areas, or where vehicle speeds are high, the consequences of collisions at intersections can be particularly severe,
- High volumes of intersecting traffic increase collision likelihood in event of side road overshoot,
- High speed on the N59 increases the collision severity,
- Narrow cross-sectional width particularly at the junction reduces the scope for evasive action and increase the risk of rear-end and angle collisions.

The existing junction on this section of the N59 has a restricted capacity due to its limited cross section and sub-standard alignment.

Consequently, this report provides a design of the route selected at the Gateway 1 Approval for Phase 2, the Feasibility and Options Report.

## 3.2 Safety Scheme Objectives

The primary objectives of the scheme are identified below:

- To address deficiencies in terms of alignment, cross-section width, curvature and visibility thereby improving the consistency, accessibility and safety of the junction and carriageway on the N59,
- Provide an improved section of road that is 'fit for purpose' for contemporary needs and is consistent with contemporary design standards,
- To improve the safety standards and reduce collision risks by developing a design to contemporary standards including improving and standardising direct private accesses, providing a forgiving roadside, and providing appropriate safety systems where required,
- Provide passively safe boundary fences and walls throughout the scheme, replacing like for like to areas where boundaries are moved or set back,
- To provide safer and more efficient accessibility to the N59 route for the local community accommodated along this section and to minimise disturbance and severance impacts to both residential and agricultural holdings,
- To improve facilities for vulnerable road users (longer term).

## 3.3 Design Objectives

To achieve the overall project objectives identified above, and in accordance with TII DMRB guidance and standards provided in DN-GEO-03030 and DN-GEO-03031, the main design objectives for the scheme are:

- To achieve a localised improvement appropriate to, and consistent with, the characteristics of the adjacent sections of the route, having regard to road user demand, collision history and design speed, as well as identified local constraints and environment,
- To improve road safety through off-line/on-line realignment, keeping land take to a minimum,
- To avoid, reduce and, if possible, remedy any significant adverse impacts on the environment. This objective shall be achieved by undertaking appropriate environmental assessment screening and implementing any specified mitigation measures and best practice guidelines,

TII DN-GEO-03030 states that the following are the primary objectives of Road Safety Improvement Schemes:

"The objective of a Road Safety Improvement Scheme is to achieve a reduction in the frequency, and severity of collision. Road Safety Improvement Schemes should be appropriate to and consistent with the characteristics of the adjacent sections of the route having regard to collision history, road user demand collision history and design speed."

"Road Safety Improvement Schemes should be designed to improve road safety and make better use of the existing road network".

Furthermore, the local realignment of the existing N59 will achieve a reduction in the frequency and severity of collision, through the removal of the hidden dip within the existing road alignment and improved horizontal radii throughout the scheme which will reduce likelihood of rear end collisions.

# 4 Existing Conditions

## 4.1 Existing Road Conditions and Constraints

This section of the N59 and its intersection with local road L-5381 falls below the standard of the TII Publications (Standards) in terms of horizontal and vertical alignment, visibility, cross-section, and safety on the route is compromised as a result. The section has been assessed under the AM-STY-06044 Road Safety Inspection and was identified as a site having road safety problems needing further assessment to identify if there is a treatable engineering solution. A selection of photographs of the existing road is provided below in **Figure 4.1** and **Figure 4.2** below to illustrate the existing conditions:

**Figure 4.1: Junction Layout**


**Figure 4.2: Hidden Dip on approach to junction from Moycullen direction (West)**

## 4.2 Speed

A traffic survey was conducted and as part of the survey, the mean speed and 85th percentile speeds were calculated. The posted speed limit at this section of the N59 is 80km/hr. The operational speed of this section of the network is 70.9km/hr. The 85th percentile speed in the northbound carriageway was 76.6km/hr and the 85th percentile speed in the southbound carriageway was 86.9km/hr.

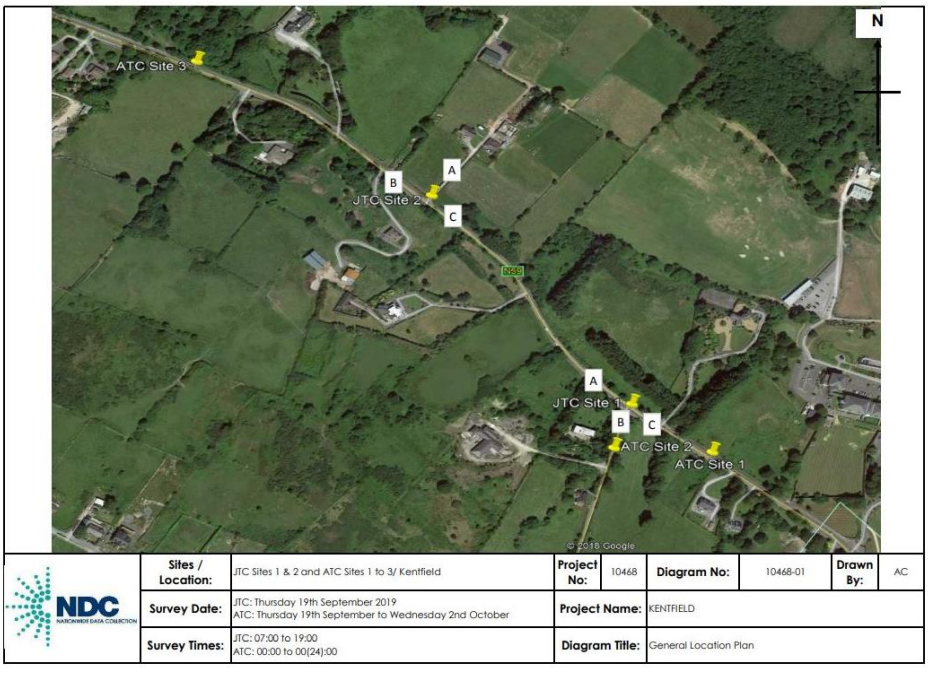
The posted speed limit on the L-5381 is 50km/hr. The operational speed is 38.7km/hr with an 85th percentile speed in the northbound carriageway of 50.4km/hr and 85th percentile speed in the southbound carriageway of 45.5km/hr.

## 4.3 Traffic Volumes

A traffic survey and assessment were carried out in October 2019 by Nationwide Data Collection (NDC) on the N59 / L-5381 to identify a concise and accurate traffic flow pattern operating in the area. **Figure 4.3** illustrates the location of the various surveys conducted. The survey work consisted of three elements.

- Junction Turning Counts,
- Pedestrian Crossing Counts,
- Automatic Traffic Counts.

**Figure 4.3: Traffic Survey Location**



### 4.3.1 Junction Turning Counts

Junction turning counts were undertaken at two sites as per **Figure 4.3**. All sites were surveyed using telescopically mounted video cameras from which the information was subsequently extracted.

**Table 4.1: Junction Turning Counts**

| Site No. | Location | Day / Date |
|---|---|---|
| 1 | N59(N) / L-5381 / N59(S) | Thursday 19th September 2019 |
| 2 | L13242 / N59(N) / N59(S) | |

### 4.3.2 Pedestrian Crossing Counts

Two-way pedestrian crossing counts were undertaken in 15-minute intervals and tabulated with both hourly and period totals. Survey was conducted on Thursday 19th September 2019 between the hours of 07:00am – 19:00pm. See **Figure 4.3** above for location.

- Site No 1 – Total of 2 Pedestrians recorded on arm B during the survey,
- Site No 2 – Total of 1 Pedestrian recorded on arm A during the survey.

### 4.3.3 Automatic Traffic Counts

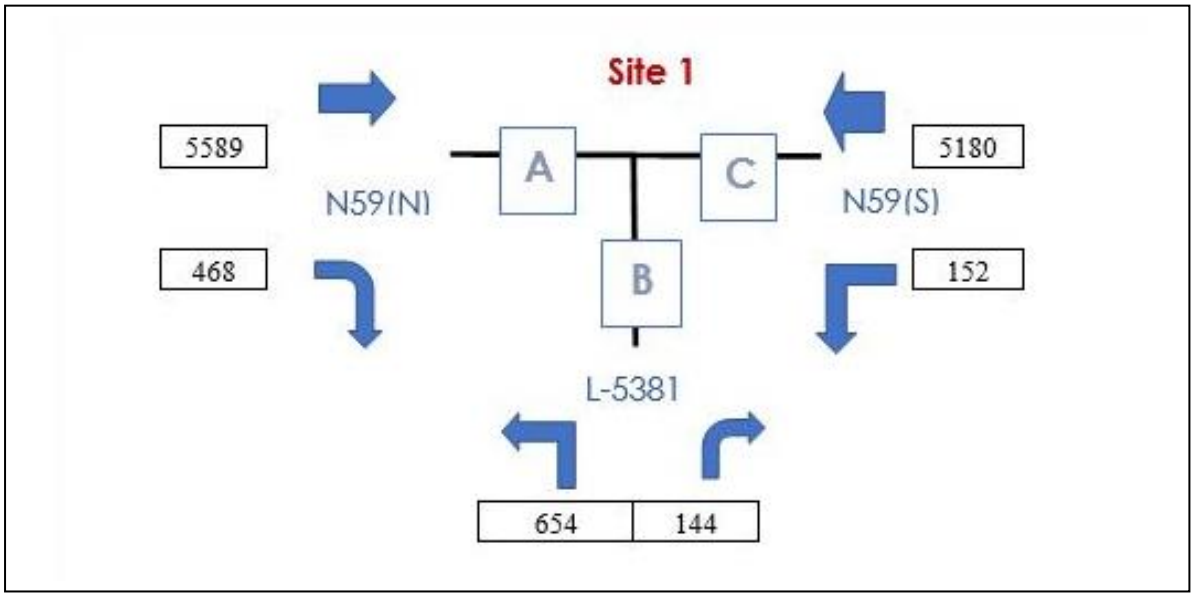
Metro count 5600 series automatic counters, attached to pneumatic tubes, were used at all the survey sites. Data was collected in both directions at all locations, with one counter being used for single carriageway sites (1 lane per direction). The survey was conducted from Thursday 19th September to Wednesday 2nd October 2019. The results were provided in excel, in hourly totals.

**Table 4.2: Automatic Traffic Counts**

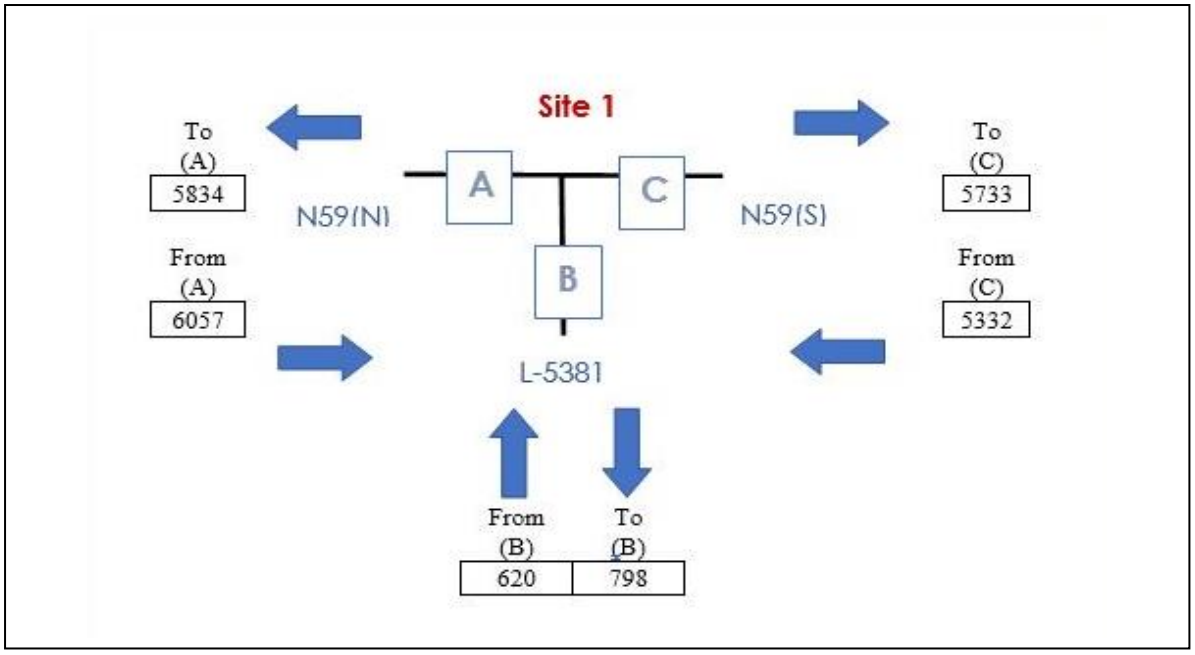
| Site No. | Location | Day/Date |
|---|---|---|
| 1 | N59, south of JTC Site 1 | Thursday 19th September to Wednesday 2nd October 2019 |
| 2 | L-5381 | |
| 3 | N59, north of JTC Site 2 | |

The final AADT for this section of the N59 was calculated from these results which gave an AADT of 13,405 vehicles per day with 7.8% HCV's.

### Figure 4.4: Junction Traffic Counts Site 1 (Gortacleva Junction)




### Figure 4.5: Accumulative Junction Traffic Counts Site 1 (Gortacleva Junction)




### Table 4.3: N59 Annual Average Daily Traffic (AADT)

| Road | AADT | % HGV's |
|---|---|---|
| N59 | 13,405 | 7.8 % |

## 4.4 Horizontal Alignment

The existing N59 horizontal geometry has two number horizontal radii for this section of road that are substandard for a design speed of 85km/hr.

- Radii 1 is 140m,
- Radii 2 is 300m.

The existing horizontal radii is considerably below the standard required as per Table 10.3 of TII Publications DN-GEO-03031. The desirable minimum R with superelevation of 5% is 510m for a design speed of 85km/h.

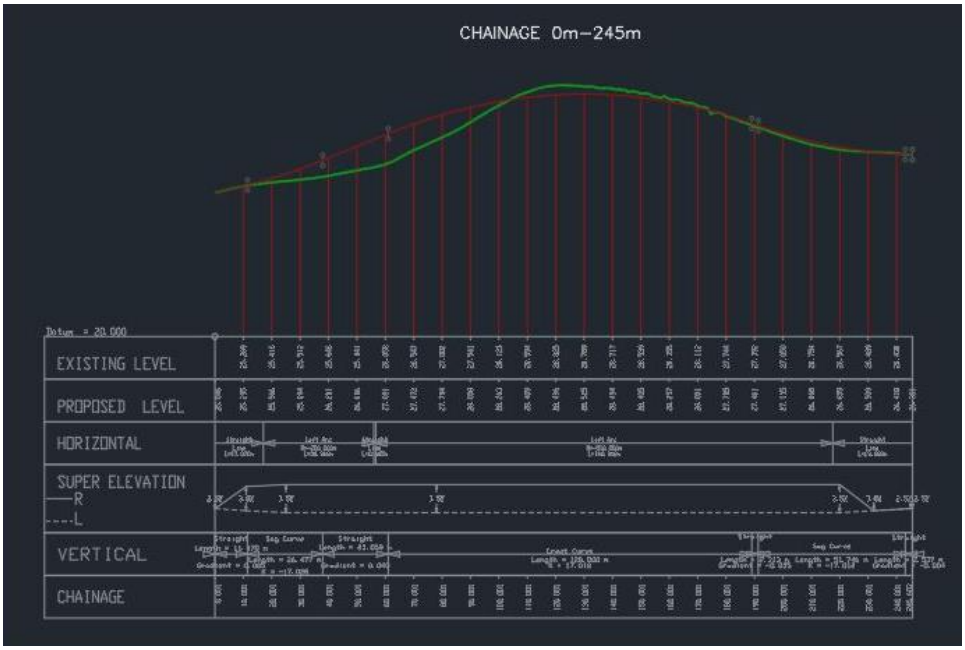
## 4.5 Vertical Alignment

The existing N59 vertical alignment contains a sag and crest curve that is below standard as illustrated with the green line as shown in **Figure 4.6**. The existing crest and sag K values falls below the standard required as per Table 10.3 TII Publications DN-GEO-03031

- Existing Crest K value is 10
- Existing Sag K value is 12

The existing vertical radii is considerably below the standard required as per Table 10.3 of TII Publications DN-GEO-03031. The desirable minimum crest K value is 55 for a design speed of 85km/h and the desirable minimum sag K value is 26 for a design speed of 85km/hr.

**Figure 4.6: Vertical Alignment**



## 4.6 Cross Section, Crossfall & Superelevation

### 4.6.1 Cross Section

The existing cross section of the N59 varies along this section. The carriageway varied from 5.9 m to 6.8m wide with no hard shoulder and verge width varying from 0.3m to 1.2m. There is edge of carriageway road markings but without a hard strip provided. The width between the edge of carriageway markings is as low as 5.9m at some locations.

### 4.6.2 Crossfall

The crossfall on the N59 varies from 1.5% to 3% on areas where normal camber (2.5%) would be expected.

### 4.6.3 Superelevation

There is some nominal superelevation at the tighter horizontal bends, it is not developed consistently and varies from 2% to 3.5% in an inconsistent manner.

## 4.7 Junctions & Accesses

There are a few existing agricultural and domestic accesses which are located along this section of the N59 which are to be rationalised and maintained. There is one priority junction along this section of the N59. Currently an at grade simple T- junction connects the N59 with local road L-5381, the junction is known as the Gortacleva junction.

## 4.8 Facilities for Vulnerable Road Users

This is a rural section of the N59, there are currently no dedicated facilities for pedestrians or cyclists. Pedestrians and cyclists must use the carriageway as there is no hard shoulder or hard strips. There is little or no verge provided along this section with stone wall and hedgerow forming the roadside boundary. The only place for refuge for pedestrians is private accesses.

## 4.9 Visibility & Sightlines

Forward visibility is limited due to the horizontal and vertical curves. There are no opportunities for overtaking and it is prohibited using a solid centre line. The stopping sight distance is as low as 45m at some sections which would equate to a design speed of 42km/hr. Sightlines from private accesses are limited due to the alignment and the vegetation at the road edge. Some are as low as 20m which is hazardous for access users and mainline users.

# 5 Environmental, Archaeological and Other Constraints

## 5.1 Appropriate Assessment & Natura Impact Assessment

MKO were appointed to provide the information necessary to allow the competent authority to conduct an Article 6(3) Appropriate Assessment of the proposed road improvement works to the N59 National Secondary Road at Kentfield, Co. Galway.

Screening for Appropriate Assessment is required under Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive). Where it cannot be excluded that a project or plan, either alone or in combination with other projects or plans, would have a significant effect on a European Site then same shall be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives. The project is not directly connected with, or necessary for, the management of any European Site. Consequently, the project has been subject to the Appropriate Assessment Screening process.

It cannot be excluded beyond reasonable scientific doubt, in view of best-scientific knowledge, on the basis of objective information, and in light of the conservation objectives of the relevant European Sites, that the proposed development, individually or in combination with other plans and projects, would be likely to have a significant effect on Lough Corrib SAC (000297), Lough Corrib SPA (004042), Galway Bay Complex SAC (000268), and Inner Galway Bay SPA (004031).

It can be concluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will not have a significant effect on any other European Site.

The Appropriate Assessment has identified there is a potential pathway for significant effect on Lough Corrib SAC, Lough Corrib SPA, Galway Bay Complex SAC, and Inner Galway Bay SPA, which results in mitigation measures to close this pathway and measures are further developed in the format of a Natura Impact Statement.

The Natura Impact Statement (NIS) has been prepared in accordance with the European Commission's Assessment of Plans and Projects significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2021) and Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (EC, 2018) as well as the Department of the Environment's Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DoEHLG, 2010) and the Appropriate Assessment Screening for Development Management. Office of the Planning Regulator, Dublin 7, Ireland OPR (2021)

The detailed assessment, it is concluded that the proposed development will not result in any residual adverse effects on any of the European Sites, their integrity, or their conservation objectives, when considered on its own. There is, therefore, no potential for the proposed development to contribute to any cumulative adverse effects on any European Site, when considered in combination with other plans and projects. In the review of the projects that was undertaken, no connection that could potentially result in additional or cumulative impacts was identified. Neither was any potential for different (new) impacts resulting from the combination of the various projects and plans in association with the proposed

development. Taking into consideration the reported residual impacts from other plans and projects in the area and the predicted impacts with the current proposal, no residual cumulative impacts have been identified with regard to any European Site.

The NIS has provided an assessment of all potential direct or indirect adverse effects on European Sites, whether considered individually, or in combination with other plans and projects.

Where the potential for any adverse effect on any European Site has been identified, the pathway by which any such effect may occur has been robustly blocked through the use of avoidance, appropriate design, and mitigation measures, as set out within the report. The measures ensure that the construction and operation of the proposed development will not adversely affect the integrity of European Sites.

Therefore, it can be objectively concluded that the proposed development, individually, or in combination with other plans or projects, will not adversely affect the integrity of any European Site. See Appendix G for full report.

## 5.2 Ecological Impact Assessment

MKO were commissioned to conduct an Ecological Impact Assessment (EcIA) of proposed road improvement works to the N59 National Secondary Road at Kentfield, Co. Galway (Grid Reference: M 26518 28358)

The EcIA includes an accurate description of all aspects of the proposed development during construction, operation, and decommissioning (where relevant). It then provides a comprehensive description of the baseline ecological environment, which is based on an appropriate level of survey work that was carried out in accordance with the most appropriate guidelines and methodologies. The EcIA then completes a thorough assessment of the impacts of the proposed development on biodiversity. Where likely ecologically significant effects are identified, measures are prescribed to avoid, minimise, or compensate for such effects.

A multidisciplinary ecological walkover survey was conducted on the 16th of May 2023 by Patrick O'Boyle and Keith Costello of MKO in line with NRA (2009) guidelines ('Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes'). This survey provided baseline data on the ecology of the study area and assessed whether further, more detailed habitat or species-specific ecological surveys were required. The multidisciplinary ecological walkover surveys comprehensively covered the entire study area.

Habitats were classified in accordance with the Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). Habitat mapping was undertaken with regard to guidance set out in 'Best Practice Guidance for Habitat Survey and Mapping' (Smith et al., 2011). Plant nomenclature for vascular plants follows 'New Flora of the British Isles' (Stace, 2010), while mosses and liverworts nomenclature follows 'Mosses and Liverworts of Britain and Ireland - A Field Guide' (British Bryological Society, 2010).

The walkover surveys were designed to detect any protected habitats or species, including any suitable habitat for protected species that may occur in the vicinity of the proposed

development. Incidental sightings/observations of birds and additional fauna were noted during the site visit.

During the multidisciplinary surveys, a search for Invasive Alien Species (IAS), with a focus on those listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2011), was also conducted.

The survey was undertaken during the optimal time of year for habitat surveys, i.e., April to September (Smith et al., 2011) and all habitats within the site were readily identifiable at the time of the site visit. A number of various surveys were undertaken:

- Faunal Survey
- Bat Roost Survey
- Bat Activity Survey
    - Manual Survey
    - Dusk Emergence
    - Walked Transect
- Ground Level Static Survey

The detailed assessment provided in the Ecological Impact Assessment Report has concluded that the proposed development will not result in any residual adverse effects on the biodiversity, flora, and fauna of the existing environment, when considered on its own. There is therefore no potential for the proposed development to contribute to any cumulative adverse effects on any European Site when considered in combination with other plans and projects. In the review of the projects that was undertaken, no connection that could potentially result in additional or cumulative impacts was identified. Neither was any potential for different (new) impacts resulting from the combination of the various projects and plans in association with the Proposed development. Taking into consideration the reported residual impacts from other plans and projects in the area and the predicted impacts with the current proposal, no residual cumulative impacts have been identified with regard to the biodiversity, flora, and fauna of the existing environment.

Following consideration of the residual effects (post incorporation of best practice measures) it is noted that the proposed development will not result in any significant effects on the biodiversity, flora and fauna of the existing environment. The potential residual impacts on ecological receptors will not be significant and no potential for the proposed development to contribute to any cumulative impacts on biodiversity when considered in combination with other plans and projects was identified. Provided that the proposed development is constructed and operated in accordance with the design and best practice that is described within the EcIA report, significant effects on biodiversity are not anticipated at any geographical scale. See Appendix G for full report.

## 5.3 Environment Impact Assessment

MKO were commissioned to conduct an Environmental Impact Assessment Screening for N59 Road Safety Junction Improvement Scheme and directed by Catherine Johnson (MKO) Environmental Scientist.

The Environmental Impact Assessment (EIA) Directive (Directive 2011/92/EU) as amended by Directive 2014/52/EU, aims to determine the likely significant effects of a project on the environment. EIA screening determines whether an EIA is required for a specified project.

Schedule 5 of the Planning and Development Regulations 2001 (as amended) identifies development for the purposes Part 10 of the Planning and Development Act 2000 i.e., prescribed classes of development requiring EIA where a development meets or exceeds the thresholds set out under Schedule 5 (Part 1 and Part 2) mandatory EIA is required and, as such, there is no screening determination required. Where a development is of a class included for in Schedule 5 but is sub threshold the development shall be subject to a preliminary examination and if required, screening, to determine (i.e., a Screening Determination) if it would or would not be likely to have significant effects on the environment.

The EIA Screening concluded based on a preliminary examination of the nature, size or location of the development, is there a real likelihood of significant effects to the environment, which there is no real likelihood of significant effects to the environment and an EIAR is not required. The preliminary examination as required by Article(s) 103 and 120 of the Planning and Development Regulations 2001 (as amended) has concluded that formal EIA Screening is not required. See Appendix G for full report.

## 5.4 Cultural Heritage Constraints

A cultural heritage assessment to assess whether there is potential for significant archaeological or cultural heritage impacts by the proposed scheme has been carried out by Jerry O' Sullivan TII Project Archaeologist in January 2020. It concluded that the proposed project would have no impact on any known archaeological site or monument, as the nature of the scheme is improvement works as part of a safety scheme with minimal land take to carry out the works. Based on the available information, it is anticipated that the proposed scheme will have no direct impacts on any known archaeological sites. See Appendix H for full report.

# 6 Proposed Design

## 6.1 General

The provision of a safe and efficient network of national roads is a key function of TII and local authorities. Under the Road Safety Strategy 2021 – 2030, published by the Road Safety Authority (RSA), it is a primary objective to reduce the number of deaths and serious injuries on Irish roads by 50% over the next 10 years.

To facilitate safety measures, the proposed design has adhered to the TII's Publications standards and guidelines. Under TII policy it is also mandatory for an independent safety audit to be carried out on all new or improved national road schemes. The principal factors affecting the safety of the road schemes include:

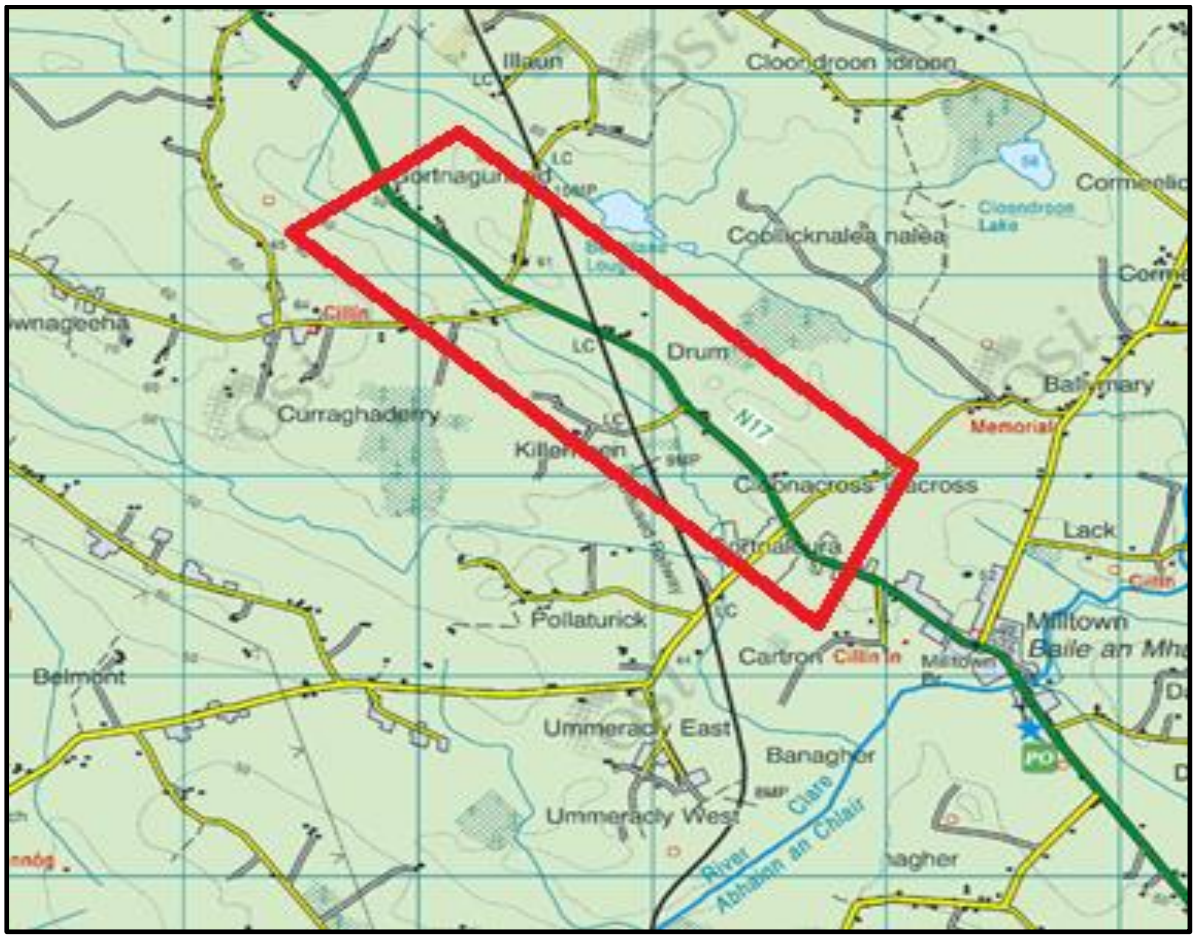
- Type and volume of traffic,
- Design speed and overtaking opportunities,
- Horizontal and vertical alignments,
- Visibility and stopping sight distances,
- Junctions including their type and consistency as well as their proximity,
- Road surfacing and road furniture,
- Road signage, road markings and route lighting,
- Private access control,
- Facilities for pedestrians, cyclists, and equestrians,
- Impacts from landscaping and other surroundings,
- Construction traffic management, and
- Any combination of the above.

At the Feasibility and Options Stage/Gateway 1 Approval, 3 route options were presented, each consisting of different scheme lengths.

- Option 1 - 245m in length,
- Option 2 - 350m in length,
- Option 3 - 945m in length.

Option 2 was presented as the preferred option however Option 1 was successful at getting Gateway 1 approval. The proposed design is to provide a Type 2 single carriageway as per DN-GEO-03036 and CC-SCD-00002. This consists of 2 x 3.5m carriageway and 0.5m hard strips and varied verge widths on both sides of the carriageway. The realignment is predominantly online realignment widening. The realignment will maintain access to existing domestic and agricultural properties, some properties will be reset back to achieve the required setback distance from the carriageway. Facilities for vulnerable road users will not be provided within the scope of works for this realignment, however a 3m wide verge on RHS and 8m wide verge on LHS will be provided along the carriageway where possible to provide sufficient sightlines for the direct accesses. At the tie-in points a reduced and tapering tie -in is proposed for both the carriageway and verge width. A Departure from Standard has also been prepared for that.

## Figure 6.1: OSI map showing scheme location (denoted by red box)



## 6.2 Land Acquisition

Land acquisition will be required for the offline section and widening of some areas along the on-line section. The land to be acquired will be a combination of the dwell areas of domestic entrances and agricultural land. Accommodation works will be required at each domestic and agricultural property that's affected by the proposed scheme. The property land take has been developed to ensure that sufficient land is included to allow for construction and future maintenance of the scheme.

Land and property owners will be among those most affected by the construction of this scheme. Impacts will range from encroachments onto property lines, loss of lands through acquisition, minor alterations of direct accesses to the new realignment. It is possible to maintain these impacts to a minimum by,

- Agreeing and providing accommodation works in an efficient manner.
- Maintaining regular communication between land/property owners and Local Authority.
- Keeping land acquisition to a minimum, at property interfaces.
- As far as practicable, maintaining access or provision of alternatives during the construction phase, and land acquisition phase.
- As far as practicable, maintain all existing utilities or provision of alternatives during the construction phase.
- Employing best practice construction methods and efficient traffic management.

### 6.2.1 Summary of Land Acquisition Requirements

Land take due to construction of the scheme will be required for various reasons including:

- Road construction,
- Grass verges,
- Embankments and cuttings,
- Local road upgrade and realignment,
- Accommodation works for entrances and access houses and properties,
- Drainage,
- Landscaping and planting requirements.

### 6.2.2 Affected Property Owners

The proposed scheme will impact on approximately 3 properties, summary details is shown in **Table 6.1** and **Figure 6.1** below. The holdings of land and property owners affected by the N59 Kentfield realignment scheme was determined through Land Registry searches using www.landdirect.ie on-line interactive database and by reference to local knowledge and landowner consultation conducted by Galway County Council NRPO office. This information has been used to establish the landownership database for the scheme.

## Figure 6.1: Land Acquisition

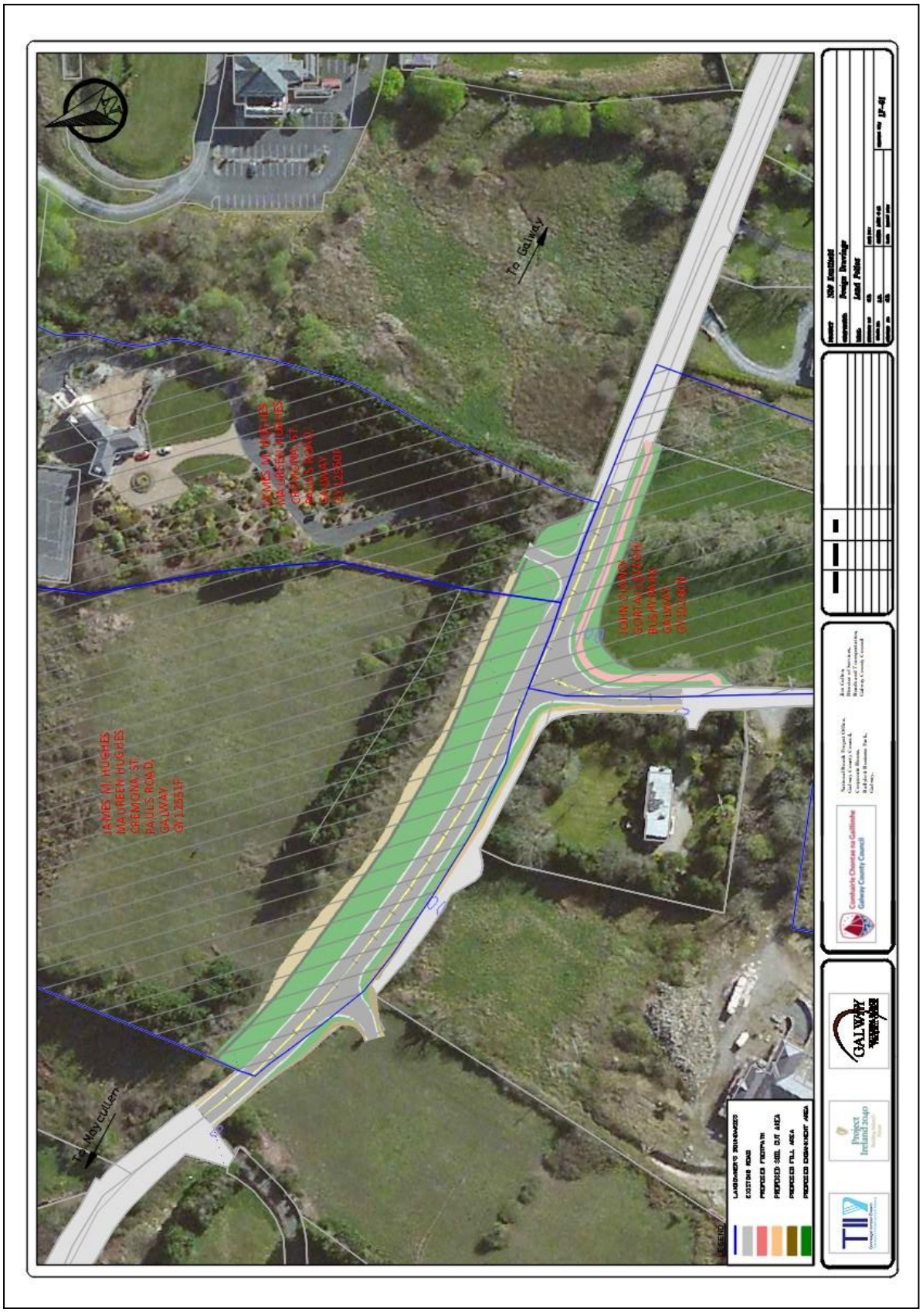


**Table 6.1: Impacted Property Owners**

| Folio | Owner | Land Type | Temporary Land Take (HA) | Permanent Land Take (HA) | Roadbed (Ha) |
|---|---|---|---|---|---|
| GY12551F | James M. Hughes & Maureen Hughes, Cremona St. Paul's Road Galway | Agricultural | 0.12628 | 0.22545 | 0.12235 |
| GY21025F | James M. Hughes & Maureen Hughes, Cremona St. Paul's Road Galway | Residential | 0.06872 | 0.03232 | 0.01182 |
| GY10260 | John Clancy, Gortacleva, Bushypark, Galway | Agricultural | 0.16879 | 0.06542 | 0.10048 |

## 6.3 Horizontal Alignment

The mainline horizontal and vertical alignment has been designed to meet the desirable minimum standards as set out in TII Publications DN-GEO-03031 where possible. The alignment was designed using Nova point design package for an 85km/h design speed on the Type 2 single carriageway ensuring the related design speed parameters given in table 1.3 TII Publications DN-GEO-03031 were satisfied and compliance was achieved for the desirable minimum requirements where possible. See in **Table 6.2** below the proposed horizontal alignment design and **Table 6.3** below for the proposed vertical alignment design.

The horizontal alignment design has 1 no. 255m radii with a superelevation of 3.5% and 1 no. 510m radii with a superelevation of 3.5%. As per table 1.3 of DN-GEO-03031 Rural Road Link Design, the 255m radii is two steps below desirable minimum for an 85km/h design speed with a 7% superelevation, however, the 7% superelevation was reduced to 3.5% by the designer due to the short length of the radii and also to provide driver comfort within the design. The same design principle was applied to the second radii curve within the design, the 510m radii curve is the desirable minimum R with superelevation of 5%, however the designer decided to reduce the superelevation to 3.5% due to the short length of the radius and the nature of the scheme. It is difficult to attain desirable minimum radius with superelevation of 5% over such a short scheme. There is no allowance for full overtaking sight distance for this scheme due to the short scheme length. A relaxation has been applied by the designer for the horizontal alignment within this scheme. A departure from standard is required as full stopping sight distance for a low object cannot be achieved.

### Table 6.2: Horizontal Alignment Design

| Chainage | | Horizontal Element | Radius (m) | Length (m) | Desirable Minimum | Comment |
|---|---|---|---|---|---|---|
| 0+000.000 | 0+006.282 | Line | | 6.282 | | |
| 0+006.282 | 0+050.487 | Arc | -255 | 44.205 | 510 | Two Steps below & 3.5% Superelevation applied |
| 0+050.487 | 0+052.358 | Line | | 1.871 | | |
| 0+052.358 | 0+221.277 | Arc | -510 | 168.919 | 510 | Desirable minimum R with Superelevation of 3.5% applied |
| 0+221.277 | 0+245.251 | Line | | 23.974 | | |

## 6.4 Vertical Alignment

The vertical alignment will have curves that are in accordance with table 1.3 of DN-GEO-03031 Rural Road Link Design. Design speed of 85km/hr with one step below desirable min crest K value and two steps below desirable min sag K value. It's difficult to meet the desirable minimum criteria for the design speed, due to the short extent of the proposed scheme. It is anticipated soil cut of 3,329m3 and soil fill of 3,542m3 is required to achieve the proposed vertical alignment.

Vertical alignment involves tie in at two locations, the northern end at Ch. 0+000m and the southern end at Ch. 0+245m. The longitudinal gradient for the proposed scheme varies from -3.483% to 4.060%. The vertical alignment was selected to eliminate the hidden dip within the vertical alignment, resulting in considerable fill between Ch. 0+020m and Ch. 0+105m. There will be a small cut between Ch. 0+105m and Ch. 0+170m. A departure from standard is required as full stopping sight distance for a low object can't be achieved.

**Table 6.3: Vertical Alignment Design**

| Chainage | | Vertical Alignment | Radius | K Value | Grade | Desirable Minimum K Value | Comment |
|---|---|---|---|---|---|---|---|
| Start (m) | End (m) | | | | | | |
| 0+000.001 | 0+11.367 | Line | | | 2.495 | | |
| 0+11.367 | 0+037.986 | Sag | -1702.792 | -17 | | 26 | Two Steps Below |
| 0+037.986 | 0+060.594 | Line | | | 4.060 | | |
| 0+060.594 | 0+188.825 | Crest | 1701.230 | 17 | | 55 | Two Steps Below |
| 0+188.825 | 0+190.927 | Line | | | -3.483 | | |
| 0+190.927 | 0+242.719 | Sag | -1701.176 | -17 | | 26 | Two Steps Below |
| 0+242.719 | 0+245.230 | Line | | | -0.436 | | |

## 6.5 Alignment Characteristics

### 6.5.1 Cross Section

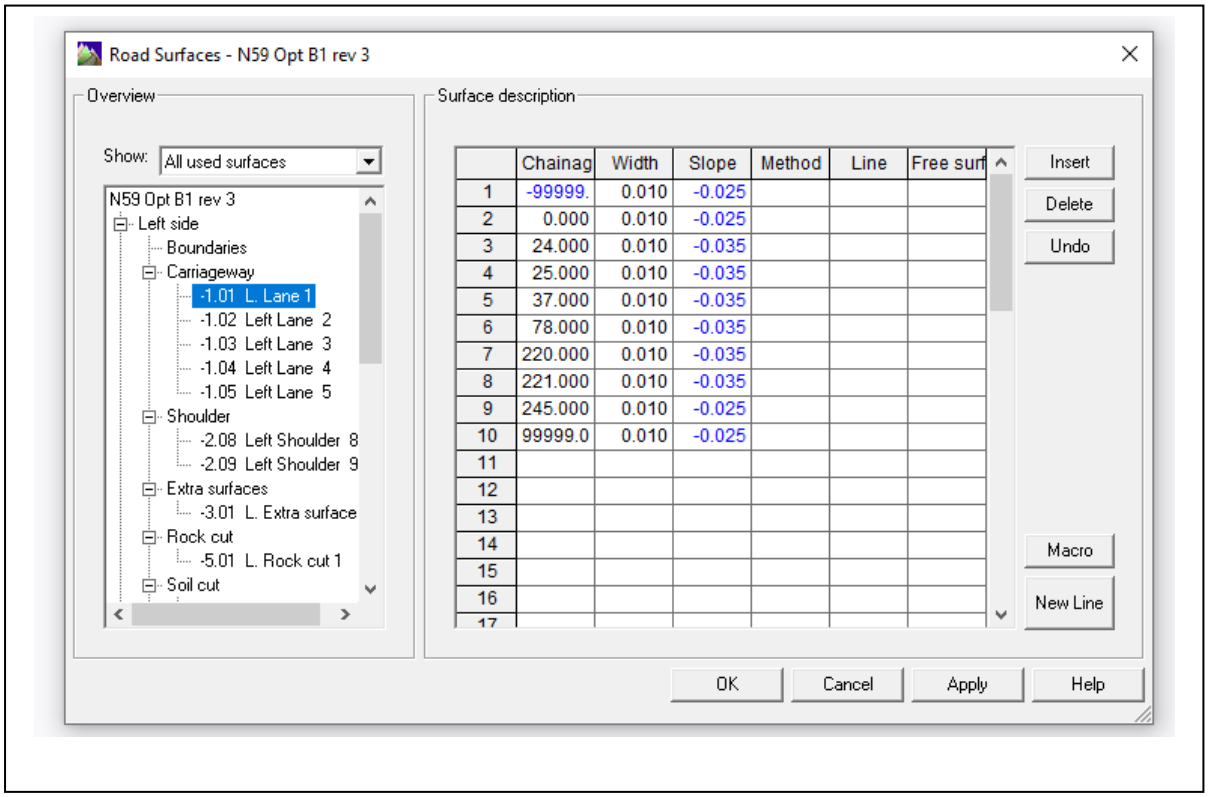
The cross-section detail along the N59 is to be as per Table 4.2 & Figure 1.4 of DN-GEO-03036 (Cross Sections and Headroom) and Standard Construction Detail CC-SCD -00002 for Type 2 single carriageway along the N59. The cycle track will be omitted. The cross-section detail along the L-5381 will be a single carriage way Type 3 as per CC-SCD-00003.

The N59 road will consist of two lanes of 3.5m, a hard strip 0.5m and verge width varies up to 3m wide verge on RHS and up to 8m verge width on LHS for the full scheme where possible. The design speed of 85km/h will be adopted for the Type 2 section of the full scheme which is consistent with National Roads.

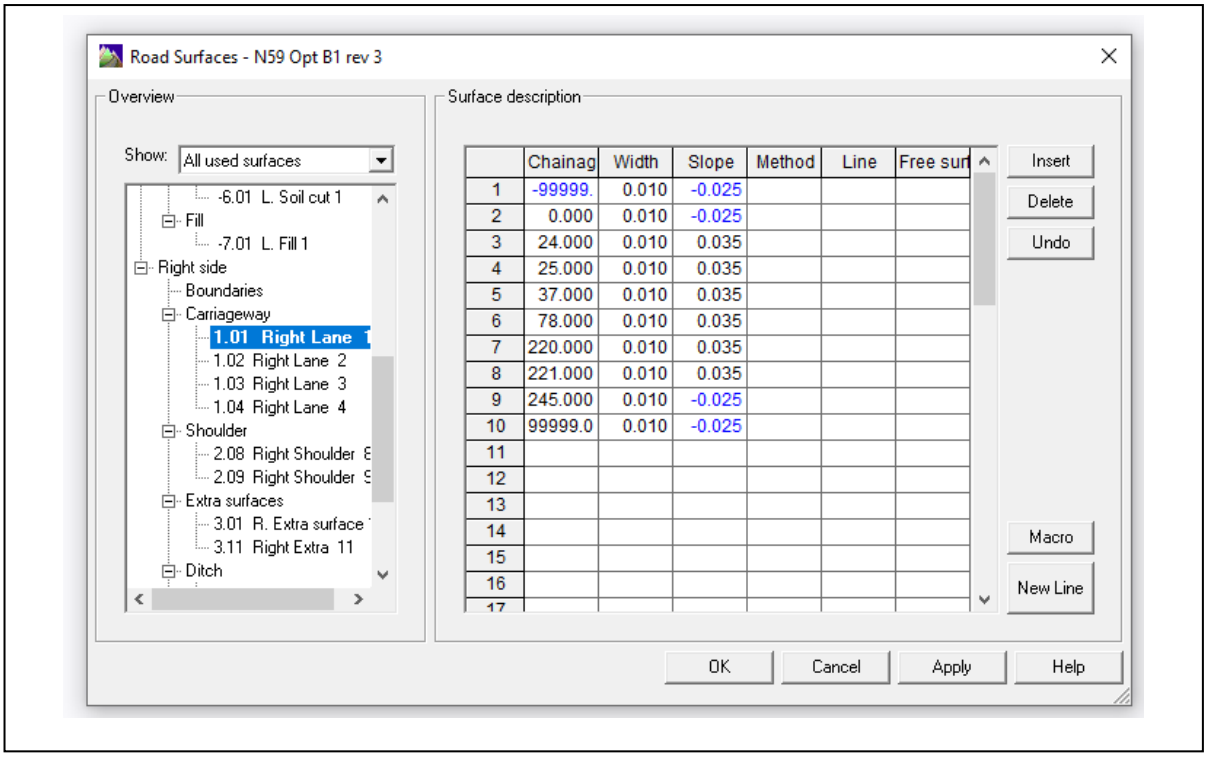
The L-5382 road will consist of two lanes of 3.0m, a hard strip 0.5m and verge width varies from 0.3m to 4m. The radii curve connecting the L-5381 with the N59 will be 13m on either side.

At the tie-in points a reduced and tapering tie-in is proposed. A Departure from Standard has also been prepared for this and is included within this report.

## Figure 6.2: Left Lane Cross section




## Figure 6.3: Right Lane Cross section



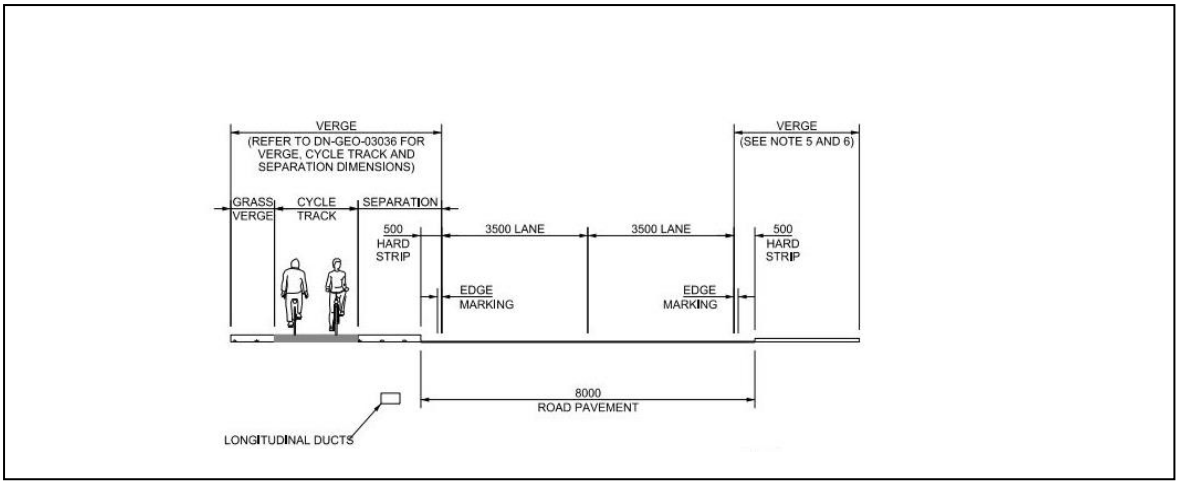
### Table 6.4: Realignment Carriageway Type

| Chainage | Road Type |
|---|---|
| 0.000m – 245.000m | Type 2 Single Carriageway comprising 2 x 3.50m lane, 2 x 0.5m Hard Strip plus (Varying verge widths 0.5m – 8m) |
| 0.000m – 45.000m | Type 3 Single Carriageway comprising 2 x 3.0m lane, 2 x 0.5m Hard Strip plus (Varying widths 0.3m – 4.0m) |

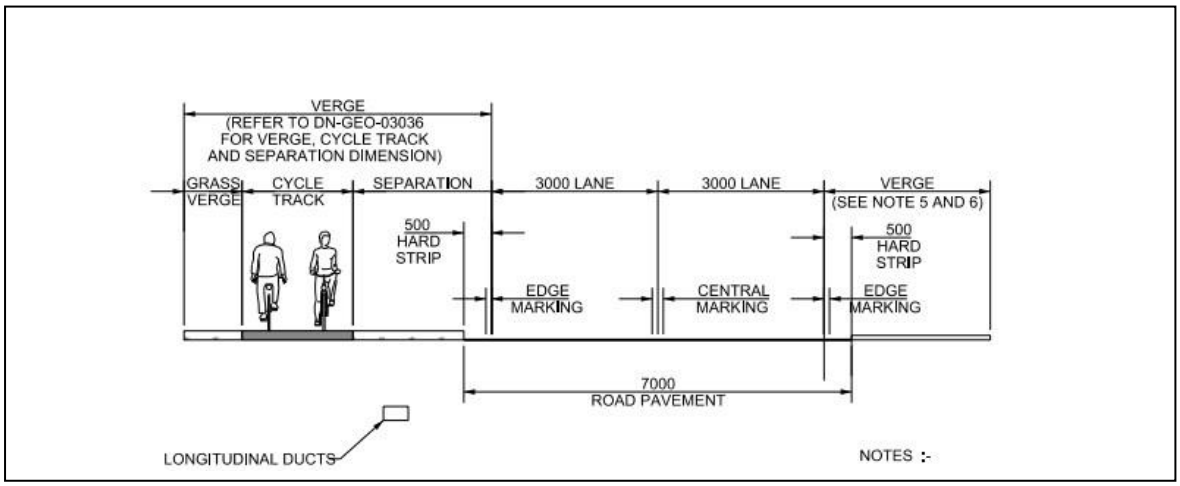
The Type 2 single carriageway has an overall pavement width 8.0m with verge width of up to 3.0m on the RHS and up to 8m on the LHS of the carriageway. The Type 2 single carriageway cross section is detailed in **Figure 6.4** below.

The Type 3 single carriageway has an overall pavement width of 7.0m with verge width of up to 4.0m provided. The Type 3 single carriageway cross section is detailed in **Figure 6.5** below.

### Figure 6.4: TII CC/SCD/00002 Type 2 Single Carriageway




### Figure 6.5: TII CC/SCD/00003 Type 3 Single Carriageway



### 6.5.2 Crossfall

A normal camber of 2.5% will be provided at the straight section and as the default crossfall.

### 6.5.3 Superelevation

Superelevation of 3.5% will be applied at the 255m and 510m radii curves. The two radii curves are located at Ch 36m and Ch 138m. The desirable minimum superelevation for the applied radii is 7%, therefore a departure from standard is required. Refer to **Table 6.2** for full details.

### 6.5.4 Aquaplaning

Aquaplaning analysis was carried out in accordance with Chapter 11 of DN-GEO-03031 to determine water film depths on a drainage path design for the proposed realignment. The assessment is carried out using the Gallaway analysis, the geometric maximum water film depth of 3.3mm shall apply to new single carriageway roads and road surface geometry shall be such that drainage paths are limited to a length of approximately 60m. The summary results of the assessment are provided in the drainage section below.

## 6.6 Facilities for Vulnerable Road Users

The cycle track shown on CC-SCD- 00002 will be omitted. It is felt that the presence of a short section of such facilities may lead to an increase in collisions due to the risk associated with the transition of vulnerable road users back onto the on-road facilities at the unimproved section on the northern side of the scheme. A wide verge will be provided on the LHS of the scheme along this part of the N59 which could facilitate the potential future incorporation of dedicated cycle way along the route.

A Departure from Standard has also been prepared for this and is included in Appendix E.

## 6.7 Safety Barrier Risk Assessment

A safety barrier risk assessment has been completed in accordance with Chapter 5 of DN-REQ-03079 and the assessment identified no requirement for a safety barrier for the scheme.

## 6.8 Clear Zones

The Clear Zone is defined as the total width of transversable land on the nearside or offside which is to be kept clear of unprotected hazards. This width is available for use by errant vehicles. The zone is measured from the nearest edge of the trafficked lane: i.e., hard shoulder, hard strip, and verge forms part of the clear zone. The design refers to table 4.1 of TII Standards DN-REQ-03034 for required width of clear zone for various design speeds. The required clear zone for the proposed scheme is shown in **Table 6.5** below.

**Table 6.5: Required Clear Zone Width for the Scheme**

| Horizontal Radius (m) | Design Speed (km/h) | | |
|---|---|---|---|
| | | 85 | |
| | Required Width of Clear Zone (m) | | |
| Inside of Bend or Straight | | 6.5 | |
| Outside of Bend ≥ 500m | | 9.6 | |

## 6.9 Side Slopes

Earthworks side slope have been designed with 1:2 side slopes in fill and 1:2 side slopes in cut. Side slopes steeper than 1:5 is not recommended in the clear zone. They should be kept as shallow as possible to avoid vehicle rollover.

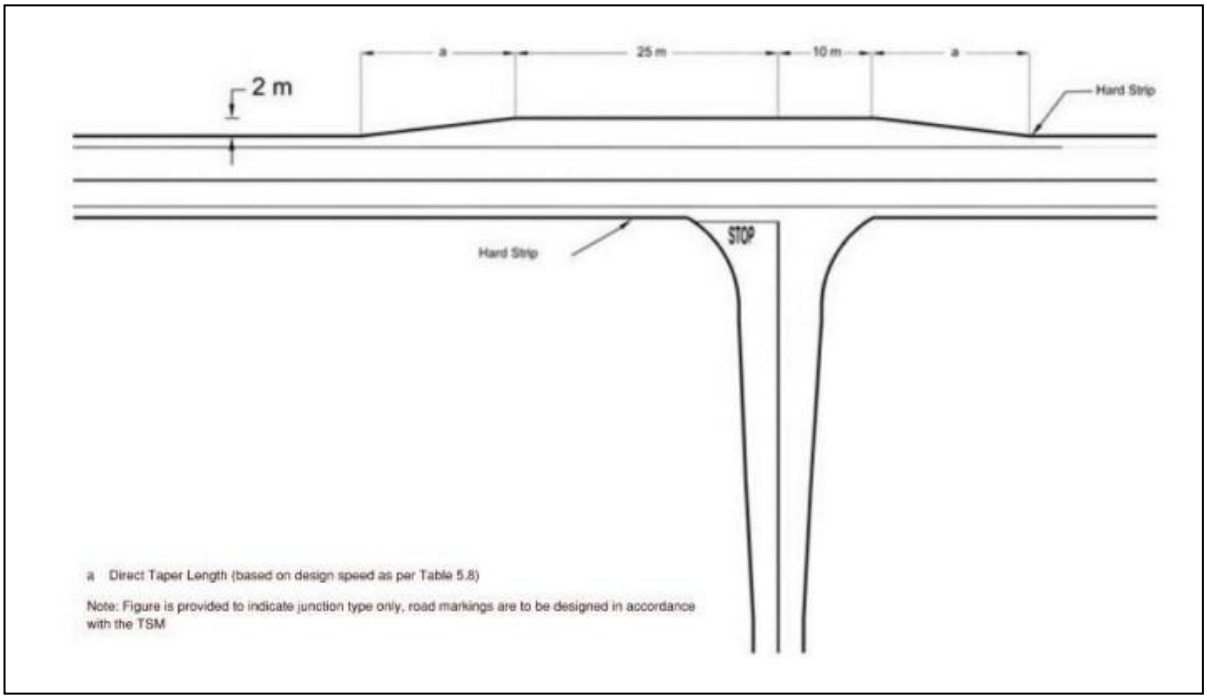
## 6.10 Junction

Local road junction and private road accesses will be realigned and designed to meet the requirements of DN-GEO-03060. Junction types depend on numerous factors but primarily safety and operational performance and will be subjected to the evaluation of design year traffic movements at the junction. A traffic analysis has been conducted to assess the capacity based on the projected turning movement at the junction. One junction is contained within the scheme N17/L-5381, known as the Gortacleva junction. The L-5381 will be realigned and upgraded for approx. 45m in length to a Type 3 single carriageway.

### 6.10.1 Simple Priority Junction

Where a simple priority junction is provided on a Type 2 or Type 3 single carriageway, a nearside passing bay shall be provided to allow through traffic on the major road pass a vehicle while waiting to turn right. See **Figure 6.6** below a Priority Junction with 2m nearside passing bay incorporated into the proposed scheme. A taper length of 15m is used for a design speed of 85km/h. A total length of near side passing bay including tapers is 70m along the N59. The total length of the nearside passing bay may need to be increased where it is anticipated that HGV's will be turning off the major road. However, the use of simple priority junctions with nearside passing bay on rural single carriageway roads can, in certain circumstances, pose safety problems. In situations where overtaking opportunity on the major road on either side of the junction is restricted, the presence of a widened carriageway, could result in overtaking manoeuvres which may conflict with right turning movements into and out of the minor road.

**Figure 6.6: Priority Junction with nearside passing bay**




Simple priority junctions are the most appropriate junction type for all local accesses on single carriageway roads. For junctions with lightly trafficked minor road the provision of a simple priority junction is the most appropriate junction type where the projected flows (2-way Annual Average Daily Traffic – AADT) are less than those presented in **Figure 6.7** for both the major road and minor road. Where traffic flows fall within the ranges outlined in Table 4.1 of DN-GEO-03060, the provision of a ghost island junction is the most appropriate junction type.

The analysis of the junction traffic counts illustrates the minor road has an AADT of 1,418 and the major road has an AADT of 11,065 as demonstrated per **Figure 6.8.** The AADT received from the junction traffic count are greater than AADT provided in Table 4.1 of DN-GEO-03060, which would warrant the implementation of a ghost island junction into the road realignment design, however it has been decided not to include a ghost island design into the realignment due to the limited traffic capabilities of the local road. It is assumed the additional ghost island would encourage road users to utilise the local road which currently provides below standard carriageway cross section to facilitate large volumes of traffic. The Junction is designed in accordance with TII Publications DN-GEO-03060. Clear visibility splays have been provided at the junction. The corner radii provided at the simple priority junction is 13m on either side.

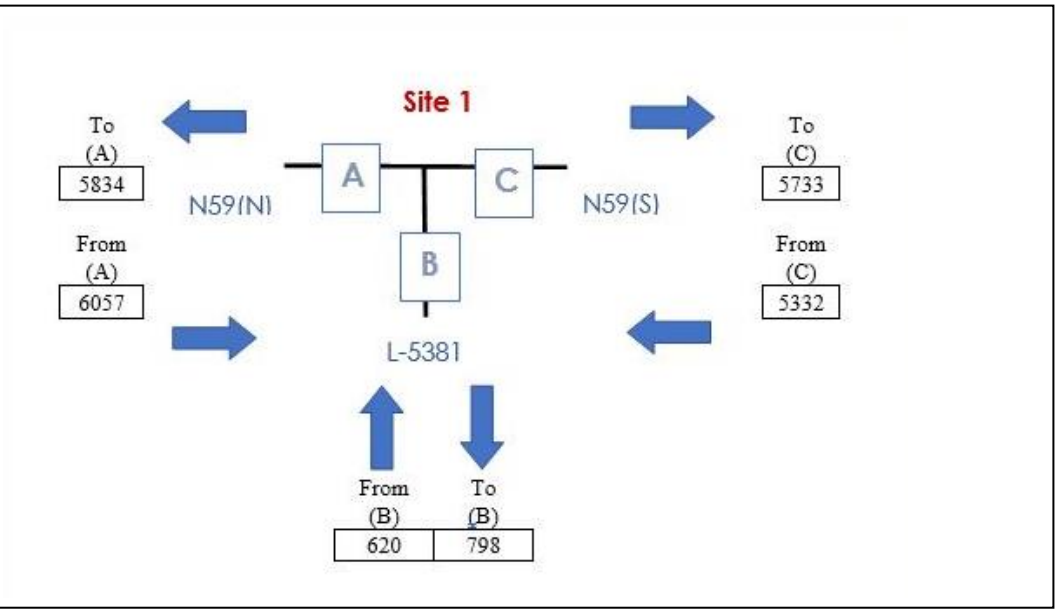
**Figure 6.7: Parameters for Ghost Island Junction**

**Table 4.1 Flow Ranges – Ghost Island junctions**

| Major road AADT | Minor road AADT | |
|---|---|---|
| < 5,000 | > 600 | < 5,000 |
| 5,000 - 10,000 | > 450 | < 3,000 |
| > 10,000 | > 300 | < 1,500 |

*Note: AADT values provided should only be used as an initial assessment of the most appropriate junction type, the final junction arrangement shall be informed by a detailed analysis of peak hour flows (see Appendix D).*

**Figure 6.8: Accumulative Traffic Counts at Gortacleva Junction**




### 6.10.2 Field Access

The scheme comprises of two field accesses located along the N59 at Ch 63m and Ch 146m. Field gates are set back from road edge a minimum of 10m. The corner radii for the typical field entrance is 9m as per figure 5.9 of DN-GEO-03060

### 6.10.3 Residential Access

There is one residential access impacted by the proposed scheme, boundary walls and piers will be set back and repositioned to provide the minimum sight distances for an 85km/h speed design. The corner radii for the typical domestic entrance is 6m as per figure 5.9 of DN-GEO-03060.

### 6.10.4 Dwell Area

The gradient for the dwell area shall lie between plus and minus 2.5%. In difficult situations, this may be increased to between plus and minus 4% as a relaxation. The intention is to avoid the risk of vehicles stalling on a mild hill start when attempting to accept a gap in the major road traffic or inadvertently rolling out into the major road carriageway. Gradients on minor roads shall be in accordance with DN-GEO-03031. On direct accesses, gradients greater than 10% approaching the major road are a Departure from Standard. The gradient on the minor road immediately next to the major road should be considerably less and a dwell area of at least 15m shall be provided immediately adjacent to the major road carriageway. Where site conditions are particularly difficult this area may be reduced to 10m as a relaxation. In the case of a direct access to dwellings, it may be reduced to 3m as a relaxation. A combined relaxation in dwell area and approach gradient is not regarded as a departure. The dwell area on the Gortacleva road will be +4% gradient with a length of 11m which are both relaxations.

## 6.11 Visibility and Sightlines

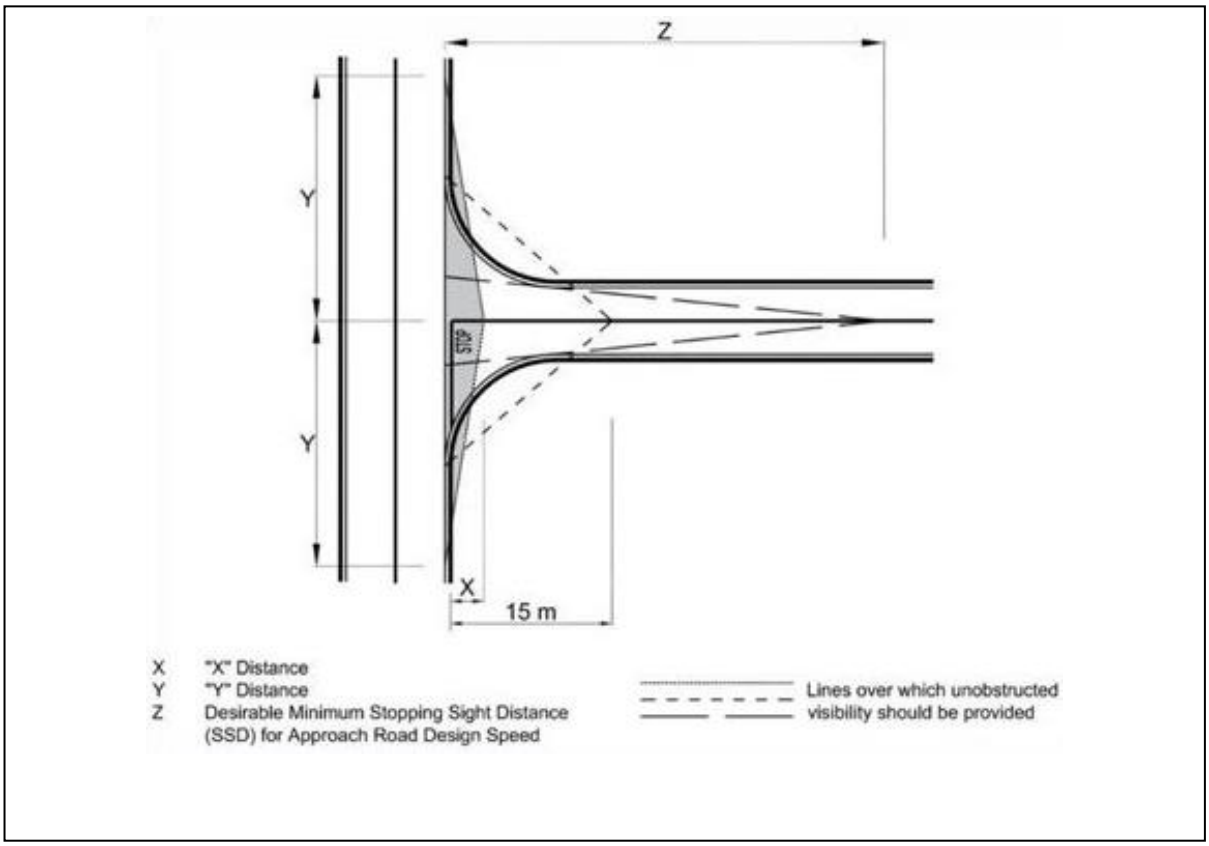
Full overtaking sight distance is not achievable in either direction along the section due to the short distance of proposed scheme 245m approx. To achieve full overtaking sight distance of 490m is required for an 85km/hr speed design.

Stopping sight distance (SSD) of 160m is achievable for all the scheme at high object height of 1.05m, however a relaxation of one step below desirable minimum is required within the scheme for a low object height of 0.260m, refer to **Tables 6.7 & 6.8** for more details.

Traffic from either a minor road or direct access must join or cross the major road when there are gaps in the major road traffic stream. It is therefore essential that drivers emerging from the minor road or direct access shall have adequate visibility in each direction to see the oncoming traffic on the major road to permit them make their manoeuvres safely. The visibility requirement for drivers emerging from minor road or direct access is to the high object (1.05m) on the major road as defined in DN-GEO-03031. This concept also applies to major road traffic turning right into minor road or direct access. Clear visibility splays are provided at the junction looking both North and South along the N59. The achievable sight distance is greater than the required 160m.

Sightlines at the domestic access and the simple priority junction have been provided to meet with the requirements of DN-GEO-03060. However, full sightlines couldn't be achieved at field entrances for a design speed of 85km/h. Gates at direct accesses have been maintained in their current location.

### Figure 6.9: Visibility Splay



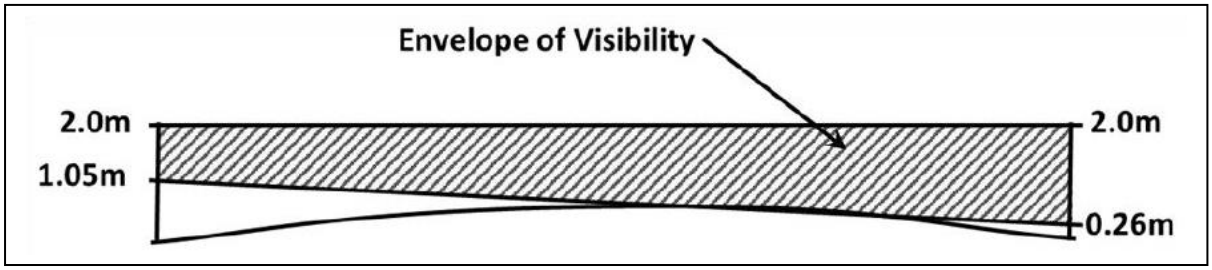

The proposed juctions in the scheme satisfy the desirable minimum 3m 'x' distance on minor roads for visibility. From the point 'x' metres back from the major road a driver approaching the junction along the minor road shall be able to see clearly points to the left and right on the nearer edge of the major road running carriageway at a distance set out in table below, measured from its intersection with the centreline of the minor road. This is called the 'y' distance and is defined in figure above.

### Table 6.6: 'Y' Visibility distance from the minor road

| Design Speed of major road (km/h) | 'y' Distance (m) |
|---|---|
| 42 | 50 |
| 50 | 70 |
| 60 | 90 |
| 70 | 120 |
| 85 | 160 |
| 100 | 215 |

On national roads, the full 'y' distance must be achieved to the high object 1.05m.
Although the 'y' distance shall always be provided, there is little advantage in increasing it, as this too can induce high approach speeds and take the attention of the minor road or direct access driver away from the immediate junction conditions. Increasing visibility should not be provided to increase the capacities of various turning movements.

### Figure 6.10: Measurement of Stopping Sight Distance




Stopping Sight Distance shall be measured from a driver's eye height of between 1.05m and 2.00m, to an object height of between 0.26m and 2.00m above the road surface, as shown in **Figure 6.10** above. It shall be checked in both horizontal and vertical planes, between any two points within the visibility envelope. The check shall be carried out along a line in the centre of the lane.

### Table 6.7: Stopping Sight Distance in forward direction for Object Height of 0.26m

| Chainage (m) | SSD Required (m) | Ok/Not Ok | SSD Achieved (m) | Obstacle |
|---|---|---|---|---|
| 0 | 160 | Not Ok | 145 | Road Surfaces |
| 10 | 160 | Not Ok | 116 | Road Surfaces |
| 20 | 160 | Not Ok | 116 | Road Surfaces |
| 30 | 160 | Not Ok | 112 | Road Surfaces |
| 40 | 160 | Not Ok | 102 | Road Surfaces |
| 50 | 160 | Not Ok | 98 | Road Surfaces |
| 60 | 160 | Not Ok | 96 | Road Surfaces |
| 70 | 160 | Not Ok | 94 | Road Surfaces |
| 80 | 160 | Not Ok | 94 | Road Surfaces |
| 90 | 160 | Not Ok | 94 | Road Surfaces |
| 100 | 160 | Not Ok | 105 | Road Surfaces |
| 110 | 160 | | (135.23) | End of Road |
| 120 | 160 | | (125.23) | End of Road |
| 130 | 160 | | (115.23) | End of Road |
| 140 | 160 | | (105.23) | End of Road |
| 150 | 160 | | (95.23) | End of Road |
| 160 | 160 | | (85.23) | End of Road |
| 170 | 160 | | (75.23) | End of Road |
| 180 | 160 | | (65.23) | End of Road |
| 190 | 160 | | (55.23) | End of Road |
| 200 | 160 | | (45.23) | End of Road |
| 210 | 160 | | (35.23) | End of Road |
| 220 | 160 | | (25.23) | End of Road |
| 230 | 160 | | (15.23) | End of Road |
| 240 | 160 | | (5.23) | End of Road |

## Table 6.8: Stopping Sight Distance in reverse direction for Object Height of 0.26m

| Chainage (m) | SSD Required (m) | Ok/Not Ok | SSD Achieved (m) | Obstacle |
|---|---|---|---|---|
| 240 | 160 | Not Ok | 126 | Road Surfaces |
| 230 | 160 | Not Ok | 116 | Road Surfaces |
| 220 | 160 | Not Ok | 108 | Road Surfaces |
| 210 | 160 | Not Ok | 102 | Road Surfaces |
| 200 | 160 | Not Ok | 98 | Road Surfaces |
| 190 | 160 | Not Ok | 94 | Road Surfaces |
| 180 | 160 | Not Ok | 94 | Road Surfaces |
| 170 | 160 | Not Ok | 94 | Road Surfaces |
| 160 | 160 | Not Ok | 100 | Road Surfaces |
| 150 | 160 | Not Ok | (150) | End of Road |
| 140 | 160 | | (140) | End of Road |
| 130 | 160 | | (130) | End of Road |
| 120 | 160 | | (120) | End of Road |
| 110 | 160 | | (110) | End of Road |
| 100 | 160 | | (100) | End of Road |
| 90 | 160 | | (90) | End of Road |
| 80 | 160 | | (80) | End of Road |
| 70 | 160 | | (70) | End of Road |
| 60 | 160 | | (60) | End of Road |
| 50 | 160 | | (50) | End of Road |
| 40 | 160 | | (40) | End of Road |
| 30 | 160 | | (30) | End of Road |
| 20 | 160 | | (20) | End of Road |
| 10 | 160 | | (10) | End of Road |
| 0 | 160 | | (0) | End of Road |

### Table 6.9: Stopping Sight Distance in forward direction for Object Height of 1.05m

| Chainage (m) | Sight Distance Required (m) | Ok/Not Ok | Sight Distance Achieved (m) | Obstacle |
|---|---|---|---|---|
| 0 | 160 | Ok | >160 | None |
| 10 | 160 | Ok | >160 | None |
| 18 | 160 | Ok | >160 | None |
| 20 | 160 | Ok | 158 | Road Surfaces |
| 30 | 160 | Not Ok | 146 | Road Surfaces |
| 40 | 160 | Not Ok | 136 | Road Surfaces |
| 50 | 160 | Not Ok | 130 | Road Surfaces |
| 60 | 160 | Not Ok | 126 | Road Surfaces |
| 70 | 160 | Not Ok | 126 | Road Surfaces |
| 80 | 160 | Not Ok | 135 | Road Surfaces |
| 84 | 160 | Ok | >160 | None |
| 90 | 160 | | (155.23) | End of Road |
| 100 | 160 | | (145.23) | End of Road |
| 110 | 160 | | (135.23) | End of Road |
| 120 | 160 | | (125.23) | End of Road |
| 130 | 160 | | (115.23) | End of Road |
| 140 | 160 | | (105.23) | End of Road |
| 150 | 160 | | (95.23) | End of Road |
| 160 | 160 | | (85.23) | End of Road |
| 170 | 160 | | (75.23) | End of Road |
| 180 | 160 | | (65.23) | End of Road |
| 190 | 160 | | (55.23) | End of Road |
| 200 | 160 | | (45.23) | End of Road |
| 210 | 160 | | (35.23) | End of Road |
| 220 | 160 | | (25.23) | End of Road |

| | | | | |
|---|---|---|---|---|
| 230 | 160 | | (15.23) | End of Road |
| 240 | 160 | | (5.23) | End of Road |
| 245 | 160 | | (-0.00) | End of Road |

### Table 6.10: Stopping Sight Distance in reverse direction for Object Height of 1.05m

| Chainage (m) | Sight Distance Required (m) | Ok/Not Ok | Sight Distance Achieved (m) | Obstacle |
|---|---|---|---|---|
| 245 | 160 | Ok | >160 | None |
| 240 | 160 | Not Ok | 158 | Road Surfaces |
| 230 | 160 | Not Ok | 148 | Road Surfaces |
| 220 | 160 | Not Ok | 140 | Road Surfaces |
| 210 | 160 | Not Ok | 134 | Road Surfaces |
| 200 | 160 | Not Ok | 130 | Road Surfaces |
| 190 | 160 | Not Ok | 130 | Road Surfaces |
| 180 | 160 | Not Ok | 142 | Road Surfaces |
| 170 | 160 | OK | >160 | None |
| 160 | 160 | Ok | 160 | None |
| 150 | 160 | | (150) | End of Road |
| 140 | 160 | | (140) | End of Road |
| 130 | 160 | | (130) | End of Road |
| 120 | 160 | | (120) | End of Road |
| 110 | 160 | | (110) | End of Road |
| 100 | 160 | | (100) | End of Road |
| 90 | 160 | | (90) | End of Road |
| 80 | 160 | | (80) | End of Road |
| 70 | 160 | | (70) | End of Road |
| 60 | 160 | | (60) | End of Road |

| | | | | |
|---|---|---|---|---|
| 50 | 160 | | (50) | End of Road |
| 40 | 160 | | (40) | End of Road |
| 30 | 160 | | (30) | End of Road |
| 20 | 160 | | (20) | End of Road |
| 10 | 160 | | (10) | End of Road |
| 0 | 160 | | (0) | End of Road |

## 6.12 Drainage

The drainage preliminary design was developed following consultation by Galway County Council with a Hydrologist consultant and Ecologist consultant for the proposed scheme. A sustainable drainage system was considered in the form of kerb and gully system connected to an underground tank to control the quantity and quality of runoff. A petrol interceptor located upstream from the outfall which is a small stream providing connectivity into the local watercourse at the river Corrib.

The principal objectives for the proposed road drainage system include:

- To ensure the speedy removal of surface water from the road pavement, to provide safe driving conditions,
- To mimic, in as far as is practical, the existing road drainage regime, particularly in relation to runoff rates and watercourse outfalls,
- To ensure that the impact of the drainage outfalls on the receiving waters is negligible,
- To minimise the impact of runoff on the receiving environment, and
- To provide effective sub-surface drainage to maximise longevity of the road pavement and associated earthworks.

The preliminary drainage proposals have been developed in accordance with the TII Design Manual for Roads and Bridges and in particular in accordance with the TII Drainage systems for National Roads DN-DNG-03022.

The existing topography naturally slopes from west to east of the scheme. Any existing culverts impacted by the proposed road development works will be assessed in relation to their existing capacity and structural stability. These culverts will be extended, up graded, or replaced, as necessary. Section 50 approval will be required for the upgrade or extension of culverts. New land open drainage will be connected to existing land open drainage and kept separate of the road drainage system. Dredging of existing open drainage system will be carried out as required. The existing road network does not provide any form of attenuation or pollution control. The risk to flooding is minimal with no recorded flooding in this area, as per OPW mapping.

### 6.12.1 General Principles of drainage design

- Sustainable Urban Drainage Systems (SuDS) requirements. A SuDS drainage design will be developed as a first preference and in accordance with the SuDS hierarchy.

- All drainage structures should be designed with a minimum return period of no flooding in 1:100 years. A climate change allowance of 20% will be added to all rainfall depths.
- Physical drainage investigation might be required at detailed design stage to precise details of existing drainage along the route, the size, number, depth, and location etc. of each drainage infrastructure present along the route.

- The design will be based on avoiding increasing the discharge flow to an existing network. An assessment of the necessity of possible attenuation to restrict the flow rates to the current conditions should be carried out and sized accordingly. The attenuation facilities will be provided in the shape of SuDS. Where spatial or other constraints make the SuDS not feasible or not possible or when SuDS do not provide enough attenuation, oversized pipes will be required.

- While the scheme will involve an increased paved area it is envisaged that the realignment in operation will dramatically improve water quality and reduce the risk of pollution with the proposed sustainable urban drainage system compared with its current situation that provide over the edge drainage with no pollution control.

### 6.12.2 Carriageway Drainage

As the proposed road development incorporates both online upgrade and offline road widening, the proposed road drainage system will replace the current one where the road run-off is discharging directly over the edge which filters through grass verge and side slopes. The proposed system will be designed to ensure the speedy removal of surface water to provide safe driving conditions and to minimise the impact of runoff on the receiving environment. The preliminary drainage proposals are developed in accordance with the TII Design Manual for Roads and Bridges, and the principles of SUDS (Sustainable Drainage Systems) will be applied throughout.

The proposed drainage system consists of a Sealed Drainage (SD) for the full scheme CH 0m to Ch 245m comprising of kerbs and gullies system. Gullies are connected to sealed pipes which discharge to outfall positioned at low points in the alignment generally via longitudinal carrier pipes set within the verge. The advantage of the kerb and gullies is that the longitudinal gradient to carry road surface runoff to outlet is not dependent upon the longitudinal gradient of the road itself and can be formed within a longitudinal carrier pipe. The function of the kerbs is not purely to constrain edge drainage, but to provide some structural support during pavement laying and protect verges from vehicular overrun. Spacing of Road Gullies will be designed in accordance with TII Standards DN-DNG-03067.

The proposed drainage system includes petrol interceptors and underground storage tank, all of which ensures that the runoff is attenuated and treated before being discharged. This system discharges to a local drainage network which flows east before eventually connecting

into the river Corrib approximately 0.5km downstream. The river Corrib is included within the Lough Corrib SAC. The proposed drainage works are outlined in the preliminary design drawings in the Appendix A of this report.

### 6.12.3 HAWRAT Analysis of Routine Road Drainage discharge on receiving Waters

Research has found that a broad band of potential pollutants are associated with routine runoff from road schemes arising from road traffic and road maintenance. These contaminants are generally associated with the particulate phase and are principally heavy metals, hydrocarbons and suspended solids and de-icing agents (salt and grit) and to a lesser extent nutrients, organics, and faecal coliforms. In terms of the potential impact to receiving watercourses research has found the first flush runoff (10 to 15mm rainfall runoff) can produce elevated concentrations locally in the receiving waters. The impact of contaminants within routine road runoff depends on the loading (associated with traffic numbers) and the available dilution in the receiving watercourse.

TII DMRB publications document DN-DNG-03065 gives guidance and assessment tools for the impact of road projects on the water environment, including the effects of runoff on surface waters. The Highways Agency Water Risk Assessment Tool (HAWRAT) is the tool used to assess the effects of road runoff on surface water quality and uses toxicity thresholds based on UK field research programmes which are consistent with the requirements of the Water Framework Directive (WFD) and appropriate for assessment of National Road Schemes in Ireland. The UK research programme has shown that pollution impacts from routine runoff on receiving waters are broadly correlated with Annual Average Daily Traffic (AADT) numbers.

A HAWRAT assessment has been carried out for all proposed drainage outfalls directly discharging to surface watercourses along the proposed road development, see Table 6.9 below. The HAWRAT assessment tool uses the AADT category of 10,000 to 50,000 in the assessment process which is appropriate for the Design Year AADT number of 13,405. This ADDT category is likely to be precautionary in terms of its water quality predictions as the ADDT numbers are much closer to 10,000 than 50,000. It is also important to note that the HAWRAT assessment is based on direct discharges to watercourses in the absence of proposed drainage design measures, which include petrol interceptors, water quality treatment ponds and wetlands and attenuation ponds, and therefore, the predictions are worst case, not including any treatment performance which will achieve more than 60% reduction in suspended sediments and associated heavy metals. The HAWRAT analysis was carried out on all the proposed outfalls in the absence of proposed water quality and attenuation measures and the required level of treatment quantified, refer to Table 6.9 below.

In general, HAWRAT is considered to provide a very precautionary means to assess those road outfall discharges on the receiving water quality with respect to soluble and sediment-bound pollutants. The screening parameters are sediment and the dissolved heavy metals of zinc and copper concentrations. These represent the primary waste constituents in the road drainage discharges and used as screening parameters for other pollutant substances such as de-icing agents of salt and grit, hydrocarbons, Cadmium, Pyrene, PAHs, nutrients, and organics.

### Table 6.11: HAWRAT Results of Outfall

| Outfall No. | Chainage (m) | Water Hardness (mg/l $CaCO_3$) | Dissolved Copper (ug/l) | Dissolved Zinc (ug/l) | Sediment Deposition Index | Comment |
|---|---|---|---|---|---|---|
| 1 | 245 | High > 200 | 0.01 | 0.03 | 0 | **Pass** Soluble, **Pass** Sediment |

Refer to appendix for full detailed HAWRAT results output

This analysis shows that sufficient dilution is available at 95 percentile low flow in the Kentfield Stream as meet the threshold limits for associated road drainage of heavy metal pollutants. It is generally fond that if the soluble zinc and copper limits are met then the limits for the other associated road drainage pollutants will be satisfied. Water detention is to be provided which will contain the first flush event of 20mm from the road pavement within the Pond before releasing it slowly. Such treatment facilities should achieve up to 60% settlement. The outfall passes the HAWRAT Analysis in respect to the soluble pollutants with no additional treatment required.

The conclusion of this assessment is that the proposed Road drainage routine discharges will not result in any significant impact on the water quality of the receiving Waters of the local stream outfall, and imperceptible impact on the downstream receiving Corrib River and the Lough Corrib SAC. The proposed water quality treatment will further safely guard the receiving water quality and will avoid any significant accumulation of sediment at the respective outfalls.

### 6.12.4 Stormwater and drainage water flow and Flood Impacts

The proposed road development through its increased paved area and drainage system can result in increased storm flows. The drainage design for the proposed road has been designed not to increase flooding. This is achieved through the provision of storm water attenuation underground tank and flow controls upstream of the outfall to limit outflow to greenfield flood runoff rates. The separation of land drainage flows from road pavement flows is important from storm attenuation and water treatment design of the pavement runoff and rationalising the storage required.

The natural greenfield runoff rate for the Kentfield area is determined using the IH124 ungauged flood estimation equation for small catchments. This equation is presented below as follows:

$$QBAR = 0.00108*AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17}$$

Where QBAR is the mean annual flood rate (m3/s)

AREA is drainage area (km2)

SAAR is mean annual rainfall (mm)

SOIL is the Winter Rainfall acceptance potential (conversely runoff coefficient) for type 2 soils represents Kentfield area SOIL = 0.3.

The design flood $Q_{100} = X_{100} * QBAR$

Where from the national flood growth curve $X_{100} = 1.96$

This gives a greenfield flood runoff rate $Q_{100}$ = of 4.5l/s per ha and an annual flood runoff rate (5year return period) of 2.76 l/s per ha.

The attenuation storage is sized based on the 100year rainstorm event + 20% climate change discharging at greenfield flood rate of 5l/s per ha.

**Table 6.12: Attenuation Underground Storage Required**

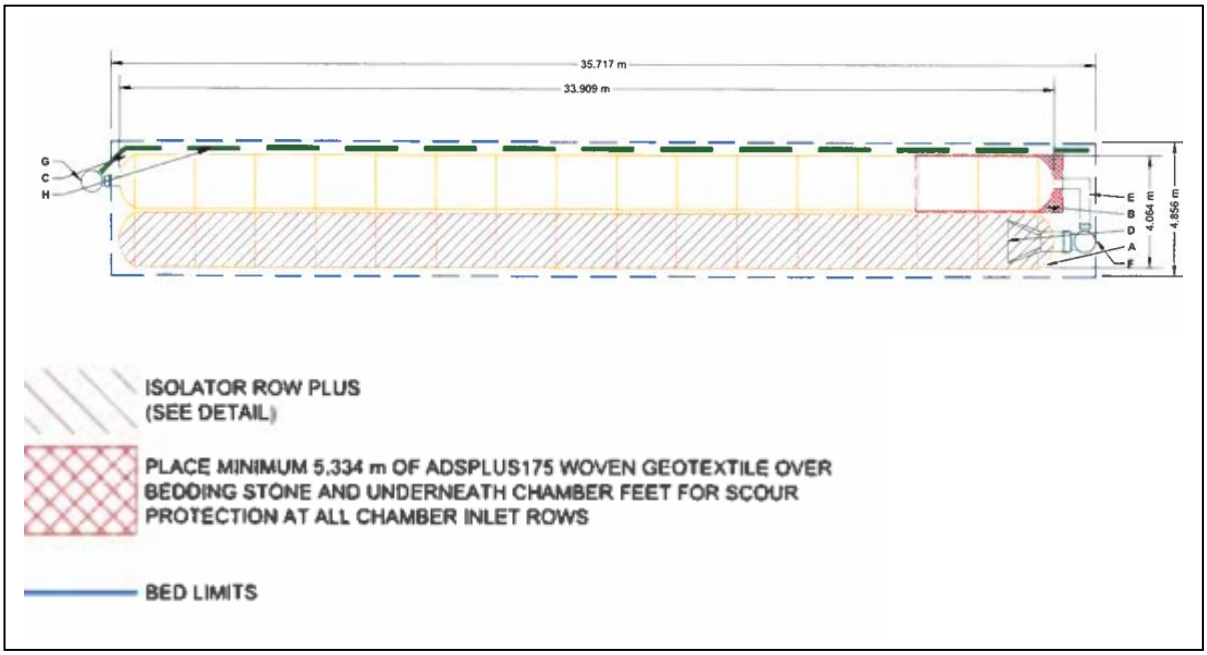
| Underground Tank | Chainage (m) | Permissible maximum Greenfield outflow (l/s) | Storm Attenuation Storage m3 | Permanent First Flush Storage for water treatment m3 | Total Storage required m3 |
|---|---|---|---|---|---|
| 1 | 200 | 5 | 98.2 | 54 | 152 |

Attenuations storage designed to include 20% increase in 100-year rainstorm depth for medium range climate allowance. Detention storage for water quality treatment sized for 20mm first flush rainfall depth which equates to 54m$^3$. The critical rainstorm duration is 2 to 3 hours. The total storage required including first flush is 152m$^3$. The underground tank has been designed to provide 173.4m$^3$.

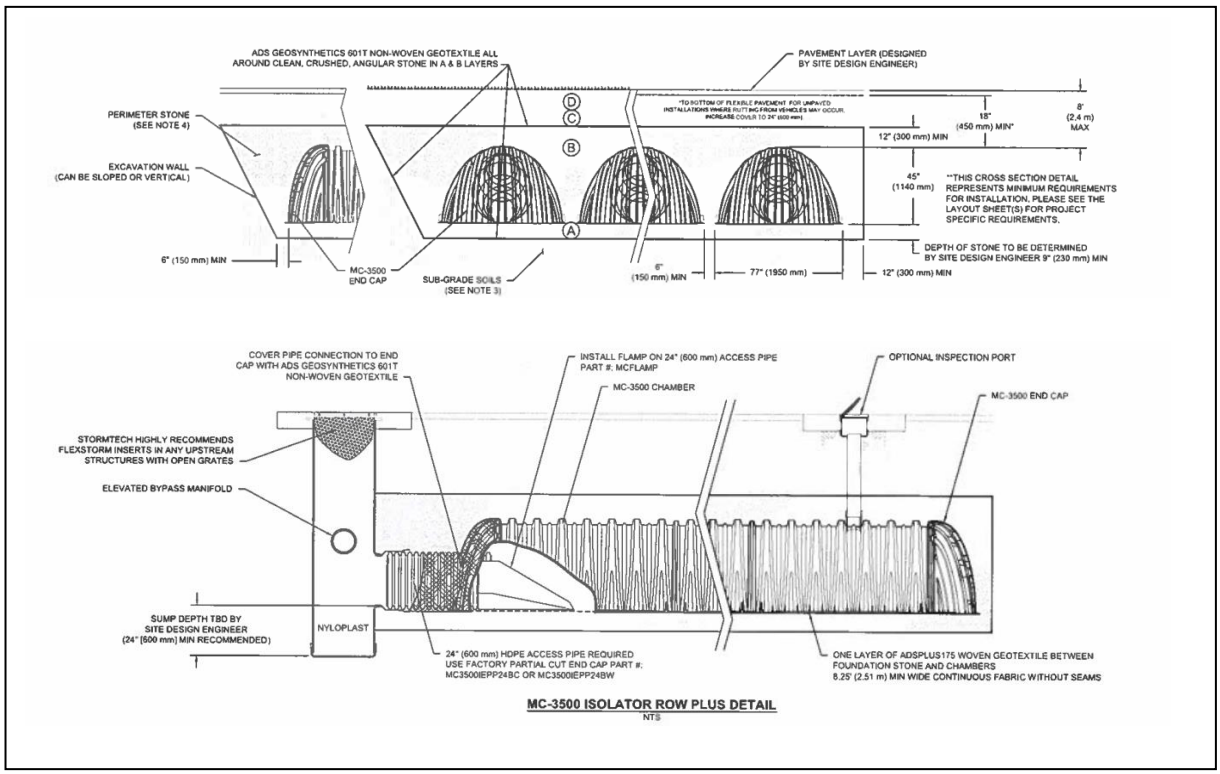
### 6.12.5 Underground Attenuation Tank

Advanced Drainage Systems (ADS) is a leading manufacturer of innovative stormwater solutions that provides design on drainage products and services that deliver solutions for the most persistent and challenging water management problems. The stormwater solution for the N59 Kentfield utilises the innovative product of StormTech MC-3500, which is designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The MC-3500 chamber is designed primarily to be used underground, thus maximising land usage where land availability is limited. The underground tank is constructed insitu on-site using 30No. Stormtech MC-3500 chambers consisting of an overall footprint of 35.717m long and 4.856m wide. Refer to **Figure 6.11 & 6.12** which demonstrates Plan view and cross section, respectively. For the detailed design and drawings refer to Appendix F

## Figure 6.11: Plan for Underground Attenuation Tank




## Figure 6.12: Underground Cross Section



### 6.12.6 Culverting of Watercourses

Streams or drainage ditches crossed by the route of the mainline or associated public roads will be culverted by means of piped culverts, box culverts or other culvert sections with a head wall on either end. The culverts will be sized during the detailed design process. The minimum culvert diameter for ditches and earthwork drainage cross drains should be 450mm as smaller sizes are prone to blockages in accordance with TII publications.

### 6.12.7 Water Film Depth

The expected surface water film depth was calculated using the metric version of the Gallaway formula which provides an empirical relationship relating average pavement texture depth, drainage path length, rainfall intensity and slope of drainage path to the expected water film depth on the carriageway surface.

Gallaway formula:

$$D = \frac{0.103 \times T^{0.11} \times L^{0.43} \times I^{0.59}}{S^{0.42}} - T$$

Where,

D = Water film depth above the top of pavement texture (mm)

T = Average pavement texture depth (mm)

L = Length of drainage path (m)

I = Rainfall intensity (mm/hour)

S = Slope of drainage path (%)

The Length of drainage path was calculated using Nova point software and the longest drainage path returned from the analysis was 14.229m between chainage 0m and 9m on the RHS. The slope of the drainage path was calculated using the equal area slope. Refer to **Table 6.13** for the maximum water film depth for the scheme which is below the allowable water film depth of 3.3mm.

**Table 6.13: Water Film Depth Analysis**

| Length of Drainage path (L)(m) | Rainfall Intensity (I)(mm/hr) | Slope of Drainage Path (S) (%) | Ave Pavement texture (T) (mm) | Water Film Depth (D)(mm) | Water Film Depth Allowed (mm) |
|---|---|---|---|---|---|
| 14.229 | 50.000 | 3.176 | 0.400 | 1.405 | 3.3 |

## 6.13 Pavement

The pavement design option for the N59 Kentfield realignment has been completed in accordance with TII publications PE-SMG-020002 and DN-PAV-03021. The pavement is designed for a 40-year design life in accordance with regular recommendations outlined in TII publications.

A fully flexible pavement design has been completed for the pavement design options. The final selection for the preferred pavement option for the carriageway will be made in the detailed design phase of the project prior to construction. Refer to Drawings CS-01-GC/19/18753 to CS-03-GC/19/18753 in Appendix A of this report for typical payment cross section.

Road pavement has two primary functions:

- Provide a good quality surface and appropriate resistance to skidding.
- 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.

### 6.13.1 Pavement Design Standards

The pavement for the new Mainline shall be designed to withstand the traffic loading as detailed in the TII Addendum to HD 24/06 of Volume 7 of the TII DMRB. These requirements will be used to assess the options for the pavement at detailed design stage.

The design of capping layer, sub-base and pavement layers shall follow the requirements of 'TII DN-PAV-03021 Pavement and Foundation Design of Volume 7 of the TII DMRB.

The pavement materials to be used and method of construction shall follow the requirements of Series 700 to 1000 inclusive of the TII's 'Specification for Road Works' contained within Volume 1 of the 'Manual of Contract Documents for Road Works'.

### 6.13.2 Pavement Foundation

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. 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 design standard TII DN-PAV-03021 – Pavement and Foundation Design and are based on the strength of the sub-grade, measured as its 'CBR' value.

The minimum permitted design CBR for Subgrade is 2.5%. Where a subgrade has a lower CBR it is considered unsuitable support for a pavement foundation. Therefore, it must be permanently improved prior to proceeding with the capping layer.

Capping material is used to improve weak sub-grade material. The aim is to increase the stiffness modulus and strength of the formation, on which the subbase will be placed. Capping with laboratory CBR value of at least 15% should be used to provide an adequate platform for construction of the subbase when compacted to appropriate thickness. It is proposed to use a capping layer using granular material which conforms with type 6F1, 6F2 or 6F3 (Series 600 of the Specification for Roadworks) 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. The overlying capping is again designed based on a subgrade with a minimum CBR value of 2.5%.

The grading for unbound granular subbase is intended to provide a dense layer of relatively high stiffness modulus, which is reasonably impermeable and will shed rainwater during construction, given adequate fall. It is not necessarily free draining and may exhibit suction, which will result with an increase in moisture content. Unbound granular subbase with laboratory CBR of at least 30% should provide an adequate platform for construction of the pavement when compacted to the appropriate thickness.

The detailed ground investigation will provide information required for the detailed design and as such a detailed analysis of sub-grade strength has not been undertaken at this stage. Typically for a 3% design CBR and a fully flexible pavement a capping depth of 350mm will be required. A thin regulating layer of Clause 804 sub-base is required in lieu of the capping layer where rock is encountered.

### 6.13.3 Geotextile

The intended use of these geotextile and geotextile related products is to fulfil one or more of the following functions.

- Reinforcement – Binding the asphaltic layer together to resist crack propagation in either direction, spanning the potential crack.
- Barrier – Sealing and prevention of water penetration into the lower layers and the avoidance of associated problems due to freeze/thaw effects and the need for lower drainage to remove subsurface water resulting in potential reduction of oxidation of lower bitumen layers.
- Stress Relief – Absorb transient stress in all directions.

It is intended at this stage, that a geotextile membrane will be included in the design for the proposed road realignment scheme. This will be placed on the subgrade prior to the deposition of the capping layer.

### 6.13.4 Surface and Binder Course

For this proposed project, the use of a Hot Rolled Asphaltic type surfacing with pre-coated chip is proposed. Therefore, the use of 45mm nominal layer thickness of 30% Hot Rolled Asphalt (nominal size 14mm) has been used, in accordance with clause 4.1.1 of the TII Specification for Roadworks Series 900. This is in conjunction with a binder layer of DBM 40/60 des Asphaltic Concrete complying with clause 3 of the TII Specification for Roadworks Series 900. Alternative pavement materials, compliant with the DMRB, may be considered further at the detailed design stage.

The junctions to the proposed L-5381 will be designed to the same pavement specification as the mainline alignment for the first 30m adjacent to the Mainline. Beyond this point the junctions will be designed to have a pavement based on the design traffic loading calculated for the junction based on the available traffic data.

**Table 6.14: N59 Pavement Design**

| Pavement Location | Design MSA | Total Thickness of Asphalt Layers |
|---|---|---|
| Mainline | 11.48 | 290mm |
| Local Road | 0.98 | 220mm |

**Table 6.15: Preliminary Design Pavement**

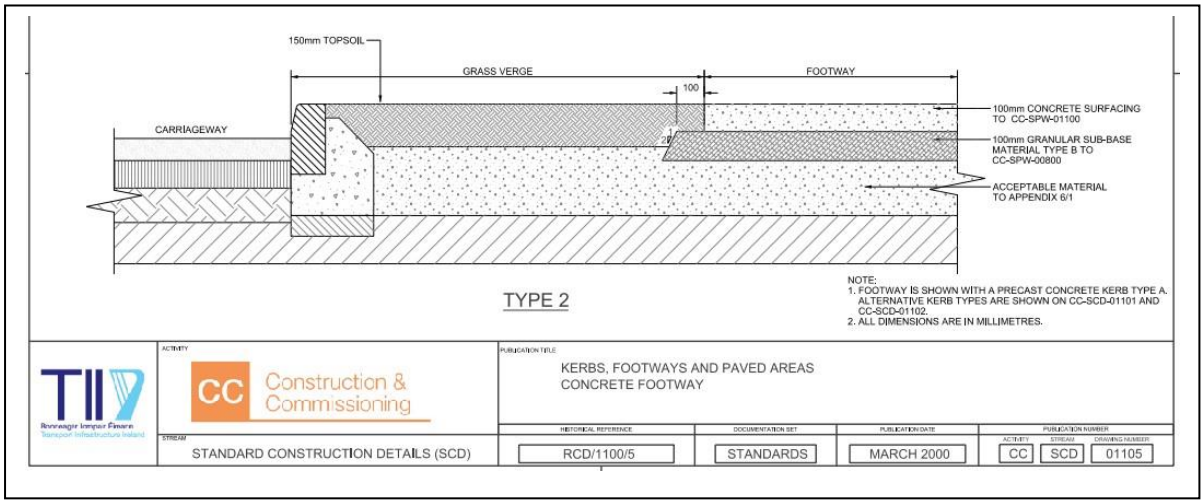
| Location | Wearing Course | Binder | Road Base | Sub- Base | Capping |
|---|---|---|---|---|---|
| Mainline | 50mm HRA 30/14f Surf 40/60 | 80mm AC20 dense bin 40/60 | 160mm AC32 dense base 40/60 | 150mm Granular Material Type B to Cl.804 | 200mm course graded material (6F2) |
| Local Road | 50mm HRA 30/14f Surf 40/60 | 70mm AC20 dense bin 40/60 | 100mm AC32 dense base 40/60 | 150mm Granular Material Type B to CL.804 | 200mm course graded material (6F2) |
| Field Access | Double Surface Dressing | | | 150mm Granular Material Type B to CL.804 | |
| Domestic Access | 50mm SMA 14 Surf des | | | 150mm Granular Material Type B to CL.804 | |

### 6.13.5 Footpath Design

The footpath design will be 2m wide with a minimum separation distance of 1.5m provided in accordance with TII Specification CC-SCD-01105 as per **Figure 6.13** below, with the more detailed construction make up detailed below:

- 100mm Concrete Surfacing to CC-SPW-01100
- 100mm Granular sub-base material type B to CC-SPW-00800
- Geosynthetic Layer between sub-grade and sub-base.
- Joints every 3.0m c/c;
- Joints formed with double thickness of Bituminous roofing felt to I.S. 36 (Type 1F);
- All concrete edges and joints shall be bullnosed with a trowel.
- Concrete shall be finished by floating with a wooden trowel and while still green lightly brushed with a bass broom to produce a slight roughness.
- Footpath to be dished at road crossing points.
- Note Kerb detail is Type C, 75mm Height as per CC-SCD-01101

**Figure 6.13: Typical Footpath Construction (CC-SCD-01105)**




### 6.13.6 Traffic Sign & Road Markings

The Road Traffic Signing and Road Markings for the scheme will be designed and implemented primarily in accordance with the Traffic Signs Manual. Where situations not covered by the Traffic Signs Manual arises best appropriate international practice will be followed, amended to suit Irish conditions and provisional on approval by TII. Conceptual proposals for the signage of the scheme have been undertaken during the preliminary design of the scheme. The preliminary proposals cover the following sign types:

- Regulatory Signs (e.g. Yield Signs)
- Warning Signs (e.g. Junction Sign)

There is no provision for directional signs for the extents of the proposed scheme. The proposed signage works are outlined in the scheme drawings, RS-01-GC/19/18753 in Appendix A of this report.

The road marking for the scheme will be generally in accordance with the Traffic Signs Manual. However, where situations arise not covered by the Traffic Signs Manual then appropriate international practice will be followed, amended to suit Irish conditions and subject to approval by TII. The proposed road markings are outlined in the scheme drawings, RM-01-GC/19/18753 in Appendix A of this report.

## 6.14 Accommodation Works

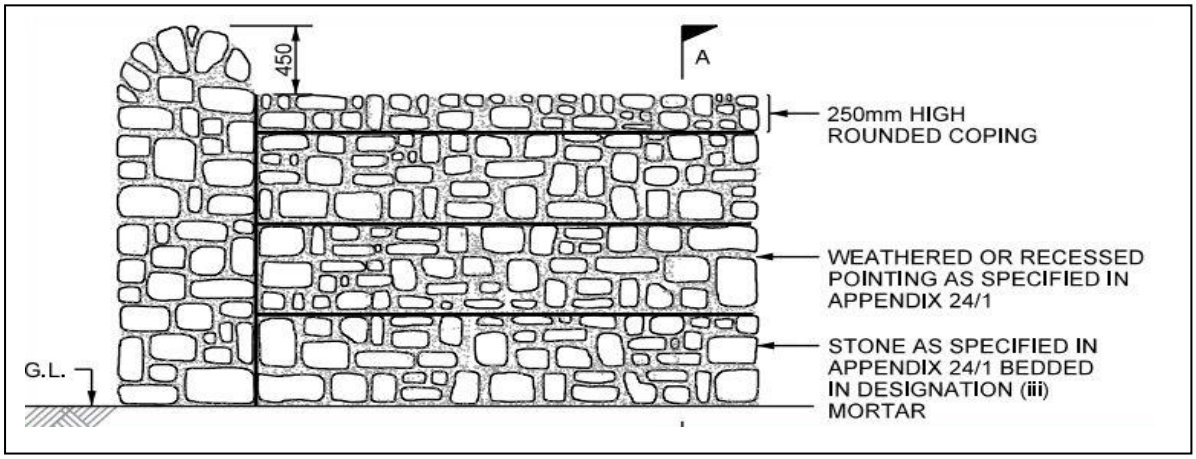
Measures have been considered to facilitate landowners that will be affected by the realignment of the road and are termed as 'Accommodation Works'. These are provided to accommodate the following:

- Re-instatement of access to properties/holdings severed by the scheme
- Provision of re-instatement of boundary walls and boundary fencing at properties affected by the scheme
- Re-instatement of domestic services such as water, sewage, electricity, and telecommunications
- It is proposed that any field drains severed by the scheme will be reconnected to the existing open drainage system. At the detailed design stage, the new drainage will be designed to ensure that there will be no increased risk of flooding and that the current drainage situation will not be worsened.

### 6.14.1 Boundary Treatment

At the beginning of the construction phase the land to be acquired as per the proposed boundary will be fenced and access across it restricted where possible. Boundary treatment for the scheme will consist of single sided stone wall. Boundary walls to be constructed in accordance with the TII Standard Construction Details (SCD's). The scheme will impact upon individual residential properties and in some cases, it will be necessary to acquire lands which include boundary walls and portions of property frontages. In this case, accommodations work will be required, and the approach adopted will be to replace a 'like for like' basis. Road boundary walls will generally be complying with TII standard detail CC-SCD-02403 as indicated in **Figure 6.14** below, and to be provided where specified for the proposed scheme. Refer to Drawings AC-01-GC/19/18753 in Appendix A of this report for further information on Walls.

**Figure 6.14: Typical Stonework Wall (CC-SCD-02403)**




### 6.14.2 Direct Accesses

Existing direct accesses will be permitted throughout the scheme and will remain at the same location. There will be 3 No. direct accesses along the N59 road, however only 1No direct access is impacted by the proposed scheme. No direct accesses affected along the L-5381. **Table 6.16** lists the proposed accesses.

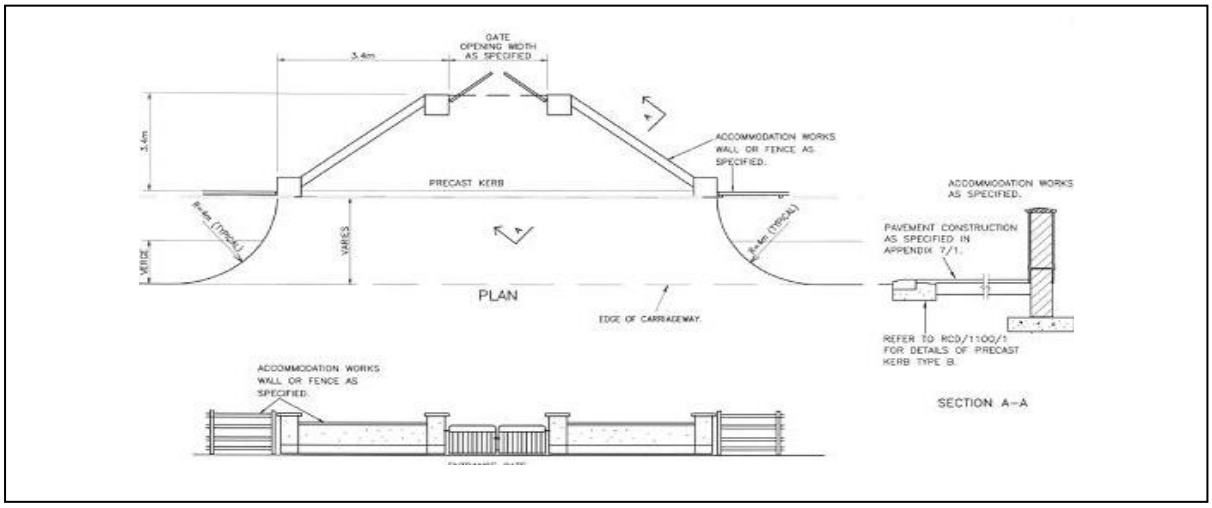
**Table 6.16: Direct Accesses**

| Access | No. | Description |
|---|---|---|
| Domestic Entrance | 1 | Single private house entrance onto proposed N59 |
| Field Accesses | 2 | Scheme doesn't impact on these accesses |
| Junction | 1 | Junction designed to DN-GEO-03060 along the N59 |

### 6.14.3 Domestic Entrances

There is one houses that connect to the N59 along the scheme. There is a dwell area of approx. 13m provided, this will allow a vehicle to park safely outside the gate before opening gate. In some cases, driveways may be regraded where the levels of the existing road are being elevated or dropped. New house entrances will be constructed in accordance with the TII standard detail CC-SCD-02753 as indicated on **Figure 6.15** or as agreed with the individual landowner.

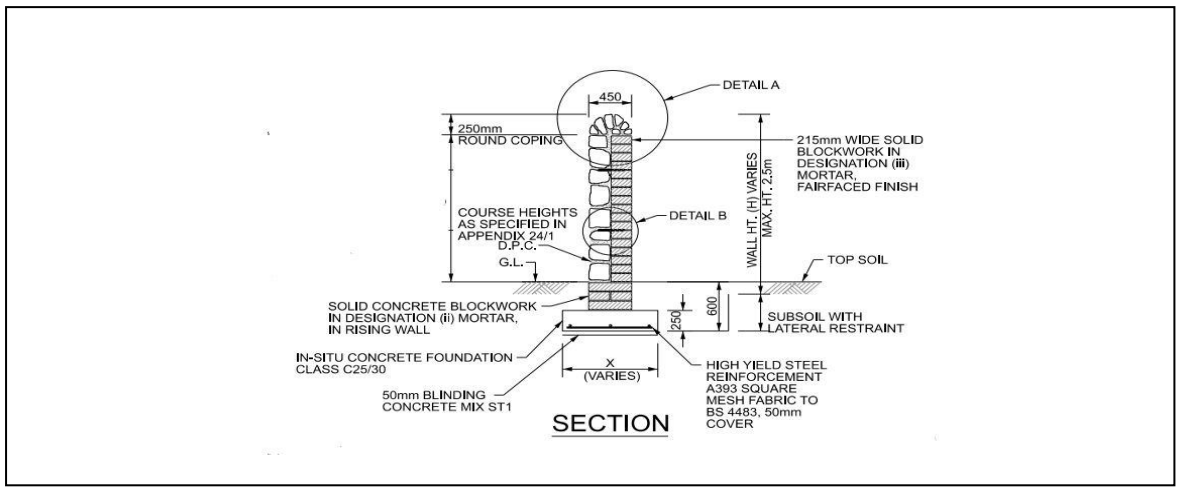
**Figure 6.15: Typical Domestic Entrance (CC-SCD-02753)**




## 6.14.4 Walls

Stone Walls will be constructed along eastern boundaries at various locations along the proposed scheme, which will consist of a single-sided stone wall finish, complying with TII SCD/02403 standard construction detail, as indicated in **Figure 6.16** below. Other locations along the scheme will have existing stone walls repaired and retained.

**Figure 6.16: Typical Stonework Wall (CC-SCD-02403)**




## 6.14.5 Field Entrance

Field accesses will generally be constructed as per the detail shown in **Figure 6.17** below with a typical single steel gate type serving farm accesses which will be constructed as per agreement with landowner, as shown in **Figure 6.18** below. However, the proposed scheme has minor impacts on 2 No field entrance, with minor realignments and adjustments to gate positions.

**Figure 6.17: Typical Field Access (CC-SCD-02754)**

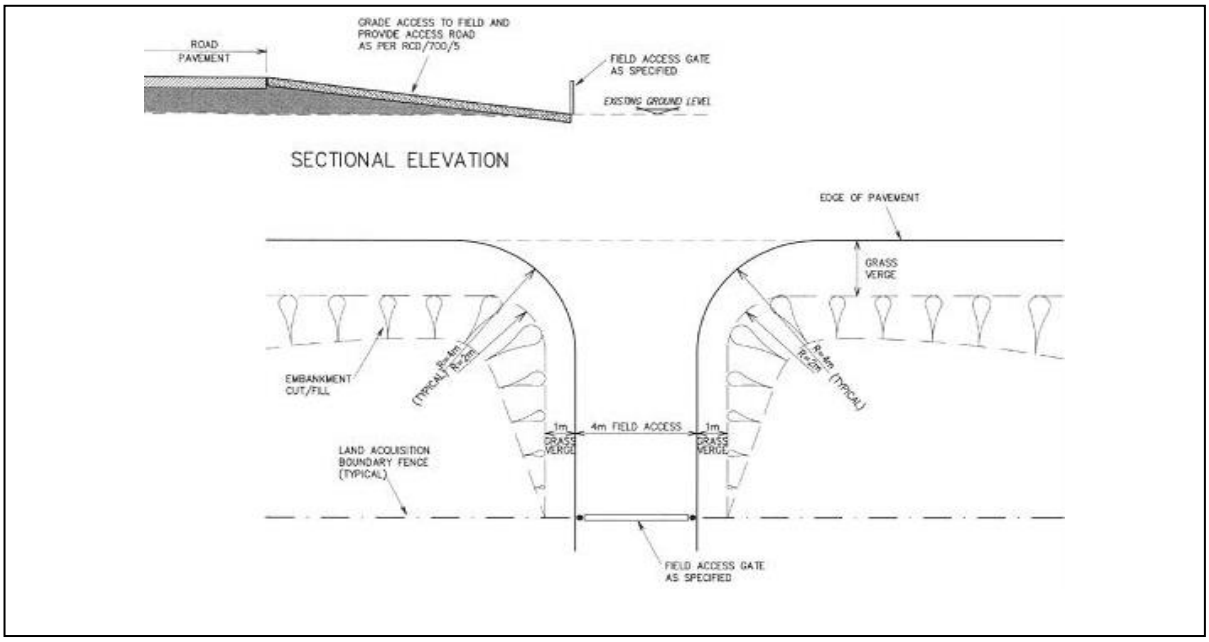
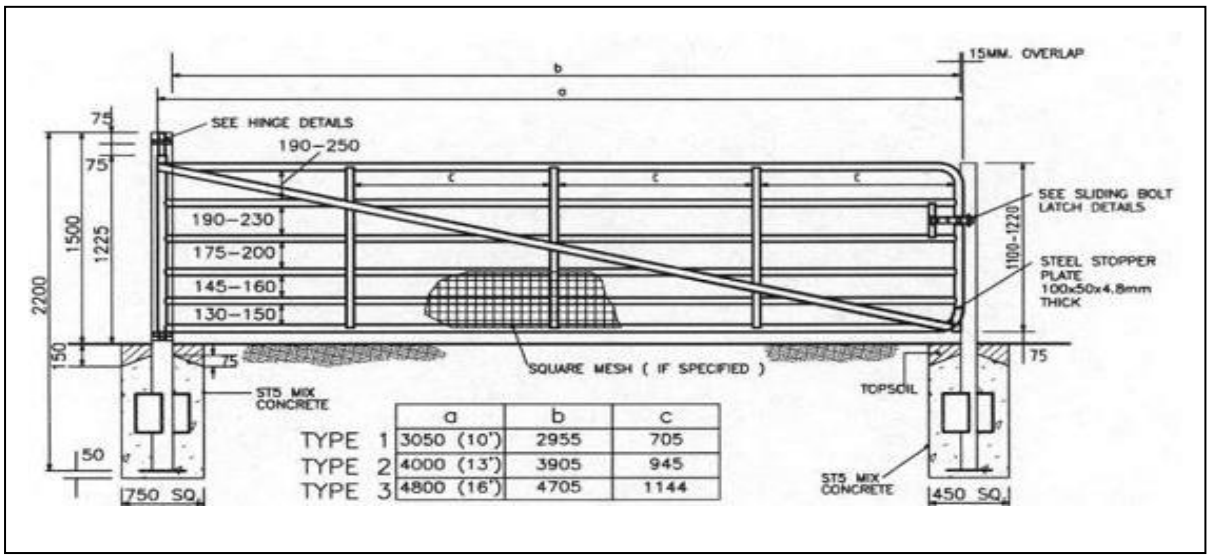



**Figure 6.18: Typical Single Steel Gate Detail (CC-SCD-00309)**




## 6.15 Services & Utilities

The new scheme intercepts various utility services along its proposed mainline. The delivery of the proposed road development shall ensure that there are no permanent disruptions to services provided by these providers and that all temporary disruptions are minimised. Where service diversions are required to facilitate the development, all design works, and construction must be carried out in accordance with the relevant statutory bodies and utility and service providers.

The relevant utility companies have been consulted to identify conflict areas between their services and the proposed road scheme. This section of the report identifies likely diversions necessary. The scheme is predominately located within a rural environment, and majority of the scheme will be online road realignment and therefore, the scheme has high impact upon telecommunications lines, watermain and ESB.

The utility companies listed in **Table 6.17** below have been approached with respect to the N59 realignment scheme. A detailed topographical survey was undertaken on behalf of Galway County Council by Apex Surveys Ltd during November 2019 to identify the location of utilities within the study area. For the location of all existing known services refer to Drawings EWS-01-GC/19/18753, ESB-01-GC/19/18753, EE-01-GC/19/18753 and WF-01-GC/19/18753, in Appendix A of this report.

**Table 6.17: Utility Companies Consulted**

| Company | Service | Affected |
|---|---|---|
| Ervia | Gas Supply | No |
| Electricity Supply Board (ESB) | Electricity Supply MV (10KV/20KV) | Yes |
| Electricity Supply Board (ESB) / Windfarm | Electricity Supply 38Kva & Higher Voltage Underground Cable Routes | Yes |
| Irish Water | Water Supply | Yes |
| Éir | Telecommunications | Yes |

### 6.15.1 Gas Supply – Ervia (Formly Board GáIS Éireann)

Ervia owns and operates the gas transmission and distribution system in Ireland. Ervia do not currently have any mains in the vicinity, of the proposed scheme. There is no impact on the Gas Supply because of the proposed scheme.

### 6.15.2 Electricity Supply Board (ESB) / Windfarm

It has been established that the ESB have various overhead and underground cables running through this study area, including medium voltage (MV) (10kV/20kV) and high voltage (HV) (38Kva and higher). It will be necessary to liaise closely with ESB personnel throughout the duration of the project, regarding existing facilities and future planning. Refer to **Table 6.18** below for a detailed list of the ESB service conflicts. The design of diversions and alterations

to the ESB network will be discussed further at detailed design stage to determine the exact head clearance between the proposed roads and the power lines and determine whether undergrounding of services will be necessary.

**Table 6.18: ESB Network affecting the proposed realignment**

| Chainage (m) | (HV) 38KV + Underground Cables | (MV) (10KV / 20KV) Overhead Lines |
|---|---|---|
| 0 – 245 | Underground along centre of existing carriageway | Crossing Carriageway |

### 6.15.3 Water Supply

Protection, diversion, or relocation of water services will be made in agreement Irish Water. Maps of the existing water main scheme have been obtained from the Galway County Council Arc GIS software database. The maps indicate that there are 2no. watermains pipes of unknown size located within the existing roads, however there is no indication as to the exact location of the watermains. Temporary diversions to the water supply may be required prior to construction of road scheme. Permanent reconnection of water supply to all dwelling houses and agricultural lands that are affected by the proposed scheme will be the responsibility of the main contractor that's awarded the contract. Refer to Drawing EWS-01-GC/19/18753, in Appendix A of this report for the existing watermain layout.

### 6.15.4 Éir

Éir have 2No. overhead lines and 3No. underground cable routes services that may be affected by the proposed road development. The locations at which conflicts occur between Éir services and the proposed road development are shown in Drawing EE-010GC/19/19753, in Appendix A of this report. The services are generally underground in the grass verge or along the road edge with connections to dwellings running overhead from poles located next to junction boxes. The remainder of the services are overhead and are generally located adjacent to the existing side road L-5381 within the Study Area. As illustrated in **Table 6.19** the location at which conflict occurs with Éir services and the proposed N59 realignment are shown.

### Table 6.19: Telecommunications affecting the proposed realignment

| Chainage (m) | Road | Telecommunications | Type |
|---|---|---|---|
| 0 – 245 | N59 | Along Carriageway LHS | Underground Cable |
| 0 – 245 | N59 | Crossing Carriageway | Overhead Line |
| 0+118 – 0+245 | N59 | Along Carriageway RHS | Underground Cable |
| 0 – 158 | L-5381 | Along Carriageway RHS | Underground Cable |
| 0 – 158 | L-5381 | Along Carriageway RHS | Overhead Line |

## 6.16 Lighting

Not Applicable, no lighting on existing alignment and no lighting proposed.

## 6.17 Relaxations & Departures from Standard

TII allows for a flexible approach to be applied to a range of design standards, including Rural Road Link Design DN-GEO-03031, for situations where strict application of the desirable minimum standards would lead to disproportionately high construction costs or severe environmental impacts upon people, property, and the landscape. The flexibility is applied as a tiered hierarchy through the application of relaxations or departures. Relaxations can be applied at the discretion of the designer. However, if departures are to be incorporated into the design, then prior approval of the TII Standards Unit is required. Having regard to the fact that the scheme consists primarily of online upgrade, and is located within a particularly sensitive environment, it has been necessary to incorporate relaxations in the geometric design in-order to avoid excessive impacts.

In addition, there is a significant number of departures from standards required for the scheme. Departures application has been submitted to the TII Standards Unit for approval to incorporate these into the design. Departure Application Number 36295 submitted in accordance with TII Publications GE-GEN-01005 from Standards has received full approval from TII.

Full details of all Departures from Standard and Relaxations for the scheme are included in **Tables 6.20 – 6.22** below. Further Departure details are included in **Appendix I**.

### Table 6.20: Schedule of Departures

| Departure | Location | Type | Details | TII Standard Requirement |
|---|---|---|---|---|
| N59 Departure 1A | CH +0m – CH +180m on Type 2 Single Carriageway | Cross Section | No segregated provision for cyclists and pedestrians. | Footpath / Active Travel facility shall be provided as part of Type 2 /Type 3 Single Carriageway as per DN-GEO-03036 Fig 1.4 |
| N59 Departure 1B | CH +0m to CH+ 245m RHS | Cross Section | Insufficient clear zone provided varies between (0.5m – 8m) | As per DN-GEO-03036 Table 3.1 for 85km/h outside of bend ≥ 500m requires clear zone of 9.4m |
| N59 Departure 1C | CH +0 – CH +20 & CH +200 – CH +245m LHS | Cross Section | Insufficient clear zone provided (0.5m – 2.8m) | As per DN-GEO-03036 Table 3.1 for 85km/h inside of bend for 85km/h requires clear zone of 6.5m |
| L-5381 Departure 1D | CH +0 – CH +45m RHS & LHS | Cross Section | Insufficient clear zone provided (0.3m -4m) on Type 3 single carriageway | As per DN-GEO-03036 Table 3.1 for 70km/h straight for 70km/h requires clear zone of 5.2m |
| N59 Departure 1E | CH 0 –40m LHS & CH 0 -40m RHS & CH 225 -245m LHS & CH 220 – 245m RHS | Cross Section | Less than 3m verge provided | As per DN-GEO-03036 Table 4.2 minimum verge required for Type 2 single carriageway is 3m |
| N59 Departure 1F | CH 6.282m – CH 50.487m | Geometry | Horizontal radius achievable is 255m with 3.5% superelevation | As per Table 1.3 of DN-GEO-03031, Desirable minimum R is 510m with superelevation of 5% |
| N59 Departure 1G | Ch 52.358 – Ch 221.277 | Geometry | Superelevation of 3.5% achieved for a 510m radius | As per Table 1.3 of DN-GEO-03031, Desirable minimum R is 510m with superelevation of 5% |

### Table 6.21: Schedule of Departures

| Departure | Location | Type | Details | TII Standard Requirement |
|---|---|---|---|---|
| N59 Departure 1H | Throughout the Scheme | Geometry | No Transition Curves provided in the design due short length of the scheme. | As per paragraph 3.8 of DN-GEO-03031 Transitions curves to be provided as per Table 1.3. |
| N59 Departure 1I | Ch 180m | Geometry | No Right Turning Lane Provided. | As per Table 4.1 of DN-GEO-03060, AADT values warranting the facility. |
| N59 Departure 1J | Throughout the Scheme | Geometry | Stopping Sight Distance at low object height of 0.26m is only achievable for 90m | As per Table 5.5 of DN-GEO-03060 'Y' distance required for 85km/h is 160m |
| N59 Departure 1K | Throughout the Scheme | Geometry | Stopping Sight Distance at high object height of 1.05m is only achievable for 120m | As per Table 5.5 of DN-GEO-03060 'Y' distance required for 85km/h is 160m |
| N59 Departure 1L | CH 180m LHS | Geometry | Junction visibility. The 'Y' distance achieved looking Northwest is 159m | As per DN-GEO-03060 Table 5.5 the required distance for an 85km/h is 160m |
| N59 Departure 1M | Ch 216m LHS | Geometry | Existing dwelling entrance to be maintained 30m from Junction. | As per 5.5.1 of DN-GEO-03060. Access should be relocated. |
| N59 Departure 1N | Ch 63m RHS & Ch 116m RHS | Geometry | Field Accesses maintained. | As per 5.5.1 of DN-GEO-03060. Access should be relocated. |
| N59 Departure 1P | Ch 63m RHS & Ch 116m RHS | Geometry | Visibility Splays overlap, full sight distance not achieved. | As per 5.2.4 of DN-GEO-03060, there shall be a clear view from the access over the immediate area of the access and its connection to the national road. |
| L-5381 Departure 1Q | CH +0m – CH +45m on Type 3 Single Carriageway | Cross Section | No segregated provision for cyclists, only 2m wide footpath adjacent to the carriageway with no separation distance provided. | Footpath / Active Travel facility shall be provided as part of Type 2 /Type 3 Single Carriageway as per DN-GEO-03036 Fig 1.4 |

### Table 6.22: Schedule of Relaxations

| Relaxation | Location | Type | Details | TII Standard Requirement |
|---|---|---|---|---|
| N59 Relaxation 1A | CH 011.367 – CH 037.986 | Geometry | Vertical Curvature Sag K value of 17 applied. | As per Table 1.3 of DN-GEO-03031, Desirable minimum Sag K value of 26. Two Steps below Desirable Min Sag K Value applied |
| N59 Relaxation 1B | CH 060.594 – CH 188.825 | Geometry | Vertical Curvature Crest K value of 17 applied. | As per Table 1.3 of DN-GEO-03031, Desirable minimum Crest K value of 55. Two Step below Desirable Min Crest K value applied |
| N59 Relaxation 1C | Ch 060.594 – Ch 188.825 | Geometry | Vertical Curvature Sag K value of 17 applied | As per Table 1.3 of DN-GEO-03031, Desirable minimum Sag K value of 26. Two Steps below Desirable Min Sag K Value applied |
| L-5381 Relaxation 1D | CH 180m | Geometry | Dwell area obtained is 11m on the Gortacleva Road with a dwell area gradient of +4% | As per 5.6.3 of DN-GEO-03060 dwell area of at least 15m shall be provided adjacent to a major road carriageway, however Cn be reduced to 10m as a relaxation. Gradient of dwell area shall lie between plus or minus 2.5% and may be increased to plus or minus 4% as a relaxation. |

# 7 Road Safety Audit

A Stage 1 Road Safety Audit has been completed in accordance with the DN-REQ-03034 and the recommendations of the audit will be incorporated into the detailed design. Right hand turning lane and increase the superelevation from 3.5% to 5% was recommended by the Audit team, however these recommendations wasn't accepted by Galway County Council, so an Exception Report was required as part of the approved Stage 1 Road Safety Audit. The Exception Report was accepted by Alastair de Beer of TII Director of Overseeing Organisation on the 09/04/2024.

A stage 1 road safety audit is deemed appropriate for a junction improvement at this stage. A stage 2 road safety audit will be undertaken once planning permission for scheme is approved and the detailed design is complete.

All recommendations from the audit will be reviewed by the Design Team and incorporated into the design drawings if agreed upon.

Full details of the Stage 1 Road Safety Audit and Exceptions Report is included in **Appendix B**.

# 8 Total Scheme Budget

The cost estimate for the scheme in the Feasibility and Options Report approved at Gateway 1 was €1,410,925 including VAT. An updated cost estimate has been prepared and a breakdown of the estimate is provided in Appendix C of this report.

The current cost estimate is **€1,410,925** including VAT which represents a 0% increase. The current estimate is based on increased inflation rates and stabilised land acquisition cost as the alignment has been tweaked from the early design stage to provide an improved horizontal alignment, providing better value for money.

# 9 Project Appraisal Balance Sheet

A project appraisal balance sheet has been prepared for this scheme in accordance with the guidance set out in DN-GEO-03030. The PABS is provided in Appendix D. The overall description of the scheme is neutral.

# 10 Appendices

Appendix A - Design Drawings
Appendix B - Road Safety Audit Stage 1
- Exceptions Report
Appendix C - Cost Estimate
Appendix D - PABS
Appendix E - Drainage Design Report (Greenfield Runoff Rate)
- Drainage Design Report (HR Wallingford Greenfield Runoff Rate)
- Drainage Design Report (N59 Kentfield Rainfall Data)
- Drainage Design Report (Treatment Volumes)
Appendix F - Hydrology & Drainage Assessment Report
Appendix G - Environmental Assessment Report (CEMP)
- Environmental Assessment Report (EcIA)
- Environmental Assessment Report (EIA)
- Environmental Assessment Report (NIS)
Appendix H - Impact Assessment Report on Cultural Heritage
- Cultural Heritage Report (Addendum)
Appendix I - Departures from Standard
- Departures Application Approval