Chapter 4 Description of the Proposed Road Development

4.1 Introduction

This chapter provides a description of the N5 Ballaghaderreen to Scramoge proposed road development. It is based on the design and includes details of engineering features, land requirements and construction and operational requirements.

The description of the main elements of the design is presented in the following sections. The description includes references to Chainages (Ch.) denoting the distance in metres (m) along the proposed alignment, increasing travelling east from the tie in with the N5 Ballaghaderreen Bypass towards the tie-in with the existing N5 at Scramoge.

It should be noted that surveys, assessments and information that form the basis of this Environmental Impact Assessment Report are based on the current design of the project which has been developed to a stage that permits a fully informed Environmental Impact Assessment and Natura Impact Assessment. While some developments and refinements of the current design may occur during the detailed design stage, any such iterations of the development, if approved, will not include any significant adverse impacts on the environment not dealt with within this EIAR and EIA process.

4.1.1 General Description

The proposed N5 Ballaghaderreen to Scramoge Road comprises of a Type 1 Single Carriageway of approximately 33.4km in length. The proposed alignment commences east of Ballaghaderreen at a tie-in with the newly constructed N5 Ballaghaderreen Bypass in the townland of Rathkeery and continues eastwards, bypassing Frenchpark to the south. The alignment crosses to the north of the existing N5 at Cashel and continues in an easterly direction through Mantua, crossing the R369 in the townlands of Corry East/Kilvoy, before once again crossing the R369 Bellanagare to Elphin road in the townland of Cartronagor, before crossing the N61 National Secondary Road, south of Elphin at Gortnacrannagh. The route continues south of Elphin before turning in a south-easterly direction, crossing the R368 and running largely parallel to the east of the R368 and bypassing Strokestown before rejoining the existing N5 in Scramoge.

The proposed road development comprises the following major elements:

- 33.4km of National Primary Road to Type 1 Single Carriageway standard;
- 15.4km of realignment of existing roads;
- Five roundabouts;
    - Frenchpark Roundabout (R361 south of Frenchpark);
    - N61 Roundabout (between Tulsk and Elphin);
    - Shankill Roundabout (N61/R369);
    - Strokestown Roundabout (LP-1405);
    - Kildalloge Roundabout (R368/LP-1405);
- At grade mainline T junctions;
    - 16 'T' Junctions, of which 5 are staggered;

- Reconfiguration of a crossroads between the existing N5 and R361 in Frenchpark;
- 3 road under bridges and 1 road overbridge;
- 4 river bridges and 14 culverts;
- Approximately 290m approx. of retaining walls at three locations;
- Provision of 9 accommodation underpasses, access roads and accesses;
- Associated earthworks including excavation of peat and unacceptable material, excavation and processing of rock and other material, provision of material deposition areas, and deposition and recovery of unacceptable material for use in the works;
- Temporary site compounds;
- Drainage works;
- Landscaping works;
- Utilities and Services Diversion Works including the diversion of high voltage electricity lines at 3 locations and the provision of associated support towers/ poles;
- Safety Barrier, Public Lighting, Fencing and Accommodation Works; and
- Environmental measures and all other Ancillary Works.

4.1.2 Purpose of Providing the Proposed Road Development

The implementation of the Proposed Road Development will achieve the following:

- Provide a road that is fit for purpose and which is designed and constructed in accordance with current design standards;
- Provide a consistent cross section which will allow efficient movement of persons and goods in safety and comfort;
- Provide full stopping sight distance along its entire length;
- Provide appropriate junction and accesses with visibility in accordance with current design standards;
- Provide a road with appropriate safe overtaking opportunities;
- Provide a safer road, by eliminating a large number of roadside hazards and providing a forgiving roadside, with appropriate protection where required;
- Provide road surface water runoff collection and treatment facilities to ensure that rainfall is effectively removed from the road surface and is treated before discharge to the existing water environment. This includes provision for cut-off and storage in the event of a road accident causing spillage of deleterious materials;
- Completing the missing link in previous investments and improvements on the N5 corridor allows a realisation of the benefits from the accumulated development on the N5 corridor.

4.2 Road and Junction Standards

The standards adopted generally follow the requirements of the National Roads Authority (now TII) Design Manual for Roads and Bridges (NRA DMRB).

4.3 Mainline Alignment

This section describes the horizontal and vertical alignment of the proposed N5 (herein after referred to as the 'mainline') and how this relates to the existing environment and other significant elements of the N5 Ballaghaderreen to Scramoge Road Project. The alignment is divided into four Sections A-D (with each section commencing at the next 10,000 round chainage), running west to east with a description of each section and is in order of increasing chainage along the mainline as shown in Table 4.1. The mainline alignment is shown in Figures 4.1 – 4.25 and each of the major junctions are shown in Figures 4.26 – 4.37.

Table 4.1 Road Alignment Chainage

Section	Segment	Chainage
A	N5 between the tie-in to the N5 Ballaghaderreen By-Pass (East) and Frenchpark Roundabout on the R361 (Junction 5).	1+000 – 5+697
B	N5 between the Frenchpark Roundabout (Junction 5) and the N61 Roundabout at Gortnacrannagh (Junction 14) including N61 Upgrade to Shankill Roundabout.	10+000 – 24+200
C	N5 between the N61 Roundabout (Junction 14) and the Strokestown Roundabout at Lavally (Junction 19)	30+000 – 40+542
D	N5 between the Strokestown Roundabout (Junction 19) and the tie-in to the existing N5 in the townland of Scramoge.	50+000 – 53+970

4.3.1 Section A, N5 Ballaghaderreen By-Pass to the Frenchpark Roundabout

Section A of the mainline commences at the eastern end of the N5 Ballaghaderreen By-Pass in the townland of Rathkeery and extends to the Frenchpark Roundabout on the R361 Regional Road south of Frenchpark in the townland of Corskeagh, a total length of 4.7km. Table 4.2 shows the geometric parameters used within Section A.

Table 4.2 Section A, Summary of Road Characteristics

Design Characteristic	Value
Mainline Chainage	Ch. 1+000 – Ch. 5+697
Length	4.7km
Cross-Section	Type 1 Single Carriageway
Design Speed	100 km/h

4.3.1.1 Ch. 1+000 to Ch. 2+250 (Junction 3)

Section A commences at the tie-in to the eastern end of the N5 Ballaghaderreen By-Pass in the townland of Rathkeery curving offline in a south-easterly direction through a series of right & left hand 2880m radii curves.

The alignment is largely at grade along this section as it follows the slightly undulating ground profile. At Ch. 1+450 the mainline severs an unclassified access road and local road LS-5632 at Ch. 2+250. New T junctions to the proposed N5 have been provided to the south at these side road crossings, with the northern arms stopped up.

4.3.1.2 Ch. 2+250 (Junction 3) to Ch. 4+620 (Junction 5)

Beyond Ch. 2+250 the alignment transitions from a left hand 2880m radius curve into a 1.9km right hand 2880m radius curve. At Ch. 2+700 a new link to the existing N5 is provided to provide local access for the surrounding communities. At Ch. 2+900

the alignment severs local road LS-5625 approximately 140m to the south of the existing N5. A T-junction provides local road access to the south of the proposed N5 mainline and the northern arm of local road LS-5625 is stopped up with a turning head provided adjacent to the proposed N5. The junction at Ch. 2+700 and Ch. 2+900 provide a left right staggered junction, with ghost islands incorporated on the proposed N5 to provide a refuge for right turning traffic.

4.3.1.3 Ch. 4+620 (Junction 5) to Ch. 5+697 (Junction 6, Frenchpark Roundabout)

At Ch. 4+620 the alignment enters a horizontal right hand curve which continues to the terminus of Section A at Ch. 5+697. In combination with the vertical alignment, this curve permits two-way overtaking. At Ch. 4+625 the alignment crosses local road LS-5629 and a simple at grade T-Junction provides access to the south-west arm of the LS-5629. The northern arm of the LS-5629 is stopped up. At Ch. 5+697, an at-grade roundabout junction with Regional Road R361 is incorporated serving the nearby settlement of Frenchpark. Due to the reduction in traffic on the existing N5 and the increase of traffic on the R361 there will be a reconfiguration of the existing crossroads between the existing N5 and R361 in Frenchpark (see Plate 4.2).

Plate 4.1 below shows the location of the proposed Frenchpark Roundabout (Junction 5).

Plate 4.1 Photo of R361 Looking South Rowards Frenchpark Roundabout Location

Plate 4.2 Photo of Existing N5/R361 Frenchpark Junction

4.3.2 Section B, Frenchpark Roundabout (Junction 6) to N61 Roundabout (Junction 13)

Section B of the mainline commences at the Frenchpark roundabout and extends through to the N61 roundabout in the townland of Gortnacrannagh a total length of 14.2km. Table 4.3 shows the geometric parameters used within Section B.

Table 4.3 Section B, Summary of Road Characteristics

Design Characteristic	Value
Mainline Chainage	Ch. 10+000 – Ch. 24+200
Length	14.2km
Cross-Section	Type 1 Single Carriageway
Design Speed	100 km/h

4.3.2.1 Ch. 10+000 (Junction 6, Frenchpark Roundabout) to Ch. 12+750 (Junction 7 – Existing N5)

From the Frenchpark Roundabout at Ch. 10+000 the horizontal alignment follows a south-easterly direction on a right hand 2880m radius curve before curving in a more easterly direction on a 1020m radius. The mainline passes to the north of Leggatinty Bog with the northern section of the severed unclassified access road stopped up. Access to the southern section of Leggatinty Bog is provided from local road LT-56295.

Through this section, the road is on embankment of a maximum height of 2m. This embankment ensures that the drainage system will be above existing ground level and will not drain the surrounding lands, allowing the existing drainage regime to be maintained.

At Ch. 11+880 the horizontal alignment changes to a right hand curve and reaches the highest point within Section B at Ch. 12+191.

At Ch. 12+750 the proposed N5 mainline severs the existing N5 and, at Ch. 12+870, local road LS-5641 in the townland of Cashel. A right-left staggered junction with a ghost island right turn lane provides access to the existing N5 north and south of the proposed N5.

4.3.2.2 Ch. 12+750 (Junction 7, Existing N5) to Ch. 15+800 (Junction 8, LS-5642 Peak Road)

From Cashel (Ch. 12+750) the horizontal alignment continues in a south easterly direction, severing the LS-5640 at Ch. 13+100, before entering a right hand 2880m radius curve whilst the vertical alignment falls in level, entering a cutting at Ch. 13+000 which has a maximum depth of 11m. The overall length of the cutting is approximately 800m. Within the cutting the horizontal alignment transitions into a left hand curve before entering a long section combining a near straight and a straight for a distance of 2.85km. Emerging from the cutting at Ch. 13+800 the alignment is on an embankment of up to 6.5m, crossing a shared agricultural & pedestrian underpass (UP13.01) at Ch. 13+950, provided to retain connectivity of the Bellanagare walking route and to provide access to severed lands.

The low point in this section of the alignment is at Ch. 14+503 adjacent to the Owennaforeesha River, from which the road rises on minimum longitudinal gradient for 3km, on generally low embankments and through shallow cuttings, largely following the existing topography.

At Ch. 15+800 the proposed N5 severs local road LS-5642, known locally as the 'Peak Road'. Two T Junctions are provided north & south at Ch. 15+550 and Ch. 15+800 in a right-left staggered arrangement. A 2m high visual screening / noise bund is proposed on the northern side of the mainline to provide shielding to a residential property that will be adjacent to the proposed N5.

4.3.2.3 Ch. 15+800 (Junction 8, LS-5642 Peak Road) to Ch. 21+950 (Junction 12, R369 Elphin Road)

From Ch. 15+800 the road continues in an easterly direction on a straight horizontal alignment. At Ch. 17+470 the alignment transitions to a left hand 2880m radius curve to pass to the south of a number of properties on the Mantua Road severing the local road LS-5601 at Ch. 17+600 and then crossing the R369 regional road to the south of the entrance to Mantua House at Ch. 18+150.

The horizontal alignment continues in an easterly direction on a straight, crossing the R369 again at Ch. 19+250 and then crossing local road LP-1218 at Ch. 19+750 to the north of Yambo Cross whilst transitioning onto a 10,000m radius right hand curve to run parallel to regional road R369.

The horizontal alignment then curves north eastwards crossing local road LT-60232 at Ch.20+675 before heading in a south easterly direction, crossing the R369 regional road at Ch. 21+950 in the townland of Cartronagor.

The vertical alignment rises on minimum longitudinal gradient to a high point at Ch. 17+803. This high point is on an embankment of approximately 3m height and a 2m high false cutting has been incorporated on the north and south of the alignment to provide noise and visual screening to properties adjacent to the proposed road development.

From the high point at Ch. 17+803, the alignment falls on minimum gradient entering a cutting with a maximum depth of 8m, to the low point at Ch. 21+149 adjacent to the Mantua River.

At Ch. 19+585 an unoccupied bungalow is within the footprint of the proposed development and will require demolition as part of the works.

The severed local road LS-5601 at Ch. 17+600 is connected to the proposed N5 at Ch. 17+580 to form a T junction. The southern section of the severed regional road R369 is connected to the N5 at Ch. 17+900 via a T-junction to facilitate access to Bellanagare and the realigned LS-6131.

The severed local road LP-1218 at Ch. 19+740 will be bridged over the proposed N5 to maintain local connectivity for the surrounding community. The priority of the junction between local road LP-1218 and regional road R369 has been reversed to provide the through priority to the LP-1218 over the proposed overbridge, with traffic on the severed regional road R369 yielding to traffic on local road LP-1218.

The R369 is connected to the mainline at Ch. 21+950 with a right left staggered junction arrangement incorporating ghost islands to provide safe waiting areas for right turning traffic.

4.3.2.4 Ch. 21+950 (Junction 12, R369 Elphin Road) to Ch. 24+200 (Junction 13 - N61) Including N61 Upgrade and Shankill Roundabout

From the R369 junction 12 at Cartronagor the alignment progresses south east through the townlands of Creeve and Gortnacrannagh. From Ch. 21+950 the

horizontal alignment continues on a straight for 1.3km before entering a left hand curve. At Creeve the alignment runs along the southern side of a hill which rises steeply to the north. Through this section the alignment is in cutting with a typical depth of 4m.

Vertically the alignment falls from the R369 junction until it meets the proposed N61 roundabout at Ch. 24+200 entering a 950m long section of cutting. This cutting reaches a depth of 8 - 9m at Ch. 23+800 and continues to junction 13, the N61 roundabout which is formed in the cutting.

4.3.3 Section C, N61 Roundabout (Junction 13) to Strokestown Roundabout (Junction 17)

Section C of the mainline commences to the east of the N61 Roundabout (Junction 13) as a Type 1 Single Carriageway and extends through to the Strokestown Roundabout (Junction 17) in the townland of Lavally, a length of 10.5km. Table 4.4 shows the geometric parameters used within Section C.

Table 4.4 Section C, Summary of Road Characteristics

Design Characteristic	Value
Mainline Chainage	Ch. 30+000 – Ch. 40+542
Length	10.5km
Cross-Section	Type 1 Single Carriageway
Design Speed	100 km/h

4.3.3.1 Ch. 30+000 (Junction 13, N61 Roundabout) to Ch. 35+000 (R368 Underbridge)

From the N61 roundabout the N5 mainline heads in a south easterly direction on a straight and on a constant downhill gradient, exiting the cutting at Ch. 30+500 and entering a 1.55km section of embankment typically 4 - 6m in height. At Ch. 30+680 a cattle underpass (UP30.01) is provided to minimise the impact of the proposed road development on the farming operations of severed lands. At Ch. 30+885 the alignment forms a low point adjacent to the Owenur River crossing. At Ch. 31+900 the mainline crosses local road LP-1412 (UB31.01), with the alignment on a 5.5m high embankment allowing the mainline to bridge over the local road maintaining local access and providing a parallel agricultural underpass to connect lands to the south of the mainline to farm sheds to the north of the alignment. To allow for construction of the mainline northern embankment one farm building will require demolition (Plate 4.3).

Plate 4.3 **Farm Buildings on LP-1412 - View South. The proposed Alignment Passes Behind the Sheds in the Foreground and Through the Far Shed.**

As the alignment continues eastwards through the townland of Killeen East, it enters a 1.0km section of cutting, with a maximum depth of 13.3m at Ch. 32+900. At Ch. 32+682 the alignment enters a left hand curve to pass to the north of Clooncullaan Lough (Plate 4.4). At Ch.33+290 the alignment crosses an underpass (UP33.01) which provides access to severed lands south of the proposed N5 from the LP-1409 to the north of the mainline.

Plate 4.4 **View South towards Clooncullaan Lough from the LP-1409. Proposed N5 Crosses the Low Ground on a 3-4m Embankment.**

Once north of Clooncullaan Lough, the mainline curves right before entering a larger radius right hand curve for a distance of 2.1km. At Ch. 34+600 the alignment crosses an underpass (UP34.01) which provides connectivity to a large landholding severed by the proposed N5. The alignment then proceeds in a south easterly direction towards Cregga Hill crossing regional road R368 to the north of the junction with Clooncullaan Road (LS-6030) at Ch. 35+000.

From the low point at Ch. 33+848 north of Clooncullaan Lough, the alignment climbs uphill for a distance of 5.1km approaching Cregga Hill. At Ch. 34+730, a link road provides access to the realigned R368 regional road. The link road connects the mainline and regional road with a priority ghost island at-grade junction provided on the N5.

4.3.3.2 Ch. 35+000 (R368 Underbridge – UB 35.01) to 39+150 (Junction 16 LT-60443)

From the R368 overbridge at Ch. 35+000, the N5 mainline continues on a right hand 2,880m radius curve climbing at minimum gradient as the alignment enters a large cutting on the side of Cregga Hill severing the local road LT-60312. At Ch. 35+900 the alignment transitions into back-to-back left and right hand curves in order to avoid a Turlough, to the south and west of the alignment and to follow the landform of Cregga Hill, minimising impacts on Cregga Demesne. At Ch. 36+230, the northern cut slope reaches a maximum depth of 33m with an overall length of cutting of 1,375m.

As the alignment progresses south towards Strokestown, the topographic characteristics change to a highly undulating drumlin landscape. The earthworks alternate frequently between sections of cut and fill with the road users following a smooth flowing alignment through this undulating landscape.

From Ch. 36+480 to Ch. 36+900, the mainline is on embankment for a length of 420m. The embankment reaches a maximum height of 13.6m as the alignment passes to the north of the Turlough crossing an agricultural underpass at Ch. 36+700 (UP36.01). Heading south from the Turlough, the alignment transitions into a left hand curve before heading south west on a near straight curve. At Ch. 36+900 the alignment enters another cutting with a maximum depth of 15m and at Ch. 37+463, the alignment increases in gradient for 1.4km crossing another section of embankment where the alignment is on sidelong ground. An agricultural underpass is proposed at Ch. 38+000 (UP38.01).

As the N5 approaches the townland of Lettreen, the alignment severs local road LT-60443. Access is maintained east & west of the mainline through provision of an at-grade right-left staggered junction arrangement (Junction 16).

4.3.3.3 Ch. 39+150 (Junction 16, LT-60443) to Ch. 40+500 (Junction 17, Strokestown Roundabout)

At Ch. 39+160 the alignment transitions into a left hand minimum radius curve to avoid a known archaeological site and provide greater separation from properties to the south. At Ch. 39+600 the alignment enters a straight section before curving right on a minimum curve and straightening to approach the Strokestown roundabout.

Vertically, from the high point at Ch. 38+980, the alignment falls towards the Strokestown roundabout.

The mainline remains generally at grade from the right-left staggered junction at Ch. 39+150 to Ch. 39+700. After a section of shallow cut, from Ch. 40+100, the mainline is on embankment for a length of 300m. The embankment reaches a height of 7.0m at Ch. 40+250 to Ch. 40+350 with an agricultural underpass (UP40.01) provided at this location.

The proposed Strokestown Roundabout intersects local road LP-1405, forming a new entrance to the north east of the town of Strokestown. The roundabout is located at the cut/fill line, with the LP-1405 locally realigned to remove a sharp blind crest, resulting in the roundabout being located on the edge of the following cutting.

4.3.4 Section D, Strokestown Roundabout (Junction 17) to the Existing N5 at Scramoge

Section D of the mainline commences at the Strokestown Roundabout and extends through to the tie-in to the existing N5 in the townland of Scramoge, a length of 3.97km. Table 4.5 shows the geometric parameters used within Section D.

Table 4.5 Section D, Summary of Road Characteristics

Design Characteristic	Value
Mainline Chainage	Ch. 50+000 – Ch. 53+970
Length	3.97km
Cross-Section	Type 1 Single Carriageway
Design Speed	100 km/h

4.3.4.1 Ch. 50+000 (Junction 17, Strokestown Roundabout) to 53+970 (N5 tie-in at Scramoge)

From the Strokestown roundabout the mainline heads south east on a straight section of alignment for 1.5km, by-passing Strokestown approx. 1km to the rear of Strokestown House. From the high point at the roundabout the alignment falls in a cutting of maximum depth 7m, then enters embankment at Ch. 50+700, crossing an underpass (UP50.01) at Ch. 50+900, before reaching a low point at Ch. 51+420 in proximity to the Strokestown River.

At Ch. 52+250 the mainline severs local road LS-6121 at Cloonradoon. At this location the mainline is on an embankment 1.7m high. Access east of the mainline is maintained through provision of an at-grade T-junction with the road being stopped up on the western side of the proposed mainline. A false cutting has been incorporated within the design on the east of the mainline from Ch. 51+700 to Ch. 52+200 to provide noise and visual screening for properties to the east of the alignment on local road LS-6121. At Ch. 52+840 the horizontal curves on a minimum radius curve to meet the existing N5 at Scramoge.

Plate 4.5 Scramoge River, View Looking North to Crossing Point in the Foreground

The alignment crests at Ch. 52+169 before falling towards the Scramoge River reaching the low point at Ch. 52+740. (Plate 4.5) Crossing the Scramoge River, the alignment climbs at a constant grade of for a distance of 1.1km rising towards the existing N5 tie-in in the townland of Scramoge. Through this section the road embankment reaches a maximum height of 8.9m at Ch. 53+150 while at Ch. 53+250 the road bridges over local road LS-6144.

A ghost island T junction is provided to re-connect the existing N5, providing a connection to Strokestown for westbound traffic.

4.4 Road Cross-Section

The proposed development has been designed with a Type 1 single carriageway cross section. From the traffic predictions (see Chapter 05 of this EIAR), the provision of a Type 1 single carriageway cross-section provides a Level of Service (LoS) C throughout its length. From the National Road Needs study, Level of Service C has the following characteristics:

Classification	% Time Delay	Average Speed	Passing Condition	Driving Condition
LoS C	≤60	84kph	Platoon formation occurs with passing demand exceeded by opportunity	Driver delay up to 60% due to slower vehicles

Various road improvement projects have been implemented on the N5 between Longford and Westport as set out in Table 4.6 below. These developments have generally consisted of upgrading the existing N5 to a Type 1 single carriageway cross-section, with the exception of the N5 Westport to Turlough Road Project which is a Type 2 Dual Carriageway. The provision of a Type 1 single carriageway on the route section between Ballaghaderreen bypass and Scramoge will therefore provide a continuity of carriageway cross-section on the N5.

Table 4.6 Road Improvement Projects on the N5

Name	Year Opened	Carriageway Type	Length	Comments
Clondara Bypass	1978	Type 1 Single	7.8km	
Scramoge – Cloonmore	2004	Type 1 Single	8km	
Pavement Rehabilitation Scramoge to Ballaghaderreen	**2000 - 2005**	**As Existing, Typically Type 2 & 3 Single Carriageway but with narrow verges**	**35km**	**Limited to re-surfacing of the existing carriageway**
N5 Longford Bypass	2013	Type 1 Single	2.6km	
N5 Ballaghaderreen Bypass	2014	Type 1 Single	13.6km	
Turlough to Swinford	1970's & 1980's	Type 1 Single	16.7km	Carried out as a number of smaller projects
Turlough Bypass	1990	Type 1 Single	10km	
Swinford Bypass	1993	Type 1 Single	5km	
Charlestown Bypass	2007	Type 1 Single	18.2km	

Name	Year Opened	Carriageway Type	Length	Comments
N5 Westport to Turlough	Planning Approval Received	Type 2 Dual	22km	Site clearance and fencing ongoing

Table 4.7 below indicates the carriageway, verge and hard shoulder width appropriate for each road class that has been incorporated into the design of the project. The cross-section for each classification of road is in accordance with TII/NRA DN-DNG-03036 and in general, the proposed width of a realigned local road will reflect the existing road width. However, if an existing road is less than 4m a minimum cross section of 4m carriageway with 1m verges has been applied.

In all areas where a junction is provided onto the National Road a short length of Type 3 Single Carriageway is provided at the junction, as a minimum, to ensure that vehicles leaving the National Road are not delayed by the presence of a vehicle waiting to join the National Road.

Table 4.7 Standard Cross-Section Dimensions

Road Type	Road Class	Carriageway Width	Hard Shoulder Width	Verge Width
Type 1 Single Carriageway	National Road	7.3m	2.5m	3.0m
Type 2 Single Carriageway	National and Regional Roads	7.0m	0.5m Hard Strip	3.0m where footway/cycleway is not present and 5.0m where cycleway/footway is incorporated in the verge (Includes 0.5m hard-strip)
Type 3 Single Carriageway	Local Roads and Regional Roads	6.0m	0.5m hard strip	3.0m where footway/cycleway is not present and 5.0m where cycleway/footway is incorporated in the verge (Includes 0.5m hard-strip)
Other Single Carriageway	Local Roads	4.0 – 6.0m	N/A	1.0 – 2.5m

The design is developed on the basis of providing a working space requirement between the earthworks and the boundary fence line for National Routes / Link Roads of either 5m or 8m depending on whether cut-off drains are required. A standard offset of 3m to 5m for other roads has been adopted.

Refer to Figures 4.38 and 4.39 for details of typical cross-sections that have been adopted within the proposed road development.

4.5 Local Road Upgrades

The mainline intersects the local road network at a number of locations. Alterations to the neighbouring road network are required in order to facilitate the proposed road development. Notwithstanding this, the integrity of the road network will be maintained. There are two major neighbouring road upgrades proposed as part of

the project, with the majority of the neighbouring roads realigned in the vicinity of their junction with the proposed realigned mainline.

4.5.1 N61 – Junction 13

The existing N61 National Secondary road is sub-standard in the vicinity of the proposed N5, particularly at Shankill cross-roads. The N61 has a sub-standard cross-section, vertical geometry and visibility from junctions and accesses. The visibility from the western arm of regional road R369 at Shankill is particularly constrained by the sub-standard vertical geometry to the right, and the horizontal alignment in conjunction with the wall of the graveyard when looking to the left. The provision of an uncontrolled cross-roads junction is prohibited in the current design standards due to their poor safety record. This is reflected at Shankill cross-roads junction which has been identified as an accident blackspot.

In conjunction with the largely online improvement to the N61, which includes upgrading the cross-section to a consistent Type 2 Single carriageway and improves the undulating sub-standard vertical profile to current design standards, the design incorporates the provision of a new roundabout at Shankill to eliminate this accident blackspot from the National Secondary road network.

The vertical alignment commences at the N5/N61 roundabout in a 7m deep cutting and rises on a constant gradient before cresting at Ch. 0+334 on a desirable minimum crest curve. As the alignment passes the properties located at Ch. 0+175 and Ch. 0+250 the proposed N61 is in a cutting approximately 4m deep and retaining walls have been incorporated to minimise the impact of the realignment on the adjacent properties. The alignment then follows the existing N61 online, before deviating to the east and rising in level to connect to the proposed Shankill roundabout.

4.5.2 LP-1405 Strokestown Link – Junction 17

The existing R368 regional road and local road LP-1405 are sub-standard with respect to horizontal and vertical geometry, in combination with a sub-standard cross-section and minimal visibility, particularly from junctions and direct accesses. The LP-1405 will be upgraded and realigned as part of the works between the proposed R368 Kildalloge roundabout to the north of Strokestown and the proposed Strokestown roundabout in the townland of Lavally. The LP-1405 realignment is 900m in length and designed to 60kph to in accordance with TII/NRA DMRB DN-GEO-03031 for a speed restricted zone with a 50kph limit. The realignment is largely online upgrading of the existing road, with small sections of offline alignment on the eastern and western approaches to the Kildalloge and Strokestown roundabouts.

A shared cycleway/footway has been incorporated into the southern verge of the realigned LP-1405, to provide a safe route to the urban surroundings of Strokestown. The R368 eastern verge incorporates a shared pedestrian/cycle facility to the R368 Kildalloge roundabout, with a crossing point to the east of the roundabout for connectivity to Strokestown.

4.6 Pedestrian and Cycle Provision

Along the length of the proposed road development, cyclists and pedestrians are facilitated by the provision of the Type 1 cross-section which includes a 2.5m wide hard shoulder on either side of the road. The proposed road will create new linkages to nearby villages and areas for both long distance cycling on the N5 corridor and local cycling movements.

No formal cycle or pedestrian facilities exist within the extents of the proposed road development, other than at the tie-in to the northern extents of Strokestown, however a number of informal walking/cycling routes are impacted by the proposed road development. Three walking/cycling routes have been identified through consultation with members of the public at the preferred route public consultation event held in March 2015.

- Bellanagare – This informal looped walking route to the north of Bellanagare Village utilises the existing local road network providing a 3.9km route.
- Lavally to Strokestown – This route provides a direct link to the northern extremity of Strokestown and is approximately 1.4km in length.
- Scramoge – This informal looped walking route is 4.8km in length, utilising the LS-6144, LS-6084, LS-6083 and R371 to the north and south of Scramoge Cross Roads on the existing N5.

4.6.1 Bellanagare Walking Route

This route was identified as a 3.9km looped walking route by local people during the public exhibition held in March 2015. It begins in Bellanagare village and follows the local road (LS-5640) north of the village turning onto the LS-5641 and then turning right at the junction with the LT-56411 to return to the village on the LS-5641, a total length of 3.9km. The proposed N5 bisects the walkway in two locations at Ch. 13+125 and Ch. 13+650 with a 3.7m cutting.

Pedestrian and cyclist surveys were undertaken during August 2015 over a seven day period to determine the extent of usage of the walking route. The survey indicated that there were approximately 15 people per day used the walking route.

To assist in mitigating the impact on Bellanagare walking route it is proposed to construct a shared segregated pedestrian/cycle path adjacent to a farm access track through an underpass at Ch. 13+950 maintaining the connectivity of local road LS-5641 as a walking route. A 3m wide shared cycle/pedestrian path will be provided on both the north and south sides of the proposed N5 connecting the LS-5640 with the LS-5641. This will provide walkers with a longer loop (5.77km) and a shorter loop (2.95km).

The proposed lines of the revised walking routes are marked in red in Plate 4.6 and 4.7 below.

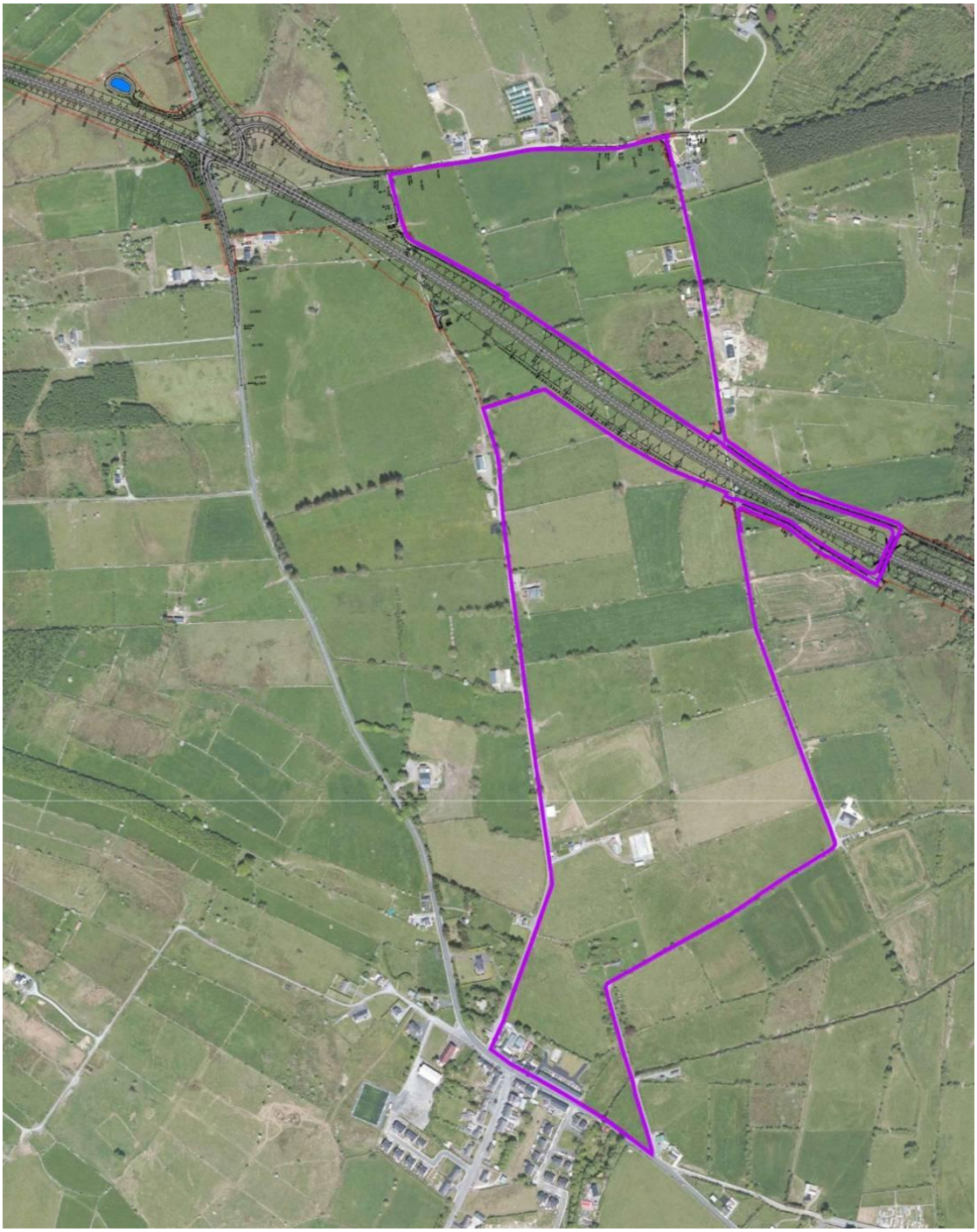

Plate 4.6 Proposed Bellanagare Walking Route – Longer option (5.77km)

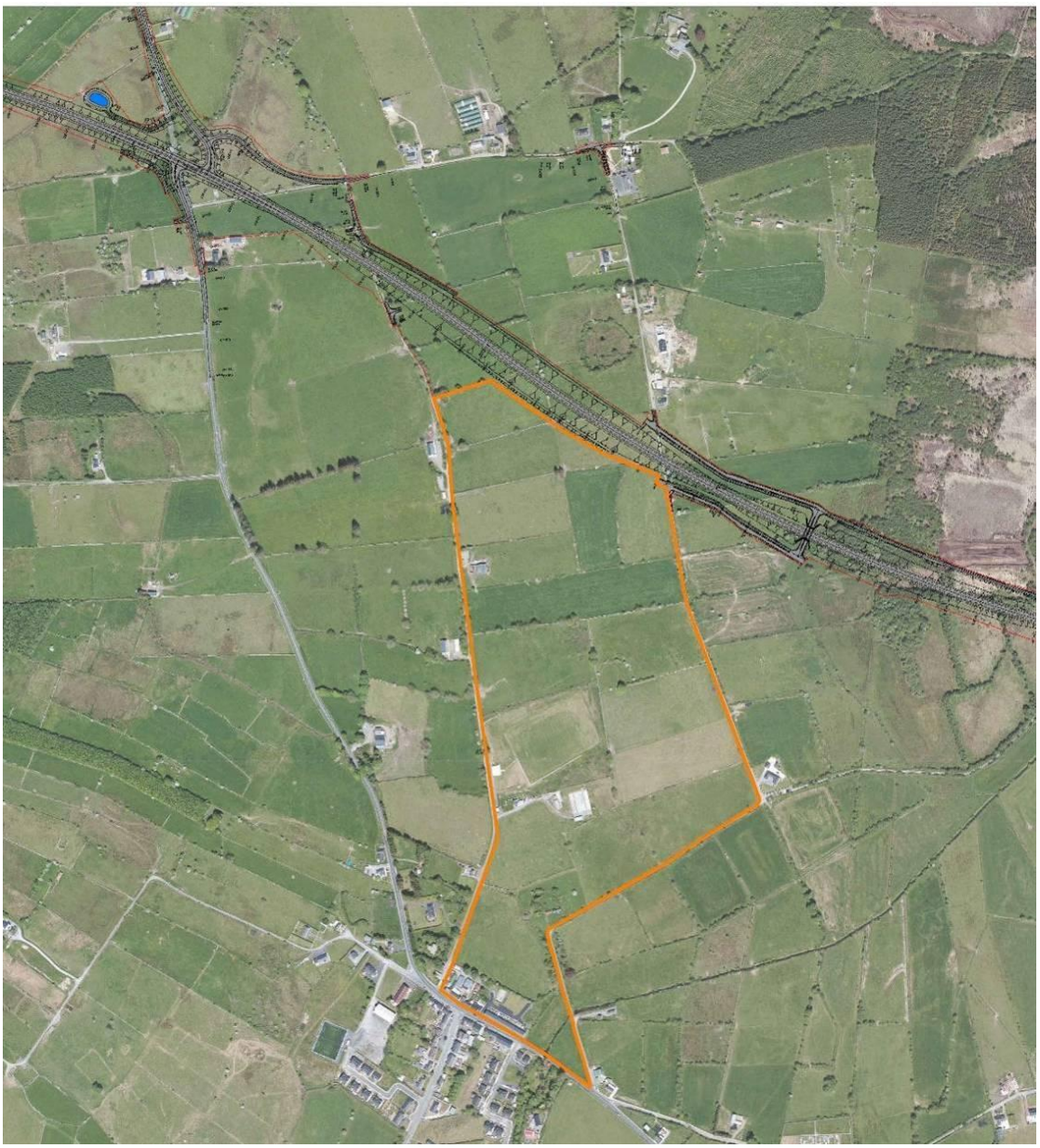

Plate 4.7 Proposed Bellanagare Walking Route – Shorter option (2.95km)

4.6.2 Lavally to Strokestown Route

The townland of Lavally is linked to the north of Strokestown by local road LP-1405. During a public consultation held in March 2015, a number of people indicated that this local road is used as an active pedestrian and cycle route to the town. In addition, a number of representations were made regarding the use by pedestrians of the R368 regional road to the Kildalloge Roundabout from the North.

Additional traffic surveys were undertaken to determine the extent of the usage of the LP-1405 as a pedestrian and cycle route for accessing the town. The surveys were undertaken during term time to ensure that children cycling or walking to school were captured by the survey. The survey indicated a minimal number of pedestrians and cyclists, with 6 recorded in each direction on a weekday and 3-4 recorded in each direction during the weekend.

The design of local road LP-1405 to the east of the Strokestown roundabout incorporates a shared pedestrian/cycleway in the southern verge, which is connected

to the existing LP-1405 to provide a crossing of the proposed N5 at grade. The island for the southern approach to the Strokestown Roundabout has been lengthened and widened to accommodate pedestrians and cyclists (see Plate 4.8 below).

An offline shared cycleway/footway, then reconnects to the realigned LP-1405 via the local access, to run offline along the proposed carriageway in the southern verge. The R368 has a shared footway/cycleway incorporated into the eastern verge over the length of the realignment of the R368 and a crossing point is provided to connect to the R368 to the centre of Strokestown.

Plate 4.8 Offline and Online Shared Cycleway / Footway Crossing of the Proposed N5

4.6.3 Scramoge Walking Route

The Scramoge walking route utilises a number of local roads and regional roads to the north and south of the existing N5 (see Plate 4.9 below). The walking route is indirectly impacted by the proposed N5, with the LS-6144 retained on its existing alignment with the proposed road bridging over the LS-6144.

Minor realignment works of the R371 have been incorporated into the design to improve the safety of this junction. The realignment works are minor and will not detrimentally impact on the walking route.

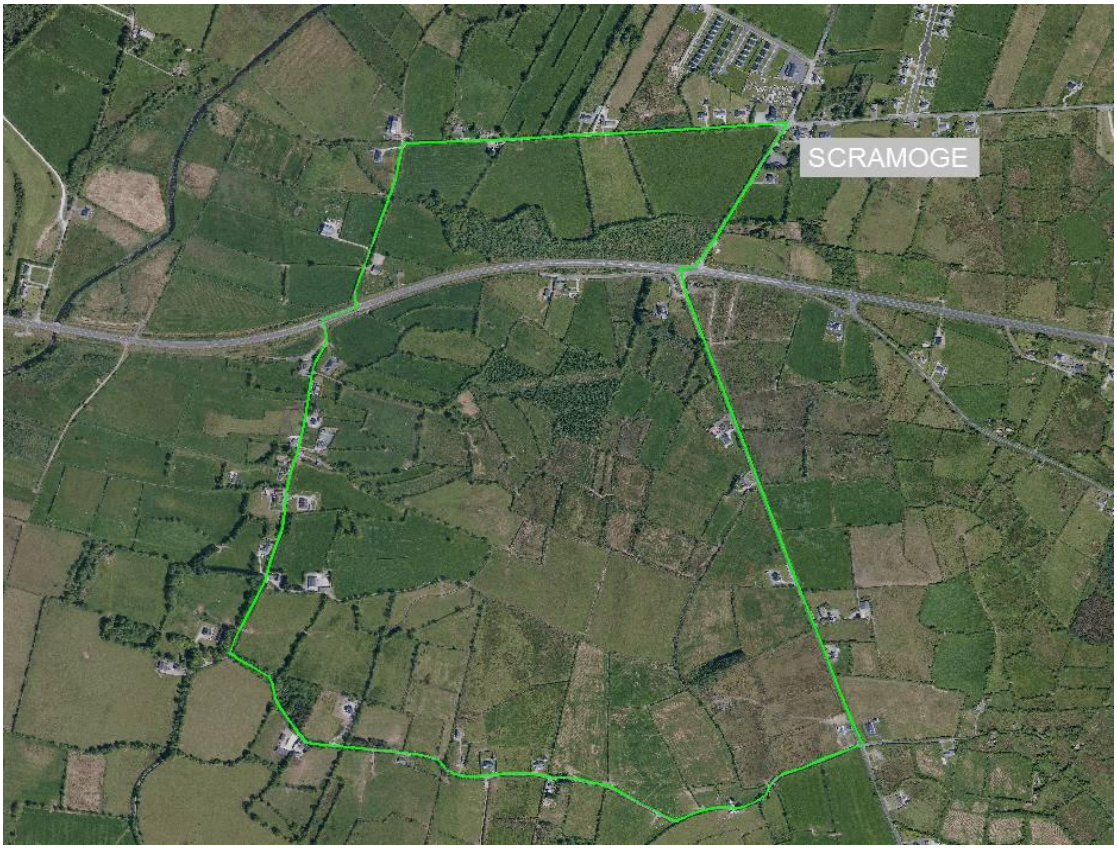

Plate 4.9 Scramoge Walking Route

4.7 Junctions

4.7.1 General

The primary function of the national road network is to provide for the safe and efficient movement of long distance through traffic whilst also collecting traffic from other National Routes and the Regional Roads in particular. As a secondary function, the network caters for local and short distance traffic. There are positive safety and route capacity benefits in minimising the number of junctions and access onto national routes. TII/NRA DN-GEO-03043 states "*The overriding principle is that direct vehicular access onto national roads should be avoided as far as practicable.*" This was the general strategy adopted for the proposed road development. Notwithstanding this, the proposed road development is an all-purpose road and as such does provide junctions and accesses for the National and Regional Roads and at those locations where to do otherwise would have resulted in considerable disruption and severance to the local communities.

The majority of roads impacted by the proposed road development are local roads, which experience very low levels of traffic. Where the traffic flows are less than 300 vehicles per day (in the design year 2035), the proposal is generally to provide a simple T junction in accordance with TII/NRA DN-GEO-03043. Where flows exceed 300 vehicles per day, consideration has been given to the provision of a ghost island right turning lane, or the provision of a roundabout where appropriate.

4.7.2 Frenchpark Roundabout (Junction 6)

This junction is formed by the mainline and R361 regional road south of Frenchpark. The traffic analysis indicates a flow, in the design year 2035, of 2500 south of the

roundabout and 3,600 north of the roundabout on the R361, with approximately 75% of the northbound flow continuing straight on the R361.

The existing alignment of the R361 is largely straight, as such the provision of a roundabout allows for a largely online construction, with only minor realignment of the R361 required to form the entry/exit to the roundabout. The high straight through flows on the R361 are more readily catered for by the provision of a roundabout, in comparison to a staggered T junction.

4.7.3 Frenchpark Junction

A reconfiguration of the crossroad junction between the existing N5 and R361 in Frenchpark village will be provided as part of the proposed development. This will cater for the significantly reduced traffic levels on the existing N5 (from a maximum of 7,300 reducing to 200 AADT west of the junction) as well as the increase in traffic on the R361 Castlerea to Boyle Road (2,000 increasing to 3,600 AADT). (See Fig. 4.37 in Volume 3)

4.7.4 Existing N5 Junction (Junction 7)

At Ch. 12+750 the proposed N5 crosses the existing N5 between Frenchpark and Bellanagare. A right left staggered at grade priority junction with ghost island has been incorporated into the design. The right turning traffic flow for eastbound traffic to the existing N5 south of the mainline is significant with over 900 vehicles per day making the right turn manoeuvre, resulting in the existing N5 south of the proposed N5 having a flow of 2100 vehicles per day.

4.7.5 R369 (Junction 12)

The mainline crosses regional road R369 at Ch. 21+950 in the townland of Cartronagor and is proposed to be connected to the mainline with a right/left staggered junction. The traffic flow on the eastern R369 connection is 800 vehicles per day, with the western section of the R369 having a flow of approximately 340 vehicles per day, reflecting that the R369 west of the N5 crossing has been stopped up further west and provides for local access only.

The high flows on the eastern connection of the R369 are facilitated by the provision of a ghost island right turn lane for both arms of the R369.

4.7.6 N5/N61 Roundabout (Junction 13)

The N5/ N61 roundabout junction is formed by the mainline and the N61 in the townland of Gortnacrannagh. The traffic analysis indicates a Design Year flow on the N61 national secondary road of 3100 vehicles AADT south and 3,700 vehicles north of the mainline, with a high proportion of straight on flow encountered on the N61.

The existing alignment of the N61 is largely straight, horizontally, with a highly undulating vertical alignment. The proposed N5/N61 roundabout is located in a cutting approximately 7m deep, as the vertical alignment of the N61 approach roads smooth the existing landform profile.

4.7.7 Shankill Roundabout (R369/N61 – Junction 13B)

The existing junction between the N61 National Secondary Road and the R369 Regional Road at Shankill is significantly substandard with respect to layout and sightlines and has been identified as an accident blackspot. The traffic analysis indicates that the forecast Design Year traffic flow through this junction on the N61 will increase by approximately 700 vehicles per day (AADT). It is proposed to

improve this junction and the section of N61 between the junction and the mainline at Gortnacrannagh as part of the proposed road development. The work will involve the provision of a roundabout at Shankill.

The upgrading of the N61 and locating of the Shankill roundabout to the east of the N61 removes a number of constraints, allowing improvements in geometry and visibility to be realised at this junction, whilst reducing the potential impacts on properties and avoiding direct impacts on the adjacent graveyard.

4.7.8 R368 (Junction 15A)

The existing R368 will be realigned as part of the proposed road development, with the proposed N5 bridging over the realigned R368. A new link to provide access to the R368 has been incorporated into the design.

The traffic analysis indicates a Design Year flow of approximately 500 vehicles per day on this link road, as such the junction has a ghost island right turn lane incorporated into the design to provide a safe refuge for right turning traffic.

4.7.9 Strokestown Roundabout (N5/LP-1405 – Junction 17A)

This junction is formed by the mainline and local road LP-1405 northeast of Strokestown. The traffic analysis indicates a Design year flow of 3,300 south and 3,400 north of the proposed N5 on local road LP-1405, with a high proportion of straight on flow encountered on the LP-1405.

The roundabout has been positioned to the north of the existing LP-1405, to provide clearance from the LP-1405 realignment from properties to accommodate the level changes required to provide a compliant design and connection to the Strokestown roundabout. The existing LP-1405 vertical alignment at this location is steep and undulating, as such the realignment of the LP-1405 requires significant earthworks to provide an appropriate approach to the proposed roundabout.

4.7.10 Kildalloge Roundabout (R368/LP-1405 – Junction 19B)

The existing R368/ LP-1405 junction is a relatively heavily used junction that is significantly substandard with respect to layout and sightlines. There are no facilities on the R368 or LP-1405 for non-motorised users, north of the existing junction. The upgrade of this junction involves the provision of a three armed roundabout, located on the northern extremity of Strokestown town. The roundabout has been positioned to the north of the existing R368/LP-1405 T junction to minimise the impact on adjacent properties and to allow the approaches to be designed in accordance with current design standards.

4.8 Structures

The proposed road development includes 34 structures, which can be broken down into the following types:

- Road Overbridges 1 No.
- Road Underbridges 3 No.
- Farm Underpasses 9 No.
- River Bridges 4 No.
- Watercourse Culverts 14 No.
- Retaining Walls 3 No.

Table 4.8 below provides details of each of the structures.

Table 4.8 Principal Structures

Ref.	Mainline Ch. (m)	Dimensions / Span (W x H)	Townland
Road Overbridges			
OB19.01	19+740	3 Span overbridge comprising 12m side spans and 29m central span	Cloonyeffer
Road Underbridges			
UB 31.01	31+900 LP-1412 and farm underpass	11m Span	Lurgan
UB 35.01	35+000 R368	8m Span	Lugboy
UB 53.01	53+260 LS-6144	7m Span	Scramoge
Farm Underpasses			
UP 13.01	13+940	8.5m x 4.5m	Ballaghcullia
UP 15.01	15+600	3.3 x 3.0m	Peak
UP 30.01	30+680	3.3 x 3.0m	Gortnacrannagh
UP 33.01	33+290	4.0 x 4.5m	Tullyloyd
UP 34.01	34+610	4.0 x 4.5m	Lugboy
UP 36.01	36+700	4.0 x 4.5m	Cregga / Cuilrevagh
UP 38.01	38+000	4.0 x 4.5m	Tullen
UP 40.01	40+260	4.0 x 4.5m	Corskeagh / Lavally
UP 50.01	50+900	3.3 x 3.0m	Vesnoy
River Bridges			
WB 10.01	10+140 Carricknabraher	11m span	Leggatinty
WB 14.01	14+550 Owennaforeesha	11m span	Ballaghcullia
WB 30.01	30+750 Owenur	10m Span	Gortnacrannagh
WB 52.01	52+830 Scramoge	20m Span	Scramoge
Watercourse Culverts			
WC 12.01	12+700	2.7m x 2.7m	Leggatinty / Derreen
WC 12.02	12+700	2.7m x 2.7m	Leggatinty / Cashel
WC 14.01	14+600	3.3m x 2.4m	Drummin
WC 15.01	15+200	1.2m Dia	Peak
WC 21.01	21+330	2.7m x 1.8m	Raheen / Cartronagor
WC 21.02	21+800	3.0m x 1.8m	Raheen
WC 23.01	23+200	1.2m Dia	Creeve
WC 24.01	24+150	4.2m x 2.4m	Gortnacrannagh
WC 24.02	0+820 (N61)	1.8m Dia	Shankill
WC 33.01	33+190	1.2m Dia	Killeen East

Ref.	Mainline Ch. (m)	Dimensions / Span (W x H)	Townland
WC 33.02	33+190	1.2m Dia	Killeen East
WC 33.03	33+300	1.2m Dia	Killeen East
WC 51.01	51+110	4.2m x 2.1m	Vesnoy
WC52.01	52+250	1.5m Dia	Cloonradoon
Retaining Walls			
N5-R1	0+125 to 0+230 (N61 Link - West)	4.5m High	Gortnacrannagh
N5-R2	0+225 to 0+310 (N61 Link - East)	4.0m High	Gortnacrannagh
N5-R3	R368 South of Kildalloge Roundabout	2.0m High	Strokestown

4.9 Road Drainage

4.9.1 General

The proposed drainage design incorporates measures to treat the surface water run-off from the paved surfaces of the proposed road development, provides for the collection and conveyance of overland surface water flow intercepted by the proposed route, and provides details of the proposed treatment of existing watercourses crossed or affected by the proposed road development.

4.9.2 The Existing Environment

The route crosses several watercourses of varying size that are in the Upper Shannon Catchment system. Watercourses intercepted by the proposed road development are at the locations listed in Table 4.9 below and Figure 10.1.

Table 4.9 Watercourses Crossed by the Proposed N5

Watercourse Name	Approx. Chainage	Tributary Of.	Comments
Unnamed minor watercourse located in the townland of Rathkerry	1+200	Lough Gara	Minor Watercourse
Carricknabraher River	10+130	Breedoge River	
Unnamed stream -located in the townland of Mullen	12+705	Carricknabraher River	Minor Watercourse
Owennaforeesha River	14+540	Breedoge River	
Unnamed minor stream in the townland of Drummin	14+632	Breedoge River	Minor Watercourse
Mantua Stream	21+325	Owenur River	Minor Watercourse
Unnamed minor watercourse in the townland of Mantua	23+200	Owenur River	Minor Watercourse
Owenur River	30+750	Upper Shannon	
Strokestown River	51+110	Mountain River	
Scramoge River	52+830	Mountain River	

In general, watercourses up to Ch. 14+540 flow in a north-easterly direction. These watercourses feed the Upper Shannon Catchment via the Breedoge River and then Lough Gara.

Watercourses between Ch. 14+540 and Ch. 30+750 flow eastwards crossing the proposed road development at the locations listed in Table 4.9 and discharge to the upper Shannon via Lough Nablahy.

The Strokestown and Scramoge Rivers flow to the North discharging into the Upper River Shannon via Kilglass Lough.

There are three types of aquifer traversed by the proposed road development with the majority lying within a Regionally Important Karstified Aquifer. The aquifer types that are encountered from west to east along the proposed road are shown in the Table 4.10 below and described further in Chapter 9.

Table 4.10: Location of Aquifer Types Along Proposed Road Alignment

Section	Approximate Chainage	Length	Aquifer type
A	1+000 – 5+700	4.7 km	Karstified bedrock **(RKc)**
B	10+000 - 11+900 14+250 – 24+200	11.85 km	Karstified bedrock **(RKc)**
B	11+900 – 14+250	2.35 km	Bedrock which is Moderately Productive only in Local Zones **(Ll)**
C	30+000 – 40+550	10.5 km	Karstified bedrock **(RKc)**
D	50+000 – 53+200	3.2 km	Karstified bedrock **(RKc)**
D	53+200 – 54+000	0.8 Km	Bedrock which is Generally Moderately Productive **(Lm)**

4.9.3 Carriageway Drainage

The principal objectives for the proposed road drainage system include:

- To ensure the speedy removal of surface water from the road pavement in order 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, while at the same time providing improved water quality treatment by means of wetland ponds prior to discharge;
- 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 design of road drainage for the Ballaghaderreen to Scramoge road project is in accordance with the principles outlined below and the TII/NRA Design manual for Roads and Bridges (DMRB) and CIRIA, in particular the following TII/NRA standards:

- DN-DNG-03065 (HD 45/15) Road Drainage and the Water Environment, March 2015 (including amendment No.1 June 2015);
- DN-DNG-03022 (HD 33/15) Drainage Systems for National Roads, March 2015 (including amendment No.1 June 2015);

- DN-DNG-03066 (HA 33/15) Design of Earthworks Drainage, Network Drainage, Attenuation & Pollution Control;
- DN-DNG-03063 (HA103/15) Vegetated Drainage Systems for Road Runoff (including Amendment No. 1 dated June 2015).
- Control of water pollution from construction sites. Guidance for consultants and contractors (C532), (CIRIA, 2001).
- Control of Water Pollution from Linear Construction Projects. Technical Guidance (C648), (CIRIA, 2006).

In addition to the TII/NRA standards, consultation with the Office of Public Works (OPW) and the Inland Fisheries Ireland (IFI) Shannon River Basin District has included additional requirements within the proposed road development.

4.9.4 Road Surface Water Runoff

The assessment of the road drainage system is based on the Modified Rational Method as described in Road Note 35 (Guidelines for Road Drainage), the Wallingford Procedure, and in the recently updated version of DN-DNG-03022 (HD33/15) of the DMRB. The drainage design can accommodate, without surcharge, a once in 1 year storm event with a maximum rainfall intensity of 50mm per hour. The design is checked against a five-year storm intensity to ensure that surcharge levels do not exceed the levels of chamber covers.

Each section of road has two areas contributing to runoff flow, namely runoff from paved surfaces and runoff from unpaved surfaces such as verges and cut/fill slopes.

Cut-off drains or channels will be provided to intercept the overland flow from the adjacent lands where they fall towards the proposed project at the following locations:

(a) top of cutting slopes where the adjoining land slopes towards the cutting

(b) bottom of embankment slopes where the adjoining land slopes towards the embankment

These cut-off drains will discharge to existing watercourses where the topography permits and to the road drainage system in areas with no suitable outfall location.

Where the road is in cut, ditches that are severed by the proposed road development will be collected by the cut-off drains and taken to existing channels or drains.

4.9.4.1 Sealed Drainage Systems

As identified in Table 4.10 above a large proportion of the proposed road development is located within areas of karst aquifer. In general, a sealed drainage system will be used where an underlying karst aquifer is present (for details please refer to Chapter 9 Hydrogeology). This sealed system will also be used adjacent to sensitive ecological wetland areas.

Where areas require ground water control, e.g. a cutting with high water table, a filter drain would usually provide for both the road drainage and the groundwater. However, in karst areas a sealed drainage system will be provided to drain the road surface and a separate filter drain or fin drain will be provided to collect groundwater.

Where a sealed drainage system is required and the longitudinal gradient of the road is less than 0.5%, road drainage will be collected by a continuous system e.g. surface water channel or continuous drainage channel.

Due to the environmental sensitivity of the receiving water environment, over-the-edge drainage is not proposed on the mainline.

4.9.4.2 Filter Drains

Where a karst aquifer and Source Protection Areas are not encountered, for sections of road in cut, and road on embankments 1.5m high or less, surface water collection will be provided by a filter drain constructed along the edges of the road. These filter drains will discharge at regular intervals to main carrier drains which will in turn discharge to outfalls located at or close to low points along the road. In less vulnerable areas where the overburden depth is greater than 5m (aquifer vulnerabilities of moderate and low) unlined drainage systems will be used which will allow some infiltration to groundwater if the permeability of the overburden allows.

4.9.4.3 Drainage of Side Roads

Where gradients allow, the surface water runoff from side roads within the proposed road development will be discharged via the proposed mainline drainage system. At locations where such arrangements are not possible, in particular due to existing road tie–in levels and gradients, the surface water runoff from side roads or sections thereof will continue to discharge to the local road drainage system or into the overland runoff drainage system.

4.9.5 Road Drainage Outfalls to Receiving Waters

All outfalls from the proposed road drainage system will be attenuated prior to discharge to the receiving watercourse as per the requirements of DN-DNG-03022 (HD33/15) Standard. The attenuation system has been designed to accommodate a 1 in 100 year rainfall event to achieve greenfield runoff rates as per the DN-DNG-03022 (HD33/15) standard.

4.9.5.1 Flow Attenuation

Flow attenuation is provided by limiting the peak flow from the road drainage runoff using a flow restricting device such as a vortex flow control device or orifice plate upstream of the outlet to a receiving waterbody. This will necessitate provision of temporary storage of the surface water runoff. Storage or attenuation ponds will be provided upstream of the flow restriction. A typical layout of an attenuation pond is given in Plate 4.10.

Inflow to the pond is generally piped from the road drainage outfall. The attenuation system has been designed to accommodate the first flush surface water runoff within a forebay (see Plate 4.10), while subsequent higher flows are diverted to the main body of the pond via a higher level connection bypass channel. First flush flows are those that arrive at the outfall first after a rainfall event. The treatment forebay can accommodate the first flush volume. The plan area of the sediment bay is a minimum of 10% of the total basin area. The connection from the forebay area to the main body of the pond is via a permeable filtration bund. A penstock is provided so that in the event of an accidental spillage entering the pond, the system can be closed and the contaminant removed.

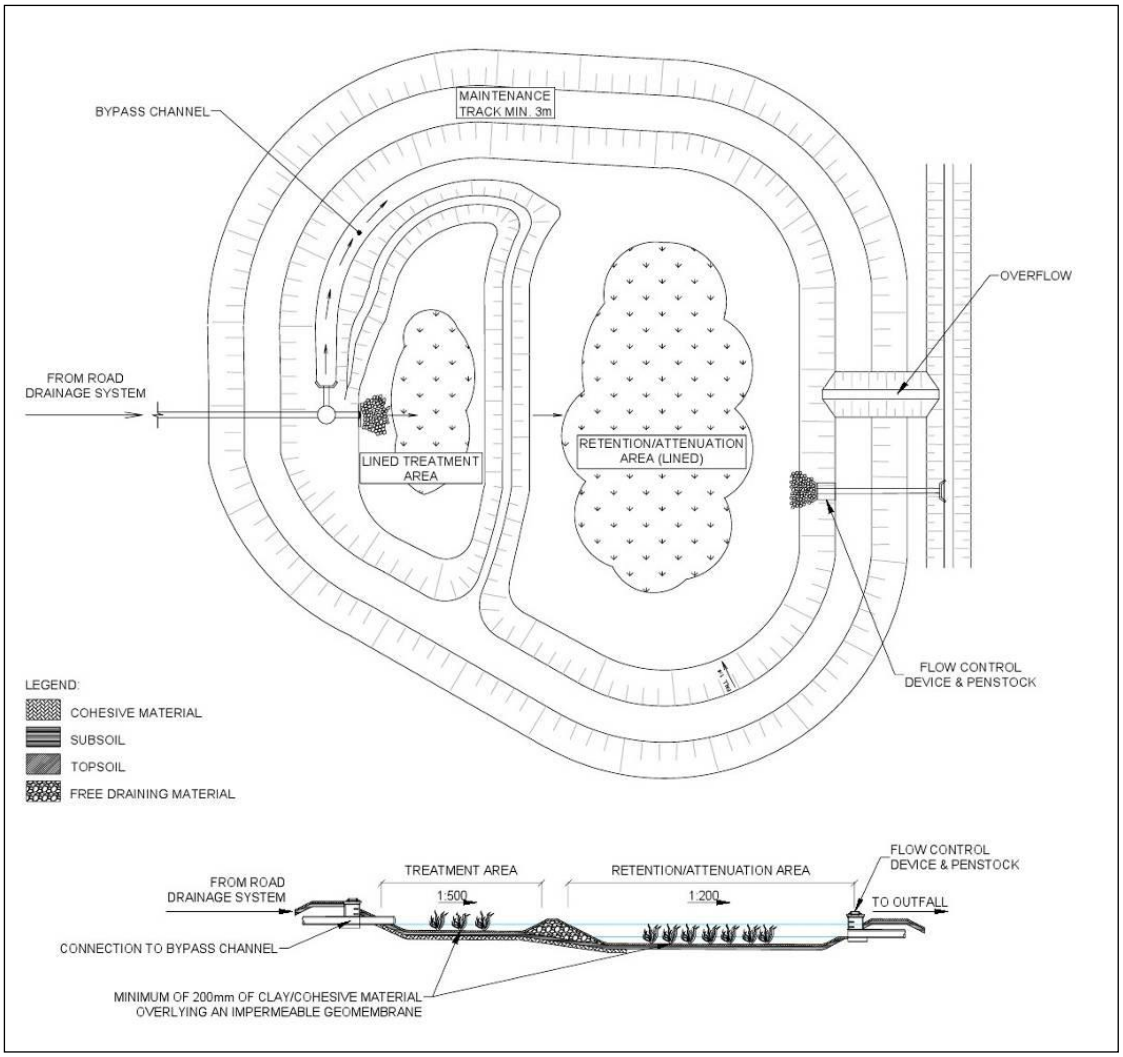

Plate 4.10 Typical Layout of Attenuation Pond

The pond shape and orientation must take account the local topography and environment and is designed to appear natural and aesthetically unobtrusive. Ponds are designed with soft geometries with curved boundaries and undulating margins, rather than straight lines and hard edges.

4.9.5.2 Water Quality

Where granular channels or filter drains are used for road drainage, these will assist in filtering the suspended solids and sediment from the road drainage runoff. Where kerb and gully arrangements are used, the gullies will contain silt traps to collect the sediment.

4.9.5.3 Water Quality Improvement Systems

Discharges of road drainage runoff will pass through a water quality improvement system. This is incorporated in the design of the attenuation ponds. Due to the high aquifer vulnerability, the main body of the pond will be lined with cohesive material or an impermeable liner and outlet by infiltration will not be permitted. The pond will be suitably planted to promote the removal of contaminants. Further treatment is provided in the main body of the attenuation ponds with a permanent water depth of approximately 200mm retained at the base of the pond to prevent the re-suspension of silt when flood waters enter the pond during a storm event.

Measures to prevent contamination of watercourses during construction of the Road Project will be required. The Construction Erosion and Sediment Control Plan (CESCP) has been prepared (see Appendix 10.1), which sets out the minimum requirements that must be adhered to. Any alternative measures that may be incorporated at the construction stage will be required to provide at least the same, or, a better standard of protection. It will be a requirement of the construction contract that the protection and mitigation measures are fully implemented.

4.9.5.4 Maintenance Access to Attenuation Ponds

To facilitate access for maintenance and emptying of the ponds and water quality improvement facilities, vehicular access has been provided. Vehicular access to the attenuation/treatment systems has been provided from the local road network where possible. Where accesses are off the proposed N5 mainline, the accesses shall be gated, with gates setback a minimum of 10m from the rear of the mainline verge to permit vehicles to pull off the N5 without encroaching on the carriageway.

4.9.5.5 Accidental Spillage

All pollution control facilities and attenuation areas will be fitted with a penstock or similar restriction at the outfall to the receiving channel. Such devices can be used to contain pollutants within the pond in the event of an accidental spillage.

A risk assessment to quantify the likelihood of a serious accidental spillage has been carried out in accordance with the TII/NRA DN-DNG-03065 (HD45/15).

When considering the risk of spillages from a road and potential pollution to the receiving environment, TII/NRA DN-DNG-03065 (HD45/15) recommends that the:

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

The spillage assessment carried out on the proposed N5 Ballaghaderreen to Scramoge project demonstrates a very low magnitude of risk for individual or grouped catchment outfalls and shows the overall predicted annual probability of a serious pollution incident for the entire proposed road to be < 0.4%.

4.10 Earthworks and Pavement

4.10.1 Ground Investigations

Three separate ground investigations have been undertaken during the development of the N5 Ballaghaderreen to Scramoge Road Project as further described below.

4.10.1.1 Soft Ground Probes Investigation No 1

In May 2007, a dynamic probing investigation was carried out by Glover Site Investigations to determine the depth and extent of soft ground.

4.10.1.2 Preliminary Ground Investigation No 2

A Preliminary Ground Investigation was undertaken by Priority Drilling Ltd of the broad route corridor between October and November 2008.

The scope of investigation was to determine the soil, bedrock and groundwater conditions and to establish the presence of any contaminants along the corridor.

4.10.1.3 Preliminary Ground Investigation No. 3

The investigation scope was to determine the subsurface conditions, the extent of soft ground, made ground, peat and likely depths to rock, rock strength and any suspected zones of karstification. The investigation was also required to assess groundwater levels and to establish the presence of any contaminants along the proposed route and assess the suitability of a number of possible material deposition and material storage areas close to the proposed road development. The scope of the survey was agreed with inputs from the Project Hydrologist, Hydrogeologist, Geologist and Ecologists whilst also ensuring that the Project Archaeologist and Architectural Historical were satisfied that the proposed woks would not impact on any recorded sites.

In addition to the exploratory holes and in-situ testing, a Geophysical Survey was carried out by Minerex Geophysics Ltd. This survey was conducted to investigate areas of suspected karstification, soft ground conditions and in deep cuts where shallow rock is likely to be encountered.

4.10.2 Earthworks Quantities

The construction stage of the proposed road development will generate approximately 298,000 cu.m. of topsoil. It is estimated that this volume of material will be sufficient to accommodate the landscaping requirements for the proposed road and it is not anticipated that there will be a requirement to dispose of any of this type of material.

Table 4.11 presents the cumulative earthworks quantities for the entire proposed road development assuming full excavation and replacement of soft ground. Although a piled embankment option may be considered at three locations, the earthworks quantities for full excavation and replacement have been presented in Table 4.11 as this is the worst case scenario in volume terms of generating materials. This table includes the mainline, Side Roads and associated drainage earthworks.

Table 4.11 Earthworks Volumes Assuming Full Excavation and Replacement of Soft Ground

1	2	3	4	5	6	7	8	9	10	11	12
Chainage	**Total General Cut Volume)(m^3)* - Underside of topsoil to base of capping**	**Acceptable material for Re-use bulked (m^3) ***	**Marginal material suitable for processing (m^3)**	**Acceptable Rock Excavation (m^3)**	**Unacceptable Material bulked within EW outline (m^3)**	**Fill requirements for Embankments – Underside of topsoil to base of capping**	**Fill requirements to replace Peat, Alluvium below formation**	**Total General Fill Required excluding Capping and assuming full excavation and replacement (m^3)**	**Cut to Fill (m^3) – Including rock assuming full excavate and replace**	**Topsoil Strip (m^3)**	**Topsoil Re-soil (m^3)**
Section A Ch. 1+000 – 5+610	19,840	9,920	4,960	-	4,960	81,038	36,787	117,825	(102,945)	26,392	11,745
Section B Ch. 10+000 – 24+100	794,043	308,432	150,058	185,496	150,058	504,068	451,001	955,069	(311,083)	120,367	89,077
Section C Ch. 30+000 – 40,943	2,007,714	672,596	327,518	682,034	325,566	821,977	160,403	982,380	699,768	118,003	78,000
Section D Ch. 50+000 – 54+350	88,344	44,172	22,086	-	22,086	258,567	92,049	350,616	(284,358)	33,629	31,890
TOTAL Section A, B, C & D	**2,909,941**	**1,035,119 (35%)**	**504,622 (17%)**	**867,530 (30%)**	**502,670 (18%)**	**1,665,650**	**740,240**	**2,405,890**	**1,382[1]**	**298,391**	**210,712**

*A bulking factor of 1.0 has been conservatively assumed for all excavated soils and rocks.

[1] This quantity does not take into account rock material required for use as capping nor the volume of material used to form visual / noise screen bunds from Class 4 material. (This reduces the requirement for a specifically engineered such as Class 1 or Class 2 fill to be used to form visual / noise screen bunds). 117,575m^3 of rock will be required as capping and 100,624m^3 of Class 4 material will be required to form visual / noise screen bunds changing this surplus to a deficit of 15,570m^3.

Section A is constructed predominately at grade / on a slight embankment and requires approximately 81,000m^3 of suitable fill material.

The alignment over the next 14km through Section B generally varies between cut and fill, generating approximately 308,000m^3 of acceptable general material plus 185,500m^3 of rock for fill. Based on the assessment of the ground investigation results, it is assumed that 150,000m^3 of marginal material could be processed to provide further suitable acceptable fill. A quantity of approximately 955,000m^3 of fill material is required for embankment construction and replacement of soft ground.

In Section C, there are a number of large cuttings which generate approximately 672,000m^3 of general fill material. The largest cuttings occur between Ch. 32+050 to Ch. 33+100, Ch. 35+100 to Ch. 36+470 and Ch. 36+900 to Ch. 37+650. Cuts between Ch. 35+150 to Ch. 36+475 and Ch. 36+900 to Ch. 37+650 are likely to generate a significant quantity of rock. The total volume of suitable cut material arising from the cuttings within this section is 672,000m^3 of general fill and 682,000m^3 of rock giving a combined total of 1,354,000m^3 approximately. It is assessed that a further 327,000m^3 of marginal material could be processed to provide further suitable fill material. Assuming the rock arising from the cuttings will be processed to provide the capping material for the full development and the surplus rock is utilised as drainage blanket within Section C, the surplus of general fill material for this section of the project is 699,000m^3.

Section D is constructed predominantly on embankment with two small cut areas, resulting in a deficit of 284,000m^3.

4.10.3 Peat and Alluvium

There will be a large amount of peat, alluvium and other unacceptable material generated from both excavate and replace operations to a suitable bearing stratum for embankment formation and from unsuitable soils derived from cuttings. The peat and alluvium will be deposited in pre-selected areas known as material deposition areas within the land acquisition boundary adjoining to or in close proximity to the mainline and will be contained within engineered bunds. Table 4.13 and Figures 4.2 – 4.25 indicate the locations of the material deposition areas.

The excavation of unsuitable material above the earthworks outline will be inevitable for construction, however, the volume of material to be removed from below the earthworks outline can be reduced by the use of ground improvement measures other than excavate and replace. However, in areas of shallow Peat/Alluvium the most economical solution is to remove this material and this earthworks option is considered to be the most likely scenario, as relatively short lengths of deep deposits are anticipated.

In areas where deep deposits occur, consideration may be given to the following ground improvement solutions:

- Partial Excavate and replace (Removal of Peat / organic soils only);
- Basal Reinforced Earthworks;
- Vertical drainage Measures in combination with Surcharge Loading (Not suitable in peat); and
- Pile Supported load Transfer Platforms.

The above list is non exhaustive and any one or a combination of measures can reduce the amount of peat and alluvium to be excavated. Some of these measures

are not suitable where peat is encountered, as peat exhibits large primary consolidation and more significantly large secondary compression characteristics.

Table 4.12 shows the total amount of existing peat, alluvium and lacustrine deposits that requires excavation and depositing in a material deposition area (assuming excavate and replacement throughout) with the right column showing the total unacceptable material arising from the earthworks cuttings.

Table 4.12 Earthwork Disposal Volumes

Section	Unacceptable material from below the EW (Peat, Alluvium and Lacustrine Deposits outline) (m^3)	Unacceptable Material from cuttings (m^3)
A	36,787	4,960
B	451,001	150,058
C	160,403	325,566
D	92,049	22,086
Total	**740,240**	**502,670**
Volume available in material deposition areas	**988,000**	
Unacceptable material from below the EW to Material Deposition Areas	**740,240**	
Unacceptable Material from Cuttings to Material Deposition Areas	**247,760**	
Use as Class 4 material		**254,910 (**100,624m^3 visual / noise screen bunds, 87,178m^3 bunds in material deposition areas, 15,570m3 to slacken slopes to 1V:3H, 51,538m^3 to form landscaping bunds**)**
Remaining Volume of unacceptable material	**0**	**0**

A number of areas were assessed as suitable for material deposition areas. This resulted in the selection of 17 material deposition areas which are included as part of the proposed road development. These areas are listed in Table 4.13 below with details of their location and potential capacity assuming an average fill depth of 2m. In total these areas accommodate 988,000m^3 of material. This is sufficient to accommodate the maximum volume of peat and alluvium that may be generated by the proposed road development.

4.10.4 Unacceptable Material

There is 502,670m^3 of unacceptable material arising from the cuttings that is not able to be processed into Class 1 or Class 2 material. The majority of this material however can be processed into Class 4 landscape material and utilised within the development. Of this volume, 100,624m^3 will be utilised to form the visual/noise

bunds and 87,178m^3 will be used to form the bunds of the material deposit areas. There are a number of locations within the proposed road development where embankment heights permit the construction of a structural core of an embankment utilising class 1 and class 2 fill material, with class 4 material utilised to reduce the side slopes to 1:3 to comply with the forgiving road-sides requirements. This results in a remaining volume of the unacceptable material reducing to 51,538m^3. This outstanding volume of unacceptable material will be utilised within the works to form landscaping bunds/mounds where "straight through" views of existing roads being diverted as part of the works is to be eliminated and to further blend slide slopes of embankments into the surrounding landform. The material deposition areas have sufficient capacity to accommodate 247,760m^3 of unacceptable material in addition to the 740,240m^3 of excavated peat and alluvium. These measures are anticipated to utilise all materials arising from the development within the works and falls within the accuracy of suitability and depths based on the currently available ground investigation information.

It is anticipated that the contractor appointed to construct the proposed road development will generally for economic reasons seek to minimise the volumes of unacceptable materials. Likely construction methods have been anticipated in the assessment of the earthworks volumes and sufficient lands have been incorporated within the boundary of the works to facilitate the deposition of these materials.

Table 4.13 Location of Material Deposition Areas

Area No.	Location and Chainage	Area (Hectares)	Approx. Capacity (m^3)*
1	Ch.4+640 – Ch. 4+750, South of proposed N5	0.4	8,000
2	Ch. 4+750 – Ch. 4+80, North of proposed N5	1.6	32,000
3	Ch. 5+400 – Ch. 5+680, South of proposed N5	1.4	28,000
4	Ch. 14+700 – Ch. 15+520, South of proposed N5	4.5	90,000
5	Ch. 14+950 – Ch. 15+200, North of proposed N5	2.6	52,000
6	Ch. 15+320 – Ch.15+600, North of proposed N5	1.8	36,000
7	Ch. 15+550 – Ch. 15+780, South of proposed N5	2.9	58,000
8	Ch.16+075 – Ch. 16+130, South of proposed N5	0.4	8,000
9	Ch.17+000 – Ch. 17+600, South of proposed N5	1.8	36,000
10	Ch. 17+050 – Ch. 17+150, South of proposed N5	0.4	8,000
11	Ch. 17+150 – Ch. 17+600, South of proposed N5	7.3	146,000
12	Ch. 17+640 – Ch. 17+875, South of proposed N5	2.0	40,000
13	Ch. 21+000 – Ch. 21+175, South of proposed N5	2.7	54,000
14	Ch. 20+950 – Ch. 21+450, North of proposed N5	5.4	108,000
15	Ch. 21+350 – Ch. 21+750, North of proposed N5	5.4	108,000
16	Ch. 22+150 – Ch. 22+850, South of proposed N5	8.4	168,000
17	Ch. 22+680 – Ch. 22+840, North of proposed N5	0.4	8,000
Total Storage Volume		**49.4**	**988,000**

*Assuming an average depth of 2m of unsuitable material

The conclusions drawn from the assessment of earthworks volumes are that there is a largely balanced earthworks design, optimising the re-use of materials arising from the site within the works.

The earthworks volumes developed to date include an assessment of the potential reuse of the materials and the quantity of material required to backfill over-excavated material below the earthworks outline, such as Peat and other unacceptable material.

Of acceptable earthworks material:

- Section A has an overall deficit of 102,945m^3
- Section B has an overall deficit of 311,083 m^3
- Section C has an overall surplus of 699,768m^3
- Section D has an overall deficit of 284,358
- Project wide Capping requirement of 118,000m^3

The earthworks volumes stated above indicate that the proposed development will generate sufficient materials within the works to meet the acceptable material requirements for the proposed embankments and has sufficient land incorporated into the development to accommodate the anticipated deposition of unacceptable materials arising from the works.

It is anticipated that 50% of the overburden material arising from the cuttings will be suitable for use as general fill and that a further 25% of this material may be made suitable by soil improvement techniques.

The Peat and Alluvium will not be suitable for reuse as earthworks material and will therefore be placed in material deposition areas.

It is anticipated that through the optimisation of the various options available an overall earthworks balance will be achieved and that there will be no requirement to dispose of unacceptable material off site.

4.10.5 Pavement Materials

The anticipated pavement options are as follows;

- Flexible for a 40 year Design Life either with SMA or HRA surface course
- Flexible Composite for a 40 year Design Life with SMA or HRA surface course

The choice of pavement type is influenced by economic and environmental factors. The N5 Ballaghaderreen to Scramoge Road Project is likely to be procured through the Design & Build process with the final choice of materials made by the successful Tenderer.

The design traffic loadings have been calculated in accordance with TII/NRA PE-SMG-02002 Pavement Design and Maintenance Traffic Assessment. The future cumulative pavement traffic loading, in terms of million standard axles (msa) have been determined as indicated in Table 4.14 below.

Table 4.14 Design Traffic

Carriageway	Design Traffic (msa)
N5 – Section A	11
N5 – Section B	10
N5 – Section C	8
N5 – Section D	9

Carriageway	Design Traffic (msa)
N61	6

The design traffic loadings in Table 4.14 indicate that the pavement thickness will vary from between 300mm to 260mm depending on the stiffness of the binder content and whether a fully flexible or flexible composite pavement is constructed for the proposed road development.

Regional Roads have relatively low vehicle movements, of less than 5msa, as such require a pavement thickness of between 260mm to 230mm, with local roads with lower vehicle movements from that of regional roads, typically <1.5msa, requiring a pavement thickness 226mm and 200mm.

The sub-base layer, using granular material (crushed rock) is proposed to be between 150mm and 200mm thick depending on the pavement construction type and is likely to be founded on a capping layer (of crushed rock) for the majority of the proposed road development of between 250mm and 350mm thick to provide a stable foundation for the road pavement, particularly where weaker sub-soils are encountered.

4.11 Fencing and Safety Barriers

Road boundary fencing will generally be of stock-proof timber post and rail construction complying with TII/NRA CC-SCD-00301 standard detail.

TII/NRA DN-REQ-03034 safety barrier design standard now classifies boundary fences within the clear zone as a hazard, with the exception of TII/NRA CC-SCD-00320 fence type indicated in Plate 4.11 below. As such this fence type has been proposed throughout the proposed road development where fencing is required within the clear zone or where specific boundary treatment is required as mitigation.

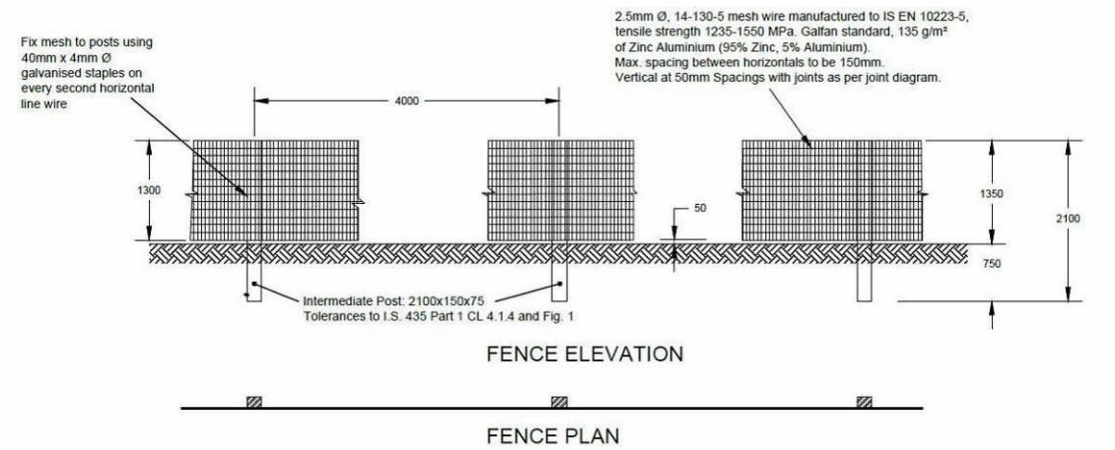

Plate 4.11 Typical Timber Post and Tension Mesh Fence (Extract from TII/NRA CC-SCD-00320)

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

The proposed road development has been designed in accordance with the principals of forgiving roadsides guidance document (TII/NRA GE-TBU-01019) and

with cognisance of the requirements of the latest TII/NRA DN-REQ-03034 safety barrier design standard.

Not all hazards can be eliminated within the design, or relocated outside the clear zone, as such safety barrier will be required as part of the project. All safety barriers will be designed in accordance with DN-REQ-03034.

4.12 Signing and Lighting

4.12.1 Signage

Directional Signs and Regulatory Signs shall be provided in accordance with the, Traffic Signs Manual 2010 as published by the Department of Transport in February 2011 and any subsequent amendment. The sign faces for the Mainline will be designed for a design speed of 100kph and for a Type 1 Single Carriageway.

The proposed road development includes the provision of Advanced Directional Signs at the approaches to each regional and national road junction to inform drivers of directions to regional and local destinations. Local road junctions with less than 500 vehicles per day will not be provided with advance directional signage, however all junctions will be provided with Directional Signage at the junction with the proposed N5 Ballaghaderreen to Scramoge.

Road Markings, Reflective Markings and Road Studs will be provided in accordance with the Traffic Signs Manual and in accordance with Series 1200 of the Specification for Road Works as published by TII/NRA.

The design of tourist signage and the confirmation of destinations to be included along the route shall be agreed in conjunction with Roscommon County Council and Fáilte Ireland and in accordance with the TII/NRA document 'Policy on the Provision of Tourist and Leisure Signage on National Roads' March 2011.

Temporary traffic signs during construction will comply with Chapter 8 of the Traffic Signs Manual16.

All signage shall comply with the requirements of the Traffic Signs Manual in relation to the use of the Irish Language.

4.12.2 Lighting

The location and provision of lighting is in accordance with TII/NRA DN-LHT-03038. For the safety of road users and pedestrians, road lighting will be provided at the following junctions and along the following lengths of carriageway:

- N5/R361 Frenchpark Roundabout;
- N5/N61 Roundabout and N61 Link to Shankill Roundabout;
- R369/N61 Shankill Roundabout;
- N5/LP-1405 Strokestown Roundabout and approximately 800m of the LP-1405 link road to Kildalloge roundabout; and
- R368/LP-1405 Kildalloge Roundabout extending to connect to existing lighting in Strokestown.

The mainline will not be lit other than on the approaches to the roundabout junctions listed above.

4.13 Utilities / Services

The proposed road development crosses largely greenfield rural environment, encountering a minimal number of utilities requiring diversion or protection.

4.13.1 Telecommunication

Eir is the predominant telecommunication service impacted by the proposed road development. The customer service network is supplied largely by overhead cables, with a number of underground cables of varying size. The network also includes underground fibre optic cables running along regional road R361 through the proposed Frenchpark roundabout and along the existing R368 north of Strokestown.

A Vodafone mast is located within the forestry south of the alignment at Ch. 04+550, although not directly impacted by the proposed development, the mast is located in close proximity to the boundary fence for the road.

4.13.2 Energy

Initial consultations between the Electricity Supply Board (ESB), Eirgrid and the design team have identified a number of locations where there are conflicts between the route corridor and existing electricity network.

The majority of conflicts are on the Local Distribution Network. The impact of these is such that some will require diversion while raising the height of the conductors in others will be sufficient. Exact details of all necessary diversions/alterations will be agreed with the ESB (Fig. 4.41 and 4.42 in Volume 3 shows the details of the diversions).

In addition to the local distribution network, the proposed development impacts on three high voltage lines as detailed below:

(i) Mainline - Ch. 22+050 Overhead

Proposed Works: The 38kV overhead cable crosses where the proposed road is at grade. At this location mitigation measures have been incorporated into the design to visually screen the proposed road from nearby properties. The visual bund will be constructed behind the southern verge, resulting in the re-position of two poles at the interface of the earthworks to ensure the clearances to the overhead lines are maintained

(ii) Mainline - Ch. 23+050 Overhead

Proposed Works: Through consultation with ESBI the proposed diversion works for the 220kV Cashla to Flagford High Voltage transmission line crossing over the alignment have been outlined. This will consist of an additional pylon erected south of the alignment earthworks to raise the levels of the overhead powerlines. It is anticipated that these works will be carried out in advance of the main construction works.

(iii) Mainline - Ch. 53+350 Overhead

Proposed Works: Through consultation with ESBI the proposed diversion works for the 110kV crossing the alignment will require two additional pylons to be erected, of which one is an angled pylon situated south of the alignment earthworks. It is anticipated that these works will be carried out in advance of the main construction contract.

The horizontal alignment of the overhead cables will be altered within the site boundary, however the line of the overhead cables will be retained in their current position outside of the site boundary. The vertical alignment of the

overhead cables will be modified in the immediate vicinity to the proposed road development but will remain their current vertical alignment beyond the proposed road development.

Proposed plans for Eirgrid Grid West project indicates two route options for the high voltage transmission line from north Mayo to Flagford, in Roscommon. The southern option which is a 220kV overhead line crosses the proposed N5 alignment east of Frenchpark between Ch. 10+000 and Ch. 11+000.

4.13.3 Water Services

Roscommon County Council's Water Services Department and Irish Water were consulted to determine the extent of public and Private Water and Wastewater services within the study area.

The information received indicates that wastewater services are impacted at one location along the proposed route, south of the proposed Kildalloge Roundabout connection to Strokestown.

An assessment of the water mains has indicated a number of impacts on minor supply mains which will require diversion or protection as part of the proposed works. A number of distribution mains are impacted by the proposed road development as described below:

(i) Ch. 1+460 Mainline

The proposed route crosses a water main which is a supply feed from the reservoir south of the alignment to the surrounding areas.

(ii) Ch. 15+800 – Mainline

A 75mm water main crossing on the mainline at Ch. 15+800 along local road LS-5642 is part of the Peak Mantua Group Water Scheme (GWS) which has approximately 40 connections. The well and pump house are located south of the alignment at Peak (Ch. 15+800). The service will be required to be maintained during the construction period, with only minor shut-downs to facilitate diversion works. In addition a 150mm duct under the N5 will be provided to allow for future upgrading of the GWS.

(iii) Ch. 39+100 – Mainline

The reservoir at Lettreen has numerous distribution mains serving the local area. A 350mm distribution main is intersected by the proposed development.

Land and property surveys/ interviews were carried out with owners along the length of the proposed road development and information on their water supply was obtained. Details of the results of this information and residual impacts is included in Chapter 9.

4.14 Land Acquisition

The provision of the N5 Ballaghaderreen to Scramoge proposed road development requires the acquisition of land for the construction and operation of the development. The area of land required is determined by a number of related parameters including:

- Road construction;
- Construction of verges, embankments, cuttings, utilities/services, pedestrian/ cycle facilities, junction realignments, drainage and associated facilities,

structures, landscaping, work space, boundary treatment, maintenance strip and ancillary road construction and operation requirements;

- Accommodation Works and Access Roads,
- Acquisition of severed plots;
- Ground/soil conditions;
- Material Deposition requirements; and
- Other road engineering, safety and environmental considerations.

Approximately 357 hectares of land is included in the Compulsory Purchase Order for the proposed road development. This area includes approx. 18.5 hectares that is currently classified as road bed and approx. 1.1 hectares classified as residential or commercial land. There is approx. 259.1 hectares classified as land (including agricultural land and facilities, bog and access tracks) and approx. 78.4 hectares classified as forestry. The proposed land acquisition is necessary for the construction, operation, and maintenance of the proposed road development.

4.15 Construction

4.15.1 Introduction

This section outlines the significant factors that need to be considered for the planning of the construction phase of the proposed road development. While progress to construction is dependant on both planning and funding approvals the following is presented on the basis that these approvals would be in place.

4.15.2 Likely Form of Contract

It is likely that the detailed Design and Construction of the proposed road development will take place as part of a Design and Build Contact (D&B). The successful Contractor will be responsible for the detailed design of the proposed road development in compliance with the Employer's Requirements, including compliance with the EIAR and NIS for the development and any planning conditions. The design has been developed to a stage to permit a fully informed environmental impact assessment to be carried out on the proposed road development. Modifications may be made to avail of opportunities to improve the design at the detailed design stage in the light of experience on the ground or other innovations, provided this has no significant adverse environmental impacts over and above those considered in the current environmental impact assessment.

4.15.3 Duration of the Works

It is likely that the construction of the proposed road development will be progressed as a single construction contract with the construction phase potentially lasting between 30 - 36 months (2.5 – 3 years).

4.15.4 Pre-Construction Works

Archaeological investigation works including testing and any follow-on resolution works will be undertaken prior to the main works contract commencing on site. Pre-construction works are likely also to include targeted diversion works of services and utilities including electricity, particularly the high voltage overhead lines, telecommunications and water services. Due to the nature of some of the diversions a number of these service diversions will only be possible during the main construction works.

Advance tree clearance, hedgerow clearance and fencing contracts may also be undertaken dependant on the anticipated seasonal timing of the award of the contracts.

4.15.5 Main Construction Works

The main construction consists predominantly of the earthworks and road pavement construction. The earthworks construction will involve the excavation and placement of materials (with possibility for blasting in rock cuttings) for the construction of cuttings and embankments as well as the hauling of materials and importation of materials to complete the road formation and sub-formation. Materials for the road construction will include materials that will be brought to site including gravels and bituminous pavement and surfacing materials. In addition to the earthworks and pavement construction the main activities will involve the following:

- Drainage – the installation of pipes, culverts, surface water channels, filter drains, ditches and attenuation ponds;
- Structures – the construction of retaining walls, piling works, construction of bridges including their foundations, abutments and the installation of precast beams and other reinforced concrete works;
- The diversion and construction of utilities and services including the diversion of high voltage electricity lines at 3 locations and the provision of associated support towers/ poles;
- Environmental mitigation including construction of noise bunds and barriers, landscaping and habitat creation;
- Ancillary roadwork's including the installation of safety barriers, public lighting, signage and road marking;
- Accommodation works for affected landowners such as access roads, entrances, fences, gates, walls, ducting and reconnection of severed services;
- Temporary traffic management

4.15.6 Temporary Traffic Management

In general, the 33.4km of mainline traverses a green field site and can be constructed without significant impact on the existing public road network. However, there are likely to be significant traffic management impacts during the construction of the side road underbridges. The construction of proposed junctions with the existing road network are also likely to create some traffic management impacts as listed below.

4.15.6.1 Junctions

Impacts are expected at the tie-in points and junctions with the existing National Primary and Secondary roads and the Regional Roads at:

- The tie-in with the N5 Ballaghaderreen Bypass;
- The roundabout on the R361 south of Frenchpark;
- The at-grade staggered T junction with the existing N5 north of Bellanagare;
- The R369 at various locations in the vicinity of Corry East/West, Cartronagor and Shankill, a total of four crossings of the R369 occur;
- The N61 at-grade roundabout and associated realignment works, in particular the construction of two 4-4.5m high retaining walls;
- Construction of the N61 Link between the N5/N61 roundabout and the Shankill Roundabout;
- The Shankill Roundabout at grade junction on the N61 and R369;

- The construction of the Strokestown Link Road and Strokestown roundabout on the proposed N5 and the proposed Kildalloge roundabout on the R368 on the northern fringe of Strokestown;
- The tie-in to the existing N5 at Scramoge and associated junction to Strokestown.

It is likely that significant temporary works and traffic management will be required to facilitate the passage of traffic on the existing N5 and other National Secondary and Regional roads at these locations.

4.15.6.2 Side Roads

The majority of the existing side roads intersected by the proposed N5 require minor realignment as part of the works. These realignments are generally at-grade with the existing alignment and will not require extensive traffic management to allow the construction of these realignments to be carried out. Where more extensive realignments necessitate a temporary diversion to facilitate the works, an allowance within the lands to be acquired for the project has been incorporated.

It is noted that the traffic management has considered the potential construction and diversions that may be adopted by the contractor. The actual traffic management plans, diversions to be implemented and the interface between the works and traffic will however be the contractor's responsibility. The contractor will be also responsible for acquiring the necessary licensing and permissions for the use of these roads with regard to temporary closures and traffic management.

4.15.7 Construction Sections

The proposed road development is subdivided into 4 sections as indicated in Table 4.15 and Plate 4.12 overleaf. The sections are generally defined by the intersection points of the proposed N5 Ballaghaderreen to Scramoge Road Project with National routes, regional roads or important local roads where at-grade roundabout junctions have been provided.

Table 4.15 Project Sections

Section	Segment	Chainage
A	N5 between the tie-in to the Ballaghaderreen By-Pass (East) and Frenchpark Roundabout on the R361 (Junction 5).	1+000 – 5+697
B	N5 between the Frenchpark Roundabout (Junction 5) and the N61 Roundabout at Gortnacrannagh (Junction 14).	10+000 – 24+200
C	N5 between the N61 Roundabout (Junction 14) and the Strokestown Roundabout at Lavally (Junction 19).	30+000 - 40+542
D	N5 between the Strokestown Roundabout (Junction 19) and the tie-in to the existing N5 in the townland of Scramoge.	50+000 – 53+970

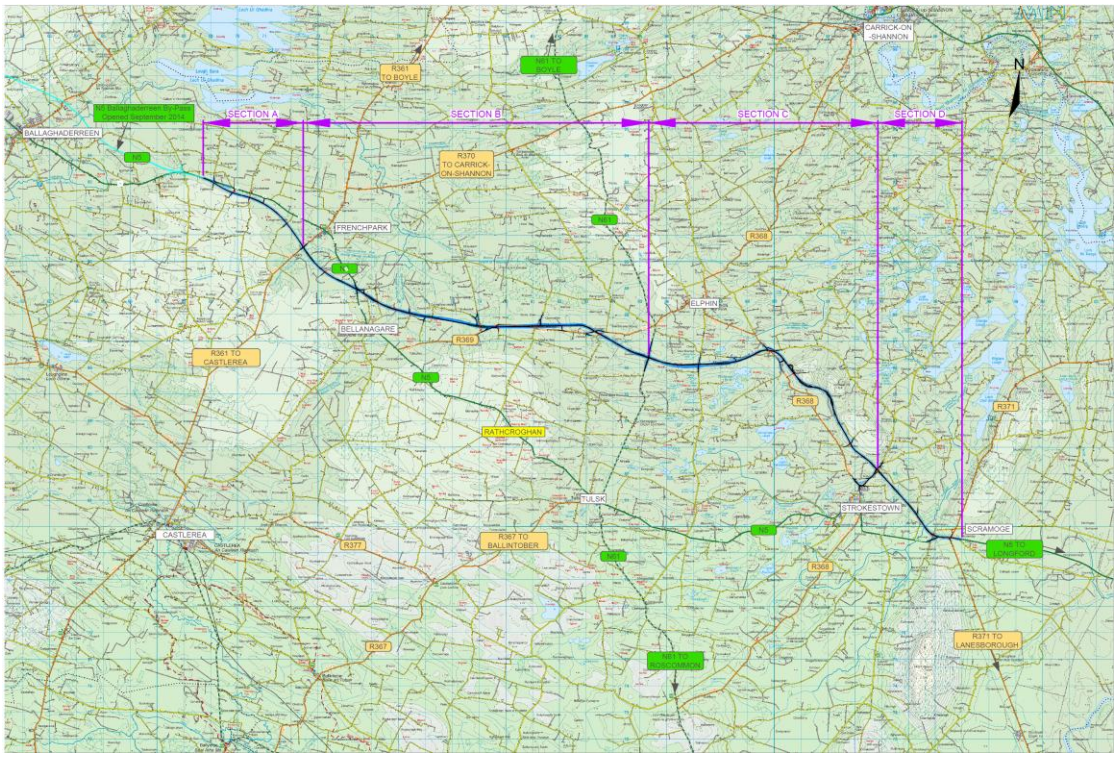

Plate 4.12 Project Sections

While for descriptive purposes, the proposed road development has been segregated into discrete sections, due to the lack of appropriate temporary termination points along the proposed road development and the optimised earthworks strategy determined as being the construction of the overall project in one contract, it is therefore envisaged that the construction of the proposed road development will be carried out as a single contract, or as multiple contracts running concurrently.

4.15.8 Construction Material

The main materials that will be imported to/from the site or hauled within the site in bulk are:

- Earthworks, including topsoil, general cut and fill material, peat, soft soils, rock and capping materials;
- Pavement Materials, including granular sub-base material and bituminous pavement materials;
- Concrete, both insitu and precast units such as concrete bridge beams, pipes, culverts and headwalls;
- Other materials will be required including fencing material, plants, ducting etc.

4.15.8.1 Earthworks

Chapter 8 outlines the details of the existing ground conditions and proposals for earthworks design based on data obtained from the site investigations undertaken. A summary of the earthworks quantities are given in Table 4.11. A detailed site investigation will be undertaken at a later date to inform the detailed design of the proposed road development. Furthermore, during construction and excavation additional details regarding the condition of the materials may be established which may lead to further development of the earthworks design to optimise the overall cut and fill requirements for the proposed road development.

The proposed road development involves the excavation and transportation of large volumes of material excavated from within the site. The volumes of materials involved will depend to a certain extent on the strategy adopted for the construction of the earthworks, and in particular on the extent to which the moist upper soils can be dried or processed/ improved to make them suitable for re-use in embankments. Chapter 8 contains further information on the envisaged earthworks construction methods likely to be employed on the project.

4.15.8.2 Sourcing of Materials and Waste

The major cuttings at Ch. 13+400 and Ch. 37+400 are anticipated to produce sufficient rock for the project as a whole, however the material arising may not conform to the specification requirements for structural backfill and sub-base (clause 804) material. The import requirement for the proposed road development for acceptable material allows for processing of the excavated rock into capping material, however if the rock is suitable to be processed into other materials (Class 6N, 6i & 6j, Clause 804 etc.), additional acceptable material will be required and may require this to be imported from local quarries.

There are a number of registered / authorised quarries in the vicinity of the proposed road development which may be utilised in the sourcing of this material including:

- Laragan Quarries, Laragan, Elphin, Co. Roscommon – to the east of the existing R368 on the L1410
- Ward Bros quarry, Ballyfeeney, Strokestown, Co. Roscommon – to the east of the R371
- Castlemaine, County Roscommon – to the south of the existing N5 east of the N61.
- Boyle, County Roscommon – south of the existing N4, 3km east of Boyle

Only those quarries that conform to all necessary statutory consents will be used in the construction phase.

Section 4.10.4 and Chapter 8 detail the measures incorporated in the design to deal with the unsuitable material arising as part of the works.

4.15.9 Construction Traffic

4.15.9.1 Site Access Routes

The haulage of materials to and from the site will create a significant temporary impact to both road users and to residents living along haul roads. To minimise these impacts it is important that only authorised site access roads, as directed by the Local Authority, are used by construction vehicles.

It is proposed that access to the site for the mainline works will be off and along the following roads:

- N5
- N61
- R361
- R369
- R368
- R371
- L1405 (Lavally Road/Kiltrustan Road)

Construction traffic will only be permitted to use the local road network for the purpose of the construction of the realigned sections of the local roads. The condition and width of these roads is not suitable for use by heavy construction traffic. To facilitate the construction of bridges it is proposed that access will be gained from the proposed N5 mainline or one of the designated roads listed above. (See Figure 4.43 for the permitted haulage routes)

4.15.9.2 Construction Traffic Routing

To construct the earthworks, materials will need to be hauled between different sections of the project. While the contractor may use the public roads listed above it is envisaged that, in general, materials will be hauled along the route of the proposed road between sections without the need to use the public road network. As such the construction of the R368 crossing at Cregga will be key in allowing haulage of rock sourced from the cuttings at Cregga Hill to be transported to other sections of the project. Similar constraints to the haulage of materials are encountered at other crossing points, in particular, the section between the Strokestown and Scramoge Rivers (Ch. 51+150 and Ch. 52+830), which will require the construction of the river structures to provide haul route access to the section between rivers.

In general, the contractor will move materials via the public road network only where necessary as it is more efficient to utilise the haul roads. The use of the public road network is also less desirable to the contractor due to potential traffic delays along these routes and potential delays for construction vehicles needing to join and exit the public road network, including additional delays to clean vehicles exiting the site onto the public road.

In order to haul material between sections it will be necessary for the contractor to set up a temporary crossing point of the existing N5 north of Bellanagare in the townland of Cashel. Temporary crossing points are likely to be required for each of the national, regional and local roads crossed by the proposed road development. The crossings will require local traffic management, in accordance with:

- The Traffic Signs Manual – Chapter 8, Temporary Traffic Measures and Signs for Roadworks;
- The Design Manual for Roads and Bridges, NRA/TII;
- Guidance for the Control and Management of Traffic at Road Works, DOEHLG;
- Guidelines for Working on Roads, Health and Safety Authority.

In calculating the additional traffic on the public road network during the construction period the following assumptions have been made;

- The entire development will be constructed in one phase;
- The construction traffic is distributed over a construction period of 3 years;
- Work will be undertaken on a five day working week;
- Construction traffic movements are based on one full load and one empty load (i.e. two movements for each load of materials);
- Pavement and concrete materials will be sourced from the quarries identified in section 4.15.8.1;
- Surplus peat and alluvium will not need to be transported via the public road network and will be transported on the haul route to the adjacent areas designated for material recovery.
- The transport of fill material will be transported through the site via haul roads as well as along the national and regional roads in close proximity to the site.

- The increase in traffic takes account of the additional trips required for the transportation of all additional fill material, pavement and concrete materials.

Table 4.16 Estimated Construction Traffic

Section of Existing Route	Construction HCV Movements Full +Empty (over 3 year period)	Existing AADT HCV's	Additional AADT HCV	Increase in HCV	Increase in Total Traffic
Existing N5 west of Frenchpark	10,500	579	24	4%	0.4%
Existing N5 Frenchpark to Tulsk	83,300	559	189	34%	3.5%
Existing N5 Tulsk to Strokestown	61,200	540	139	26%	2.8%
Existing N5 Strokestown to Scramoge	32,800	660	75	11%	1.3%

Overall there is an average increase in traffic on the existing road network of approximately 2% for three years of construction. In practice there will be more intense periods of activity on site which will generate greater volumes of construction traffic than the average. However a doubling of the traffic would only represent a total increase in traffic of 7% at most.

4.15.10 Construction Compounds

A number of temporary construction compound sites will be required along and / or in the vicinity of the development. The location, size and suitability of the sites selected will be at the discretion of the contractor. For the purpose of the Environmental Impact Assessment (EIA), the following areas have been identified as potential locations of site compounds:

(i) Adjacent to the Frenchpark Roundabout at Ch. 5+600;

(ii) Adjacent to the Junction 7 at Ch. 12+800;

(iii) Adjacent to regional road R369 between Ch. 17+200 and Ch. 17+600;

(iv) Adjacent to the N61 Roundabout between Ch. 30+000 and Ch. 30+200;

(v) Adjacent to regional road R368 between Ch. 34+750 and Ch. 35+000; and

(vi) Adjacent to the Strokestown Roundabout at Ch. 40+500.

The main compound sites are anticipated to range between 1 and 2.5 hectares in size and may include, stores, offices, materials storage areas, plant storage and parking for site and staff vehicles. These sites are likely to remain in place for the duration of the contract but may be scaled up or down during particular activities on site. Smaller temporary sites required for the construction of particular structures and bridges, specialised earthwork construction and at certain drainage areas may also be sited at various locations along the length of the proposed road development. It is ultimately at the contractor's discretion where these construction compounds are located and the locations identified may be used either in full, in part, not at all, and other different locations could be selected.

The location and layout of the construction compounds selected by the contractor will however have to incorporate the protection and mitigation measures outlined in this EIAR, and conform to the requirements outlined in the Construction Erosion and

Sediment Control Plan (CESCP), Natura Impact Statement (NIS) and planning conditions.

Following completion of construction these areas will be cleared and re-instated, temporary buildings and containers, parking areas and material such as rubble, aggregates and unused construction materials will be removed as appropriate.

4.15.11 Construction Management Plan

Prior to any demolition, excavation or construction a Construction Management Plan (CMP) will be produced by the successful contractor. The Construction Management Plan will set out the Contractor's overall management and administration of a construction project. The CMP will be prepared by the Contractor during the pre-construction phase, to ensure commitments included in the statutory approvals are adhered to, and that it integrates the requirements of the Construction Erosion and Sediment Control Plan (CESCP), Environmental Operating Plan (EOP) and the Waste Management Plan (WMP). The Contractor will be required to include details under the following headings:

- Details of working hours and days;
- Details of emergency plan - in the event of fire, chemical spillage, cement spillage, collapse of structures or failure of equipment or road traffic incident within an area of traffic management. The plan must include contact names and telephone numbers for: Local Authority (all sections/departments); Ambulance; Gardaí and Fire Services;
- Details of chemical/fuel storage areas (including location and bunding to contain runoff of spillages and leakages);
- Details of construction plant storage, temporary offices;
- Traffic management plan (to be developed in conjunction with the Local Authority – Roads Section) including details of routing of network traffic; temporary road closures; temporary signal strategy; routing of construction traffic; programme of vehicular arrivals; on-site parking for vehicles and workers; road cleaning; other traffic management requirements;
- Truck wheel wash details (including measures to reduce and treat runoff);
- Dust management to prevent nuisance (demolition & construction);
- Site run-off management;
- Noise and vibration management to prevent nuisance (demolition & construction);
- Landscape management;
- Management of demolition of all structures and assessment of risks for same;
- Stockpiles;
- Project procedures & method statements for;
    - Demolition & removal of buildings, services, pipelines (including risk assessment and disposal);
    - Diversion of services;
    - Excavation and blasting (through peat, soils & bedrock);
    - Piling;
    - Construction of pipelines;
    - Temporary hoarding & lighting;

- Borrow Pits & location of crushing plant;
- Storage and Treatment of peat and soft soils;
- Disposal of surplus geological material (peat, soils, rock etc.);
- Earthworks material improvement;
- Protection of watercourses from contamination and silting during construction;

- Site Compounds.

The production of the CMP will also detail areas of concern with regard to Health and Safety and any environmental issues that require attention during the construction phase. Adoption of good management practices on site during the construction and operation phases will also contribute to reducing environmental impacts.

4.15.12 Environmental Operating Plan

The Environmental Operating Plan (EOP) is defined as a document that outlines procedures for the delivery of environmental mitigation measures and for addressing general day-to-day environmental issues that can arise during the construction phase of a national road scheme. Essentially the EOP is a project management tool. It is prepared, developed and updated by the Contractor during the project construction stage and will be limited to setting out the detailed procedures by which the mitigation measures proposed as part of the EIAR and NIS and arising out of the Board's decision (if approving the proposed road development) will be achieved. The EOP will not give rise to any reduction of mitigation measures or measures to protect the environment.

Before any works commence on site, the Contractor will be required to prepare an Environmental Operating Plan (EOP) in accordance with the TII/NRA *Guidelines for the Creation and Maintenance of an Environmental Operating Plan*. The EOP will set out the Contractors approach to managing environmental issues associated with the construction of the road and provide a documented account to the implementation of the environmental commitments set out in the EIAR and measures stipulated in the planning conditions. Details within the plan will include:

- All Environmental commitments and mitigation measures included as part of the planning approval process and any requirements of statutory bodies such as the National Parks and Wildlife Services as well as a method documenting compliance with the measures;
- A list of all applicable environmental legislation requirements and a method of documenting compliance with these requirements; and
- Outline methods by which construction work will be managed to avoid, reduce or remedy potential adverse impacts on the environment.

To oversee the implementation of the EOP, the Contractor will be required to appoint a person to ensure that the mitigation measures included in the EIAR, the EOP and the statutory approvals are executed in the construction of the works and to monitor that those mitigation measures employed are functioning properly.

4.15.12.1 TII/NRA Environmental Construction Guidelines

The TII/NRA Environmental and Construction Guidelines provide guidance with regard to environmental best practice methods to be employed in construction on National Road Schemes for the following:

- Guidelines for the Treatment of Badgers prior to the Construction of a National Road Schemes;
- Guidelines for the Treatment of Bats during the Construction of National Road Schemes;
- Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes;
- Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes;
- Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes;
- Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes;
- Guidelines on the Management of Noxious Weeds on National Roads;
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes;
- Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes;
- Guidelines for the Management of Waste from National Road Construction Projects;
- Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.

This is a non-exhaustive list and relevant guidance current at the time of construction will be followed.

4.15.12.2 Waste Management Plan

Included within the CMP will be the Waste Management Plan (WMP) which clearly sets out the Contractor's proposals regarding the treatment, storage and disposal of waste. An outline WMP has been prepared for the proposed road development. The WMP is a live document that will be amended and updated to reflect current conditions on site as the project progress. The obligation to develop, maintain and operate a Waste Management Plan will form part of the contract documents for the project. The plan itself will contain (but not be limited to) the following measures:

- Details of waste storage to be provided for different waste;
- Details of where and how materials are to be disposed of - landfill or other appropriately licensed waste management facility;
- Details of storage areas for waste materials and containers;
- Details of how unsuitable excess materials will be disposed of where necessary;
- Details of how and where hazardous wastes such as oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner;
- A construction and demolition waste plan.

4.15.12.3 Construction Erosion and Sediment Control Plan

A detailed Construction Erosion and Sediment Control Plan (CESCP) has been prepared for the proposed road development and is included in Appendix 10.1. All of the measures, mitigations, controls, requirements, procedures, etc. included therein

will be implemented in full and will ensure that sediment laden runoff from the construction site does not enter watercourses or water bodies.

The contract documents for the proposed development will place an obligation on the construction contractor to further develop this plan to include any additional requirements stipulated by An Bord Pleanála. In addition, the exact details of the plan, particularly in relation to construction phasing, sequence or layout, may be amended by the Contractor to reflect different construction approach but in any case shall include all of the measures, mitigations, controls, requirements, procedures, etc. included the plan.

The CESCP sets out the minimum requirements that must be adhered to. Any alternative measures that may be incorporated at the construction stage will be required to provide at least the same, or, a better standard of protection.

It will be a requirement of the contract documents that the construction stage CESCP is reviewed by the Employer's Site Representative Staff, including the Environmental Assurance Officer, to certify that it fully addresses the environmental requirements of the proposed road development as detailed in this EIAR, the Natura Impact Statement and any additional requirements imposed by An Bord Pleanála.