Appendix A.6.4.1

Phase 2 Road Safety Impact Assessment Report (RSIA)

Leitrim County Council

N4 Carrick-on-Shannon to Dromod Project

Phase 2 Road Safety Impact Assessment Report

274219-ARUP-02-OS-RP-Z-000001

P04 | 11 March 2022

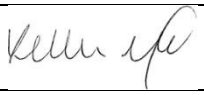
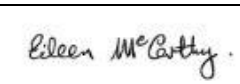
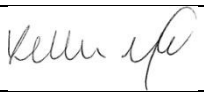
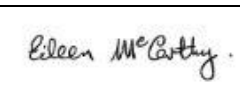
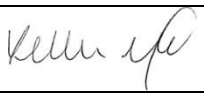
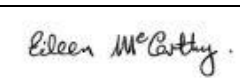
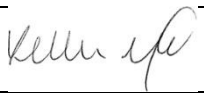
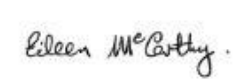
Job number 274219-00

Ove Arup & Partners Ireland Ltd
Corporate House
City East Business Park
Ballybrit
Galway H91 K5YD
Ireland
www.arup.ie

ARUP

Document Verification

ARUP

Job title		N4 Carrick-on-Shannon to Dromod Project		**Job number** 274219-00
Document title		Phase 2 Road Safety Impact Assessment Report		**File reference**
Document ref		274219-ARUP-02-OS-RP-Z-000001		
Revision	**Date**	**Filename**	274219-ARUP-02-OS-RP-Z-000001	
P01	28 Oct 2021	**Description**	First Draft	
			Prepared by	Checked by	Approved by
		Name	Keelan Ward	Hazel King	Eileen McCarthy
		Signature			
P02	17 Dec 2021	**Filename**	274219-ARUP-02-OS-RP-Z-000001.docx	
		Description	Issue	
		Name	Keelan Ward	Hazel King	Eileen McCarthy
		Signature			
P03	10 March 2022	**Filename**	274219-ARUP-02-OS-RP-Z-000001.docx	
		Description	Final Issue	
				Checked by	Approved by
		Name	Keelan Ward	Eoin Doyle	Eileen McCarthy
		Signature			
P04	11 March 2022	**Filename**	274219-ARUP-02-OS-RP-Z-000001.docx	
		Description	Final Issue with Appendix	
			Prepared by	Checked by	Approved by
		Name	Keelan Ward	Eoin Doyle	Eileen McCarthy
		Signature			
				Issue Document Verification with Document	✓

Contents

Appendices

1 Introduction

1.1 Overview

Arup has been appointed by Leitrim County Council to provide multi-disciplinary technical consultancy services for the delivery of Phases 1 to 4 of the TII Project Management Guidelines for the N4 Carrick-on-Shannon to Dromod Project, on behalf of both Leitrim County Council and Roscommon County Council. This appointment includes concept and feasibility studies, options appraisal and selection, design and environmental evaluation and the statutory process.

1.2 Purpose of this Report

The requirement to implement Road Safety Impact Assessments on infrastructure projects stems from EU Directive 2008/96/EC. The purpose of this RSIA report is to examine the existing road network and the Stage 1 Alternatives and Option Corridors within the N4 Carrick-on-Shannon to Dromod Project study area and assess the impact that any potential transportation solutions may have from a road safety perspective. This RSIA was undertaken in accordance with TII publication Road Safety Impact Assessment (reference PE-PMG-02001), the purpose of which is to "*ensure that the implications on road safety of different planning alternatives are fully assessed as part of both feasibility study and route selection process*".

1.3 Project Background

The N4 national primary road, Dublin to Sligo, is a strategic corridor from Dublin to the northwest and border counties and is approximately 198km in length. It is recognised as being of particular importance in enhancing accessibility to some of the most peripheral areas in the northwest (including Leitrim / Roscommon / Sligo and Donegal) and west of the River Shannon.

The section of the N4 under consideration falls within two local authority administrative areas with the River Shannon acting as the boundary. The area to the west of the River Shannon lies within County Roscommon and to the east of the River Shannon within County Leitrim. The town of Carrick-on-Shannon lies on the eastern side of the River Shannon while the town of Cortober lies to the west of the river. For the purposes of this report, where Carrick-on-Shannon is referred to it is taken to encompass both Carrick-on-Shannon and Cortober.

The section of the N4 under consideration passes through both rural and urban environments, is approximately 20km long and extends from Drumharlow townland north of Carrick-on-Shannon to Faulties townland south of Aghamore (refer to Figure 1.1 and Figure 1.2 below). Major towns and villages along the route are Carrick-on-Shannon, Cortober and Aghamore.

1.3.1 Previous Studies

In 2001, consulting engineers were appointed by Leitrim County Council to assist in the development of the N4 Carrick-on-Shannon Bypass. The scheme was progressed through the phases of a major road scheme with the Route Selection Report and an Emerging Preferred Route Corridor published in 2002, but work was suspended at that time due to funding restrictions. In 2009, the scheme was revisited with a Route Selection Report and Emerging Preferred Route Corridor published in 2011. A draft Environmental Impact Statement was prepared in June 2011. Due to funding restrictions, further work on the scheme was suspended in 2012.

1.3.2 Current Project Policy Context

The N4 Carrick-on-Shannon to Dromod Project is listed as a section of the transport network to be progressed through pre-appraisal and early planning and prioritised for delivery under the National Development Plan 2018 – 2027.

The following European, National, Regional and Local policy documents either reference the N4 or directly reference the N4 Carrick to Dromod Project:

- Project Ireland 2040 - **National Planning Framework;** Department of Housing, Planning and Local Government
- Project Ireland 2040 - **Ireland National Development Plan 2018 – 2027 (NDP)**; Department of Public Expenditure and Reform
- **Regulation (EU) No 1315/2013** of the European Parliament and the Council of 11 December 2013
- **Strategic Investment Framework for Land Transport (SIFLT)**, Department of Transport, Tourism and Sport (DTTaS)
- **Road Safety Strategy 2013 – 2020**, Road Safety Authority
- **Regional Economic and Spatial Strategy for the North & Western Regional Assembly (2020)**
- Regional Planning Guidelines (2010 - 2022), Border Regional Authority
- Leitrim County Development Plan (2015 - 2021) (CDP), Leitrim County Council
- Carrick-on-Shannon Local Area Plan (2010 - 2019) (LAP), Leitrim County Council
- Roscommon County Development Plan (2014 - 2020) (CPD), Roscommon County Council
- Cortober Area Plan contained within the Roscommon County Development Plan (2014 - 2020)

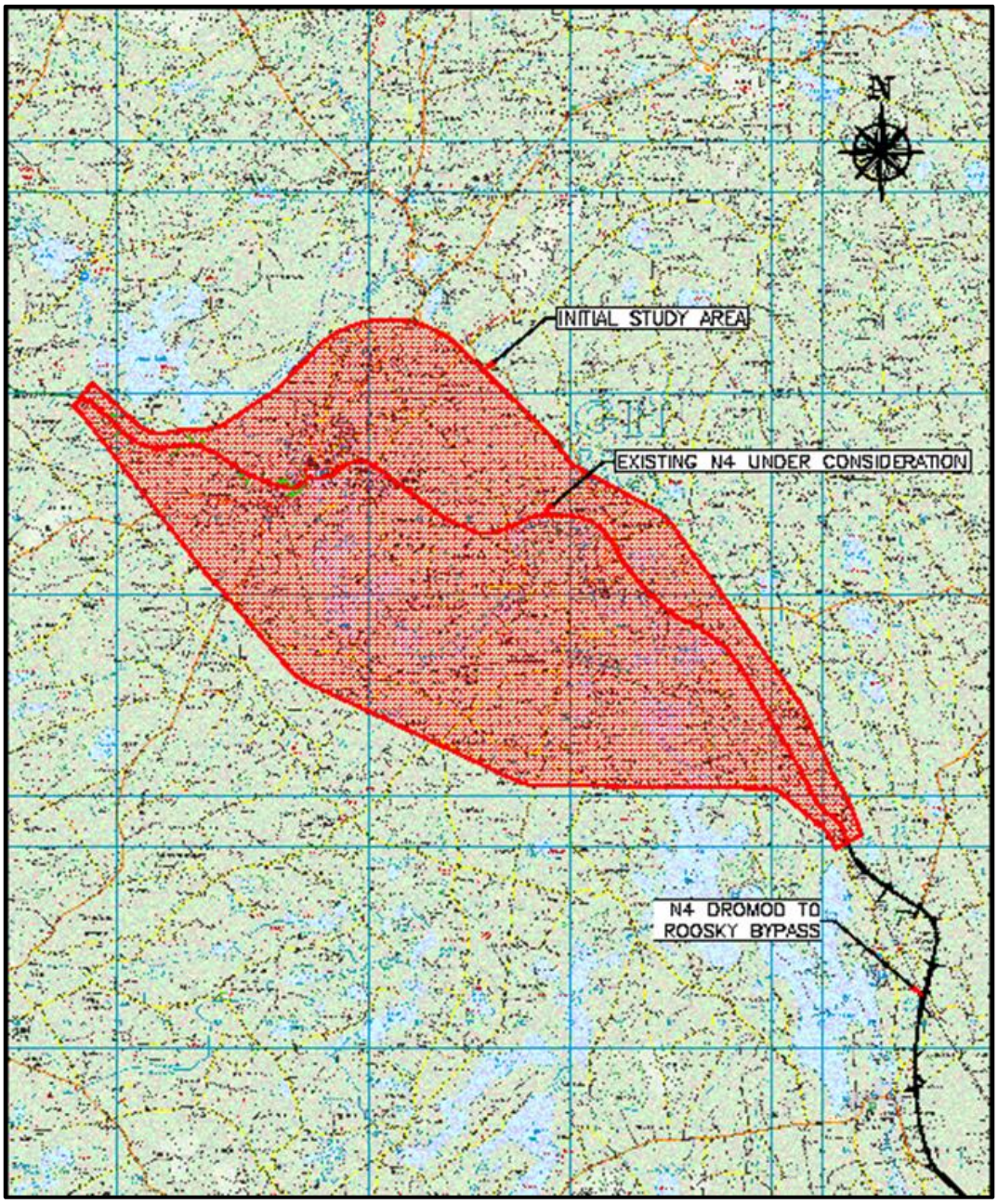


Figure 1.1: Section of the N4 under consideration

Two changes have been made to the study area boundary since Phase 1 as shown on Figure 1.2. The boundary has been widened at Portaneoght to accommodate the Purple and Dark Green Option Corridors. The study area boundary was also widened at Lisdauky to accommodate the Dark Green Option Corridor. A more detailed description of the Option Corridors is given in Section 4.1.

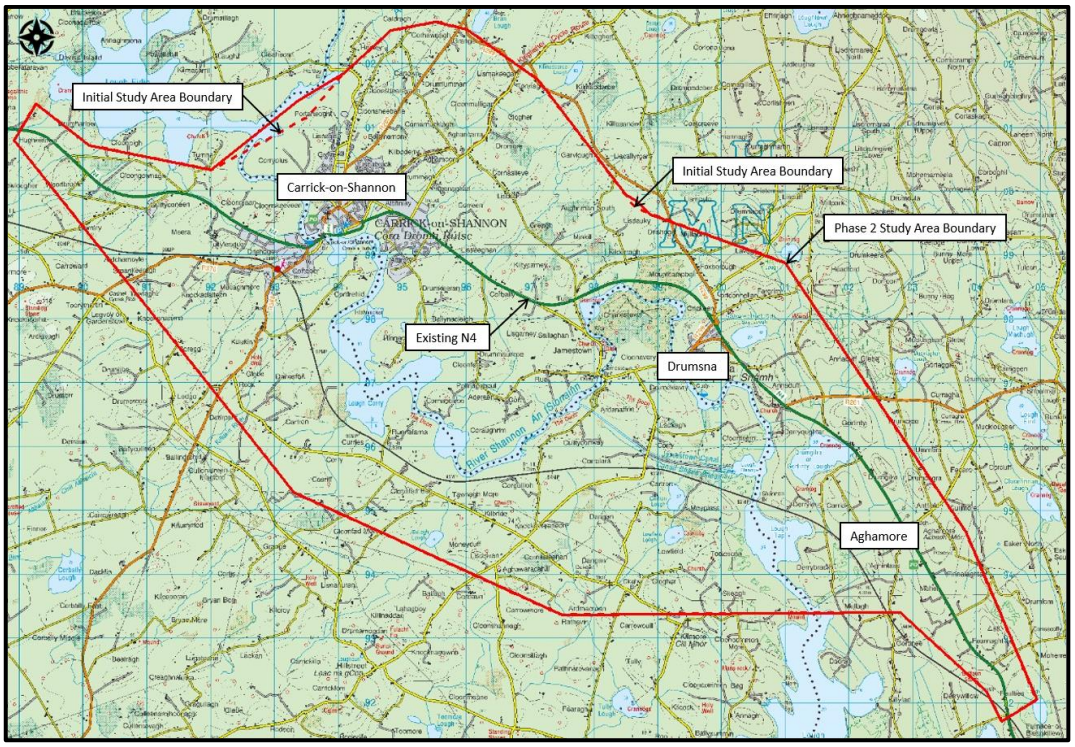


Figure 1.2: Phase 2 Study Area Boundary

1.4 Project Aim

Having identified the transportation issues within the study area in Phase 1, the objectives of any potential solution were defined i.e., the project objectives. The project now focuses on determining an appropriate sustainable solution which meets these project objectives. Additionally, alternative transport modes or routes will be assessed within the study area for suitability as a sustainable solution.

1.5 Existing Road Network

The national primary road N4, Dublin to Sligo is a strategic corridor from Dublin to the northwest and border counties; it forms part of the EU TEN-T Comprehensive road network providing a strategic link between Dublin and Sligo, which was designated a regional centre in the 2018 National Development Plan and National Planning Framework. The N4 connects directly with the N5 and N6 national primary roads which also form part of the EU TEN-T Comprehensive road network.

The N4 carries both long-distance traffic from the east of the country to the northwest of the country and significant regional and inter-urban traffic flows between Mullingar, Longford, Carrick-on-Shannon, Boyle and Sligo. The section of the N4 through Carrick-on-Shannon also provides regional connections to the towns of Elphin (R368), Frenchpark (R370) and Manorhamilton (R280). The N4 currently crosses the River Shannon at Carrick-on-Shannon to Cortober via a narrow masonry arch bridge, dating from 1846, which is sub-standard in terms of alignment and cross-section.

Significant lengths of the N4 have been improved / upgraded to dual carriageway cross-section in the recent past. With these upgrades, especially the opening of N4 Dromod to Roosky Bypass, Carrick-on-Shannon has become a bottleneck for long distance and regional traffic. It remains the only regional strategic centre on the N4 between Dublin and Sligo which has not been bypassed to date.

The high traffic flows on the N4 together with sections of poor alignment along the built-up areas on the approaches to Carrick-on-Shannon and at Aghamore, the 2-lane cross-section and frequent junctions with local road and frontage access has resulted in a high number of collisions. Further detail on the existing N4 through the study area is presented in **Appendix A**, Existing Road Condition Assessment.

1.6 RSIA Team

The RSIA team members are presented in Table 1.1 below:

Table 1.1: RSIA Team Members

Road Safety Impact Assessment Team	
Certified Road Safety Auditor:	Eileen McCarthy
Road Designer:	Hazel King
Design Engineer:	Keelan Ward

The members were chosen in accordance with the requirements of TII Publication PE-STY-02003 (Road Safety Impact Assessment - Impact Assessment Team Qualifications). The certified road safety auditor and road designer were submitted to the Road Safety Division of TII for approval and the team was approved in May 2020.

1.7 Site Visit Details

A site visit was undertaken on 29/05/2020 to assess the following elements:

- Existing road network
- Local amenities
- Topography of the area
- Existing traffic, pedestrian and cyclist movements

The weather at the time of the site visit was warm and dry.

A further site visit was undertaken on 03/09/2021 to assess the proposed Alternatives and Options with a particular focus on the crossing points of the proposed option corridors with the existing road network. The weather at the time of the site visit was warm and dry.

2 Project Objectives

2.1 Overview

The project objectives are framed in accordance with the Department of Transport, Tourism and Sport (DTTAS) publication Common Appraisal Framework for Transport Projects and Programmes (March 2016) and TII Project Appraisal Guideline (PAG) Unit 3.0. Project objectives are framed under the following criteria:

- Economy
- Safety
- Environment
- Accessibility and Social Inclusion
- Integration
- Physical Activity

The project objectives are recorded in the Project Brief and are summarised below.

2.2 Economy

- To provide a reliable transport system over the N4 corridor extents under consideration and to contribute to efficient connectivity between the Northern and Western Regions with Dublin and the Eastern and Midland Regions to balance regional development.
- To provide opportunities to enhance the future tourism and economic prospects of Carrick-on-Shannon and the wider north west regions of Roscommon, Leitrim, Sligo and Donegal
- To provide a solution that offers good value for money and reduce the cost of travel

2.3 Safety

- To reduce the potential for collisions and severity of collisions by providing a safer travelling environment for all road users over the N4 corridor extents under consideration supporting the RSA Road Safety Strategy 2013 - 2020
- To reduce the potential for conflict with vulnerable road users within built-up areas of Carrick-on-Shannon, Cortober and Aghamore

2.4 Environment

- To minimise impacts on designated Natura 2000 sites in the vicinity of the study area

- To minimise the impact to local watercourses and associated flood plains, in particular the River Shannon
- The proposed scheme will seek to reduce noise and air impacts in the various settlements along the corridor
- To provide opportunities to enhance the local amenity and heritage value of the area
- To ensure consideration of sustainable development principles and measures to minimise the effects on the environment to support the government's Climate Action Plan

2.5 Accessibility and Social Inclusion

- Improve accessibility to key facilities, such as employment, education, transport and healthcare, to satisfy transport demand for all trip types for all modes of transport on the national road transport network
- To provide opportunities to enable the successful creation of place making and generation of a vibrant community in Carrick-on-Shannon
- Facilitate the enhancement of sustainable travel and improved connectivity to public transport opportunities
- To improve connectivity across the River Shannon and in turn support social and economic development within this regional strategic town and its hinterland

2.6 Integration

- To support sustainable growth in Carrick-on-Shannon through the creation of an attractive environment to encourage sustainable trips
- To achieve the goals of the TEN-T Comprehensive network by providing high quality links which will contribute to enhancing social cohesion within Ireland and across the EU, further supporting the integration of all transport modes within the wider region, integrating with regional public transport facilities.
- To support the integration objectives to balance the social and economic development in the North West Region as set out in national and regional policies.

2.7 Physical Activity

- To enable walking and cycling opportunities in a safer environment for the communities along the corridor
- To create a healthy environment conducive to active travel for the communities along the corridor

3 Existing Road Network Safety Problems

3.1 Potential Impacts on Existing Road Network

Any potential transportation solution for the N4 Carrick-on-Shannon to Dromod Project involving amendments or additions to the existing road infrastructure has the potential to affect numerous junctions and roads within the study area. The following is a list of the existing roads which would potentially be affected by the proposed transportation solutions examined as part of the concept and feasibility studies:

- N4
- R201
- R299
- R280
- R903
- R368
- R209
- R370
- L5131
- L5078
- L50782
- L50783
- L50805
- L3655
- L7414
- L7416
- L7427
- L3657
- L3656
- L7426
- L7661
- L7429
- L3630
- L7430
- L7464

- L3470
- L3467
- L7472
- L1475
- L1601
- L3408

A Region Road Safety Inspection (RSI) Engineer has highlighted a number of road safety issues within the study area during an inspection in 2017 as set out in Table 3.1.

Table 3.1: Road safety issues identified during 2017 Road Safety Inspection

LOCATION	LATITUDE	LONGITUDE	PROBLEM DESCRIPTION	HAZARD COMMENT	BROAD SOLUTION
Fearnaght	53.882762	-7.936188	Risk of rear end shunt and loss of control due to sudden braking on approach to exit from minor road. Particular risk at night.	Erect informative directional signposts opposite exit from side road.	Signage
Aghintass	53.899832	-7.954813	Risk of rear end shunt due to motorists having insufficient warning of the junction	The advance warning sign should be re-located further away from the junction.	Signage
Antfield	53.900702	-7.955982	Risk of rear end shunt and loss of control due to sudden braking on approach to exit from minor road. Particular risk at night.	Erect informative directional signposts opposite exit from side road.	Signage
Annaduff	53.918997	-7.9862435	Risk of loss of control or overshooting junction due to drivers approaching exit at high speed with no prior warning of main road. Particular risk at night	The advance T junction sign should be relocated further away from the junction.	Signage
Annaduff	53.924586	-7.9942425	Risk of loss of control or overshooting junction due to drivers approaching exit at high speed with no prior warning of main road. Particular risk at night	The advance T junction sign should be relocated further away from the junction.	Signage
Mountcampbell	53.935892	-8.01089	A vehicle which has left the carriageway may drive down the steep embankment due to no safety barrier.	The safety barrier should be extended to ensure all areas to the edge of the carriageway with a steep embankment are protected to restrain a vehicle which has left the roadway.	Safety Barrier
Tully	53.933888	-8.035645	Risk of loss of control or overshooting junction due to drivers approaching exit at high speed with insufficient prior warning of main road. Particular risk at night.	The Stop sign should be relocated so as to make it more visible on approach to mainline.	Signage
Tully	53.933717	-8.035568	Risk of loss of control or overshooting junction due to drivers approaching exit at high speed with no prior warning of main road. Particular risk at night	The advance T junction sign should be relocated further away from the junction.	Signage
River Shannon Bridge	53.942857	-8.096158	The old footpath should be removed as pedestrians may still use it, causing them to walk close to the carriageway with risk of falling into the path of a passing vehicle due to the narrowness of the old footpaths in locations.	The old footpath is redundant and should be remove.	Surface / Pavement
Cortober	53.942444	-8.096303	Risk of loss of control or overshooting junction due to drivers approaching exit at high speed with no prior warning of main road. Particular risk at night	Erect new stop sign at junction, clearly visible to drivers on approach to main road.	Signage
Cortober	53.942088	-8.096367	Risk of loss of control or overshooting junction due to drivers approaching exit at high speed with no prior warning of main road. Particular risk at night	An advance T junction sign should be erected on the approach to the junction.	Signage

LOCATION	LATITUDE	LONGITUDE	PROBLEM DESCRIPTION	HAZARD COMMENT	BROAD SOLUTION
Cortober	53.94147	-8.0991895	Risk of collisions due to drivers not yielding for cars to their right at the roundabout. Particular risk at night	The layout of the roundabout should be more clearly defined with signage and the roundabout raised to stop motorists driving over it, rather than around it.	Minor Alignment - No Landtake Required
Cortober	53.941396	-8.0997485	The angles of entry to the roundabout are unsuitable and result in the roundabout failing to function properly.	The layout of the roundabout should be more clearly defined with signage and the roundabout raised to stop motorists driving over it, rather than around it.	Minor Alignment - No Landtake Required
Drumharlow	53.956392	-8.159928	Risk of rear end shunt and loss of control due to sudden braking on approach to exit from minor road. Particular risk at night.	Erect informative directional signposts opposite exit from side road.	Signage

3.2 Existing Road Safety Data

3.2.1 Overview

There are 52 at-grade local / regional road junctions, and multiple commercial, domestic and agricultural direct accesses onto the N4 road within the section of the N4 under consideration. In addition, there are six roundabout junctions and two controlled pedestrian crossings on the N4 within the 50km/h speed limit of Carrick-on-Shannon. There is a grade separated junction with the R299 at Drumsna.

An analysis of the collision history of this section of road for the period 1996 to 2016 has identified three significant collision locations as follows:

1. Carrick-on-Shannon – The road network through Carrick-on-Shannon shows a large cluster of minor and serious collisions, as this is where the potential for conflict between road traffic, pedestrians and cyclists is highest
2. Mountcampbell (TII Site ID N04LM_139.0) – Two collisions with three fatalities and one minor injury
3. N4 Junction at the R201 (TII Site ID N04_137.0) – Three minor collisions

In addition, the existing road contains the following problematic road safety concerns:

- Change in carriageway cross-section from Type 2 Dual Carriageway to Two-Way Single Carriageway without the provision of a junction to demark the change in cross-section. This does not comply with the recommendations of Section 8.7 of TII Publication DN-GEO-03031 (Rural Link Design)
- Direct access from Annaduff GAA club grounds and the adjacent Leitrim GAA Centre of Excellence to the N4 on the 100km/h speed limit
- 50km/h speed limit and associated traffic calming measures at Aghamore
- Six roundabouts over 2.2km within the Carrick-on-Shannon 50km/h speed limit, which is an area with significant vulnerable road users
- Direct access from the Leitrim GAA County Grounds (Páirc Seán Mac Diarmada) within the 50km/h speed limit
- On street parking on the N4 at commercial premises within the 50km/h speed limit
- Zebra controlled crossings on the national primary road
- Substandard carriageway width and restricted facilities for vulnerable road users at the River Shannon bridge crossing in Carrick-on-Shannon

3.2.2 TII Safety Ranking

TII Publication GE-STY-01022 (formerly NRA HD 15) is used to identify sections of the national road network which have a high concentration of collisions and to rank the safety of the road network. The ranking is based on the collision rate (number of collisions per 100 million vehicle kilometres travelled) on road sections

of approximately 1km compared against the national average collision rate for a similar road type.

Figure 3.1, Figure 3.2, Figure 3.3 and Figure 3.4 below show the ranking for the section of the N4 under consideration. This demonstrates that both urban (Carrick-on-Shannon) and rural sections (R201 to R299 junction) of the N4 consistently have collision rates that are above or twice above the national average for the relevant carriageway classification.

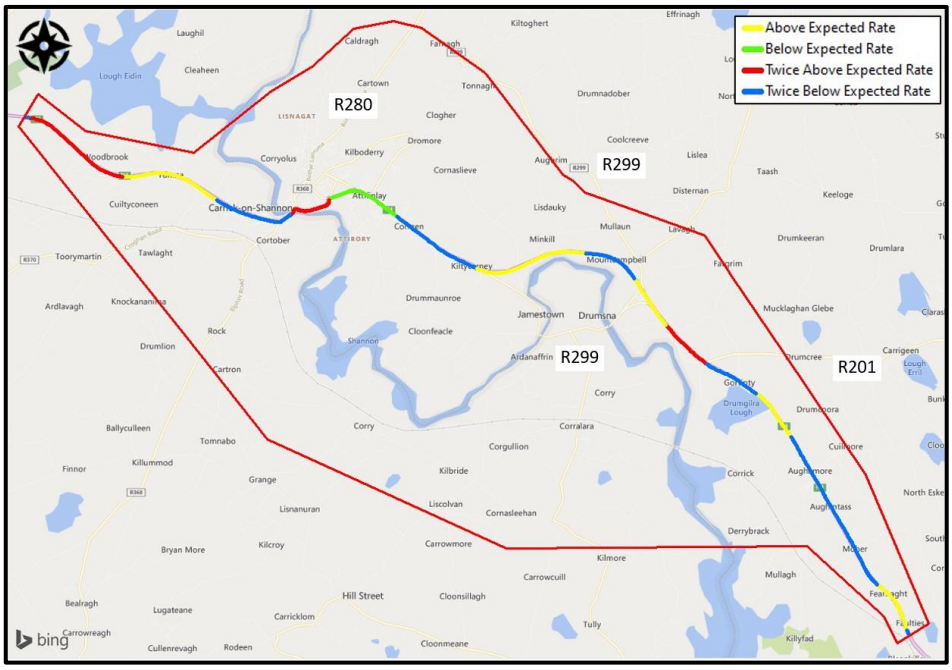


Figure 3.1: Collision Rates 2010 – 2012 (Source: Transport Infrastructure Ireland)

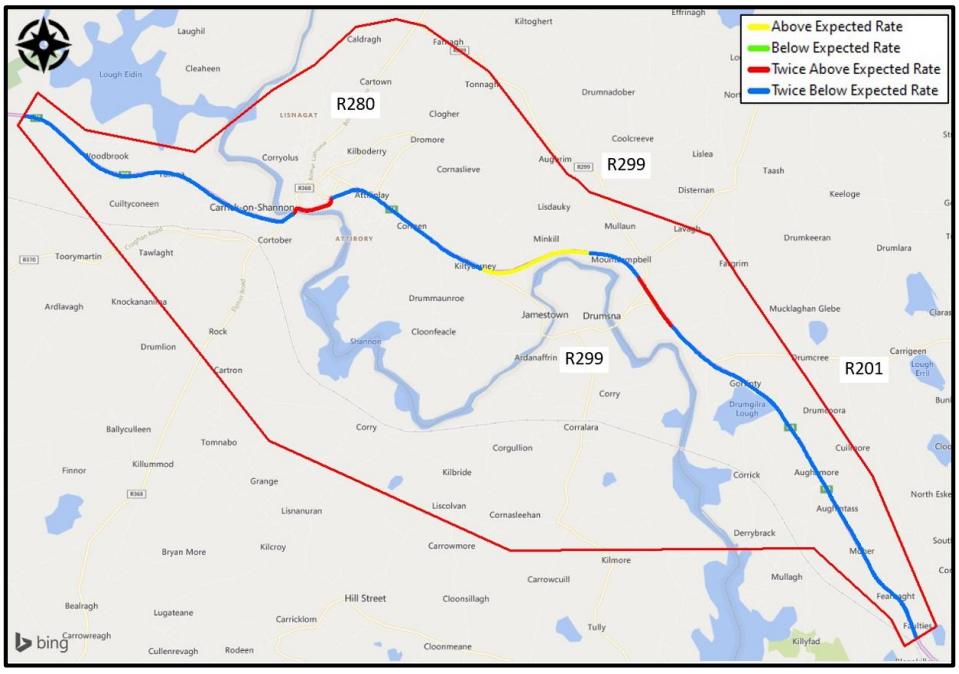


Figure 3.2: Collision Rates 2012 – 2014 (Source: Transport Infrastructure Ireland)

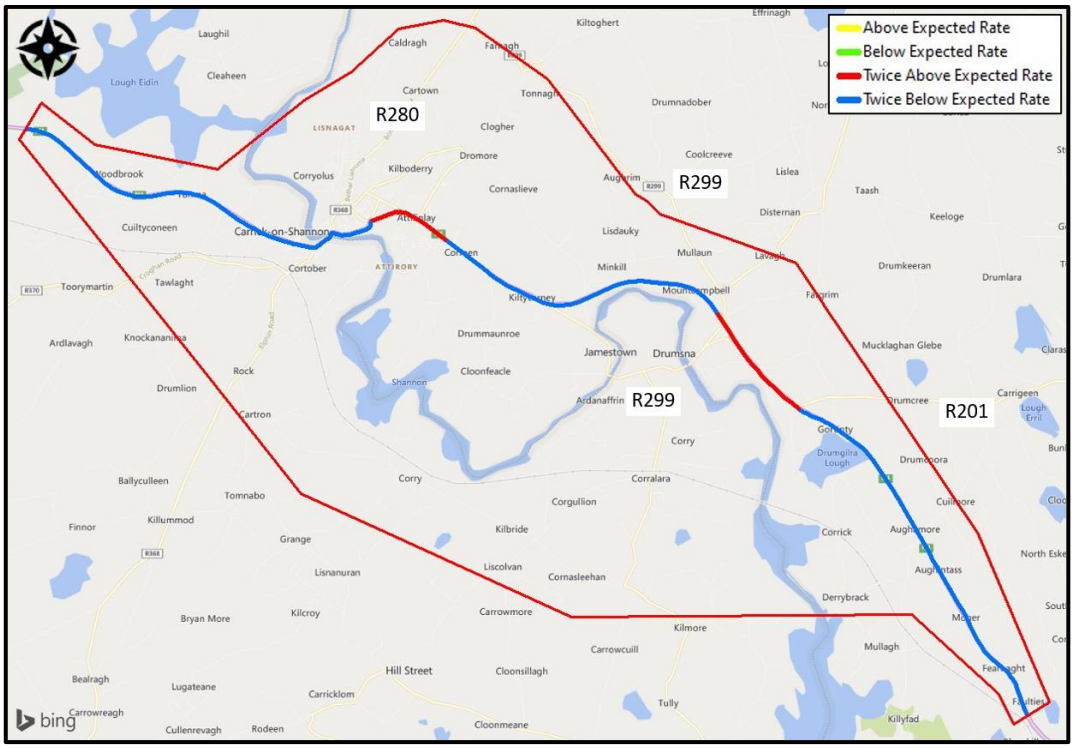


Figure 3.3: Collision Rates 2014 – 2016 (Source: Transport Infrastructure Ireland)

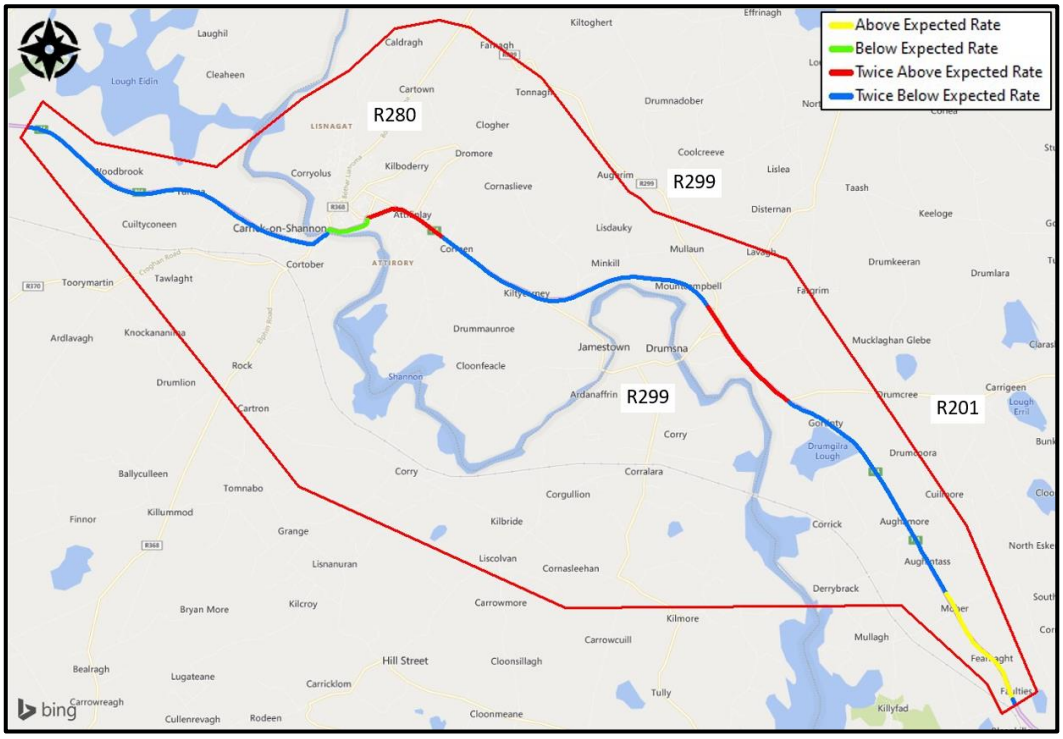


Figure 3.4: Collision Rates 2015 - September 2017 (Source: Transport Infrastructure Ireland)

3.2.3 RSA Collision Data

Collision data for the study area was obtained from the Road Safety Authority (RSA). Table 3.2 below presents the number of recorded fatalities, serious injuries

and minor injuries resulting from collisions within the study area for the period between 1996 and 2016. See section 3.2.11 for further collision data from 2017 to 2019. This additional data was received from TII but is yet to be verified by RSA.

The expansion of the study area boundary mentioned in Section 1.3.2 does not result in any changes to the collision data examined in Phase 1.

Table 3.2: Collision data within the Study Area

Year	Fatalities	Seriously Injured	Minor Injury	Injury (Unknown Severity)
1996	0	0	3	0
1997	0	1	13	1
1998	2	0	12	0
1999	1	2	20	1
2000	0	2	11	0
2001	0	4	9	1
2002	0	2	23	0
2003	1	1	10	0
2004	0	0	8	0
2005	2	1	15	3
2006	0	2	0	0
2007	3	2	6	2
2008	0	1	6	0
2009	0	0	15	0
2010	0	0	9	0
2011	0	0	20	0
2012	0	1	22	0
2013	0	0	8	0
2014	0	2	11	0
2015	0	0	21	0
2016	0	0	19	0
Total	9	21	261	8

The geographical distribution of these collisions is presented in Figure 3.5. A red marker denotes a fatal collision. Yellow and green markers signify collisions where serious and minor injuries were sustained respectively.

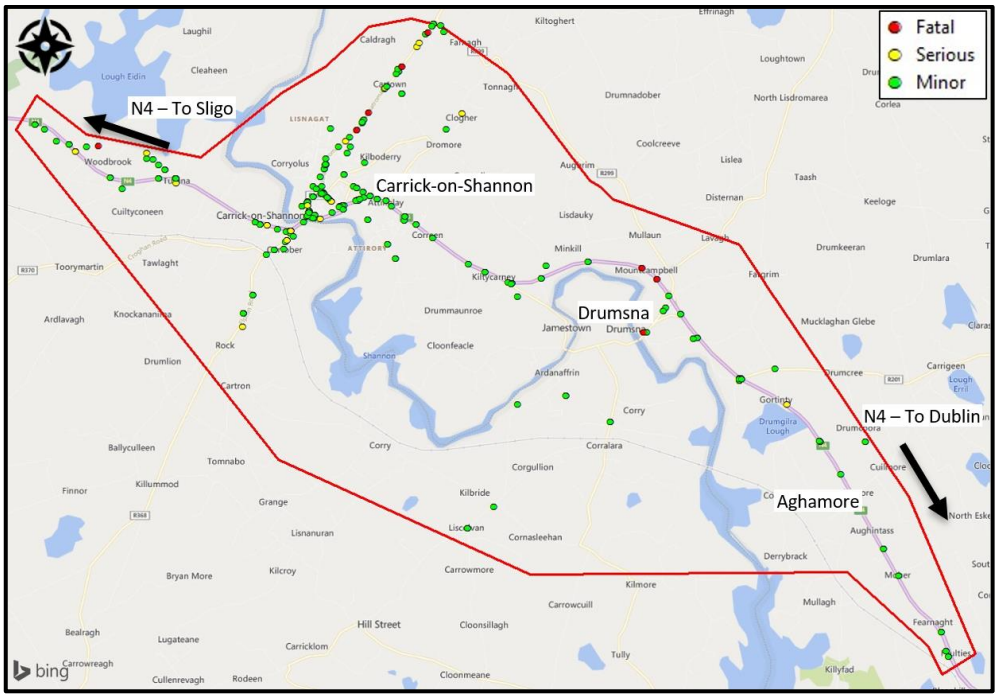


Figure 3.5: Distribution of Collisions within the Study Area (1996 - 2016)

The level of congestion, journey time unreliability and stop/start traffic patterns on the national road network within the study area have the potential to lead to collisions in the following situations:

- Driver frustration resulting from poor traffic flow can result in drivers making swift lane changes to queue jump and making sudden and unpredictable sharp direction changes in response to a perceived gap, all of which can result in collisions
- As congestion increases, adherence to the rules of the road can decrease, for example by the illegal use of hard shoulders to avoid queues at junctions
- Motorists use adjacent residential streets to try to queue jump which are not suitable for large traffic volumes or high speed to avoid congestion, which can lead to an increased likelihood of collisions between vulnerable road users and vehicular traffic
- Congestion can lead to an increase in rear-end shunt type incidents

Poor traffic flow, heavy congestion and queuing at junctions are experienced on the existing N4 in particular through Carrick-on-Shannon.

The existing road network which may be affected by any road based transportation solution contains a variety of road safety issues including those identified above. These safety issues are examined in more detail in Section 6 of this report in the context of whether any potential transportation solution involving the modification of, or addition to road infrastructure, could resolve the existing safety issues and void the addition of new safety issues. The data which is examined and detailed was obtained from the Road Safety Authority and covers the period between 1996 and 2016.

3.2.4 Overall Collision Assessment for Study Area

Table 3.2 and Figure 3.5 present the collision casualties and the geographical distribution of collisions within the study area between the years 1996 and 2016.

Figure 3.5 demonstrated a high concentration of collisions in or adjacent to the Carrick-on-Shannon town centre. Outside of the town area, collisions are mostly seen along the existing N4 and the R280 Leitrim Road.

Table 3.3 gives an overall summary of the collision statistics gathered for the study area for the period between 1996 and 2016. Details on the time of day, collision type, road characteristics, vehicle type and weather at the time of collision are presented.

Table 3.3: Overall Collision Assessment for Study Area Statistics (1996 - 2016)

Total No. Collisions	**187**	
Time of Day		
AM Peak (07:00 - 10:00)	16	8.56%
PM Peak (16:00 - 19:00)	43	22.99%
Outside Peaks	128	68.45%
Collision Type		
Pedestrian Involvement	39	20.86%
Single Vehicle Collision	40	21.39%
Rear-End Collision	37	19.79%
Head-On Collision	27	14.44%
Other	44	23.53%
Road Characteristics		
Straight	115	61.50%
Bend	34	18.18%
Hill / Crest	2	1.07%
Gradient	6	3.21%
Other	30	16.04%
Vehicle Type		
Private Car	227	N/A
Goods Vehicle	14	N/A
Other	52	N/A
Weather		

Total No. Collisions	**187**	
Dry	131	70.05%
Other	56	29.95%

In total, nine fatalities were recorded due to road collisions within the study area from 1996 and 2016. 21 individuals were seriously injured, while 261 more sustained minor injuries. Eight others were also injured, but the severity of these injuries is unknown.

Within the study area 49% of the collisions occur during the weekend period Friday to Sunday and 41% of the collisions occur during the summer period May to August which may point to higher incident rates during the busy tourism season.

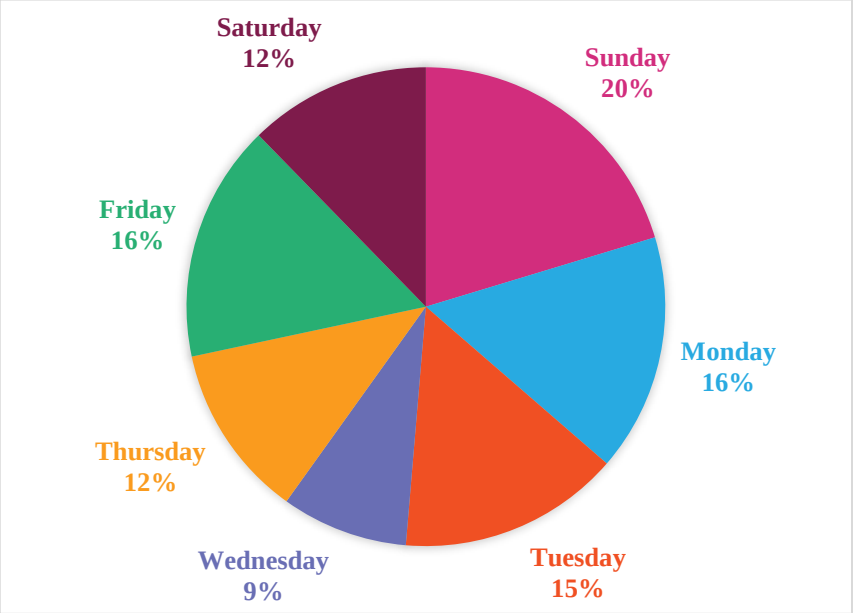


Figure 3.6: Distribution of collisions over weekdays

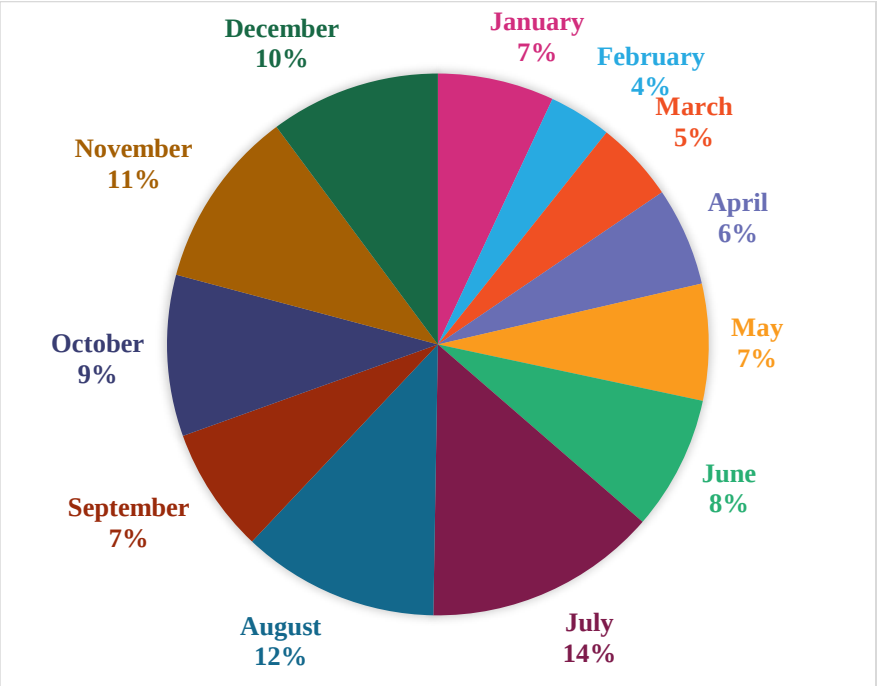


Figure 3.7: Distribution of collisions over months

More detailed analyses of the collision statistics for six subsections within this overall study area are given in the following sections of this report.

3.2.5 Section A

Section A comprises the boundary of the Carrick-on-Shannon urban / town area, which is outlined in Figure 3.8, where the locations of collisions recorded from 1996 to 2016 are also illustrated.

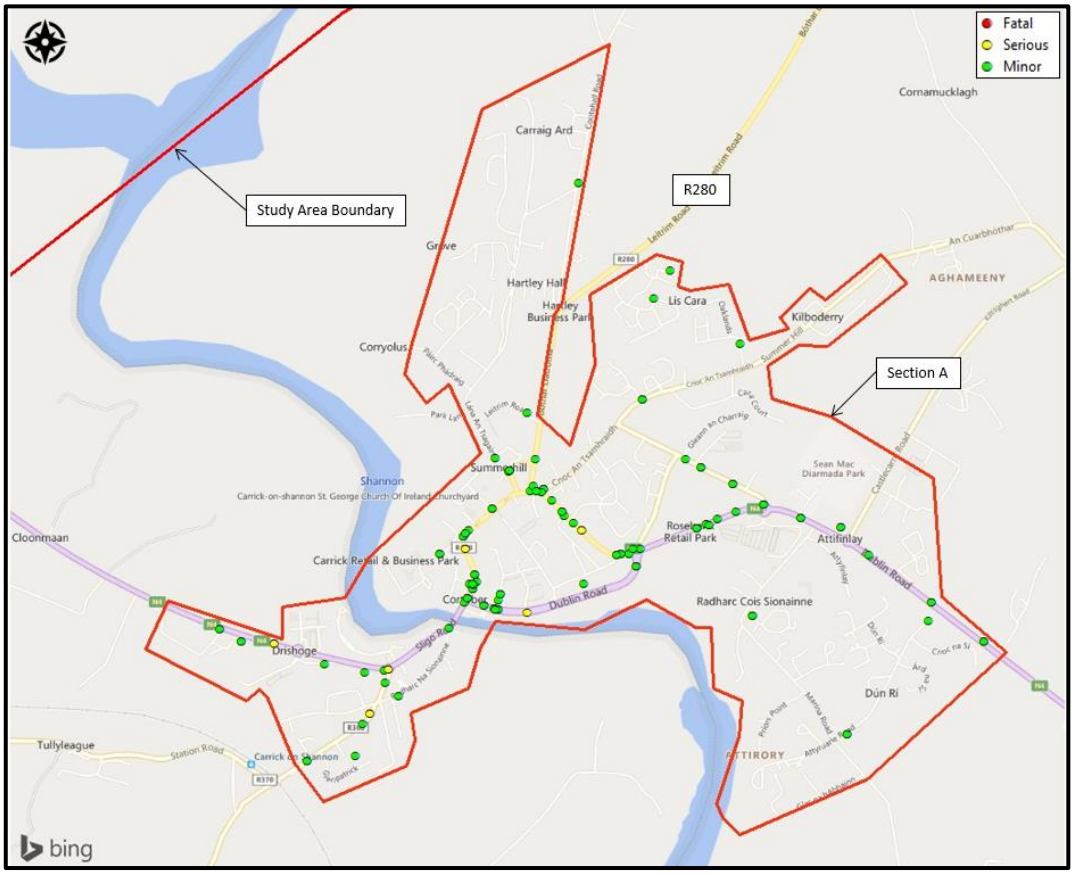


Figure 3.8: Section A Collisions (1996 - 2016)

Table 3.4 and Table 3.5 present the collision casualties and statistics for the Carrick-on-Shannon Town area between the years 1996 and 2016.

Table 3.4: Section A Collision Casualties (1996 - 2016)

Year	Fatalities	Seriously Injured	Minor Injury	Injury (Unknown Severity)
1996	0	0	1	0
1997	0	0	10	1
1998	0	0	8	0
1999	0	0	11	0
2000	0	0	4	0
2001	0	0	1	0
2002	0	1	4	0
2003	0	0	3	0
2004	0	0	2	0
2005	0	1	3	2
2006	0	2	0	0
2007	0	1	0	0
2008	0	1	6	0
2009	0	0	6	0
2010	0	0	3	0
2011	0	0	10	0
2012	0	1	15	0
2013	0	0	5	0
2014	0	0	6	0
2015	0	0	9	0
2016	0	0	13	0
Total	**0**	**7**	**120**	**3**

Table 3.5: Section A Collision Statistics (1996 - 2016)

Total No. Collisions	**82**		
Time of Day			Study Area Averages
AM Peak (07:00 - 10:00)	4	4.88%	8.56%
PM Peak (16:00 - 19:00)	17	20.73%	22.99%
Outside Peaks	61	74.39%	68.45%
Collision Type			
Pedestrian Involvement	28	34.15%	20.86%
Single Vehicle Collision	10	12.20%	21.39%
Rear-End Collision	20	24.39%	19.79%
Head-On Collision	9	10.98%	14.44%
Other	15	18.29%	23.53%
Road Characteristics			
Straight	53	64.63%	61.50%
Bend	14	17.07%	18.18%
Hill / Crest	0	0.00%	1.07%
Gradient	3	3.66%	3.21%
Other	12	14.63%	16.04%
Vehicle Type			
Private Car	98	N/A	N/A
Goods Vehicle	8	N/A	N/A
Other	20	N/A	N/A
Weather			
Dry	60	73.17%	70.05%
Other	22	26.83%	29.95%

Between 1996 and 2016 there were 82 collisions within the Carrick-on-Shannon urban/town study area. No fatalities were recorded in this time, however seven individuals were seriously injured, while a further 120 sustained minor injuries. Three others were also injured but the severity of these injuries is unknown.

Pedestrians were involved in over 34% of the collisions in the urban/town area. This is a significantly higher pedestrian involvement than the total study area average of 20.8%. This could be attributed to a greater number of pedestrians expected in an urban environment and may also indicate poor segregation between pedestrians and the road network.

Rear-end shunt type collisions are symptomatic of congestion issues where vehicles are travelling too closely for adequate stopping distance. 24.4% of collisions within the Carrick-on-Shannon were of this collision type, over 4.6% higher than the study area average of 19.8%.

Although an increase in collisions might be expected during AM and PM peak times, this was not the case. While PM peak hour collision rates in the urban area are quite similar to the overall study area at 20.7% and 23% respectively, the rate of AM peak time collisions within the town are little over half that of the total study area. This in turn illustrates a higher collision rate outside of peak hours, suggesting a more widespread distribution of collisions throughout the day.

3.2.6 Section B

Section B encompasses approximately 4.2km of the existing N4 northwest of Cortober, County Roscommon, and is shown in Figure 3.9. A portion of this road has been realigned to the south in recent years and the original alignment reclassified as local road L5131(Clooneigh label in Figure 3.9).

Figure 3.9: Section B Collisions (1996-2016)

Only four collisions were recorded on this section of the N4 in the period between 1996 and 2016. Table 3.6 shows that one serious injury was sustained as a result of these collisions, and four further minor injuries.

Table 3.6: Section B Collision Casualties (1996 - 2016)

Year	Fatalities	Seriously Injured	Minor Injury	Injury (Unknown Severity)
1996	0	0	0	0
1997	0	0	0	0
1998	0	0	0	0
1999	0	0	0	0
2000	0	0	0	0
2001	0	0	0	0
2002	0	0	0	0
2003	0	0	0	0
2004	0	0	0	0
2005	0	0	0	0
2006	0	0	0	0
2007	0	1	0	0
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	4	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0
2015	0	0	0	0
2016	0	0	0	0
Total	**0**	**1**	**4**	**0**

Table 3.7: Section B Collision Statistics (1996 - 2016)

Total No. Collisions	**4**		
Time of Day			Study Area Averages
AM Peak (07:00 - 10:00)	1	25.00%	8.56%
PM Peak (16:00 - 19:00)	1	25.00%	22.99%
Outside Peaks	2	50.00%	68.45%
Collision Type			
Pedestrian Involvement	0	0.00%	20.86%
Single Vehicle Collision	3	75.00%	21.39%
Rear-End Collision	1	25.00%	19.79%
Head-On Collision	0	0.00%	14.44%
Other	0	0.00%	23.53%
Road Characteristics			
Straight	3	75.00%	61.50%
Bend	0	0.00%	18.18%
Hill / Crest	0	0.00%	1.07%
Gradient	0	0.00%	3.21%
Other	1	25.00%	16.04%
Vehicle Type			
Private Car	3	N/A	N/A
Goods Vehicle	0	N/A	N/A
Other	2	N/A	N/A
Weather			
Dry	0	0.00%	70.05%
Other	4	100.00%	29.95%

The statistics of the collisions recorded on the existing N4, northwest of Carrick-on-Shannon, are presented in Table 3.7 above. Three of four collisions were single vehicle collisions on a straight stretch of road, which can often be attributed to driver error, a pre-existing deficiency in the road infrastructure or weather conditions. Here, it is possible weather and road conditions were a contributing factor in these collisions, as conditions for each were recorded as '*other'* than dry.

The final collision was a rear-end type collision at the western junction of the N4 and the reclassified L5131. This particular collision occurred on a November

evening, where weather conditions for this collision were recorded as wet which could have contributed to poor visibility at the junction.

3.2.7 Section C

Section C encompasses the extents of the R280, Carrick-on-Shannon to Leitrim Village road, within the study area and is outlined in Figure 3.10. The locations of collisions along this route recorded from 1996 to 2016 are also illustrated in Figure 3.10.

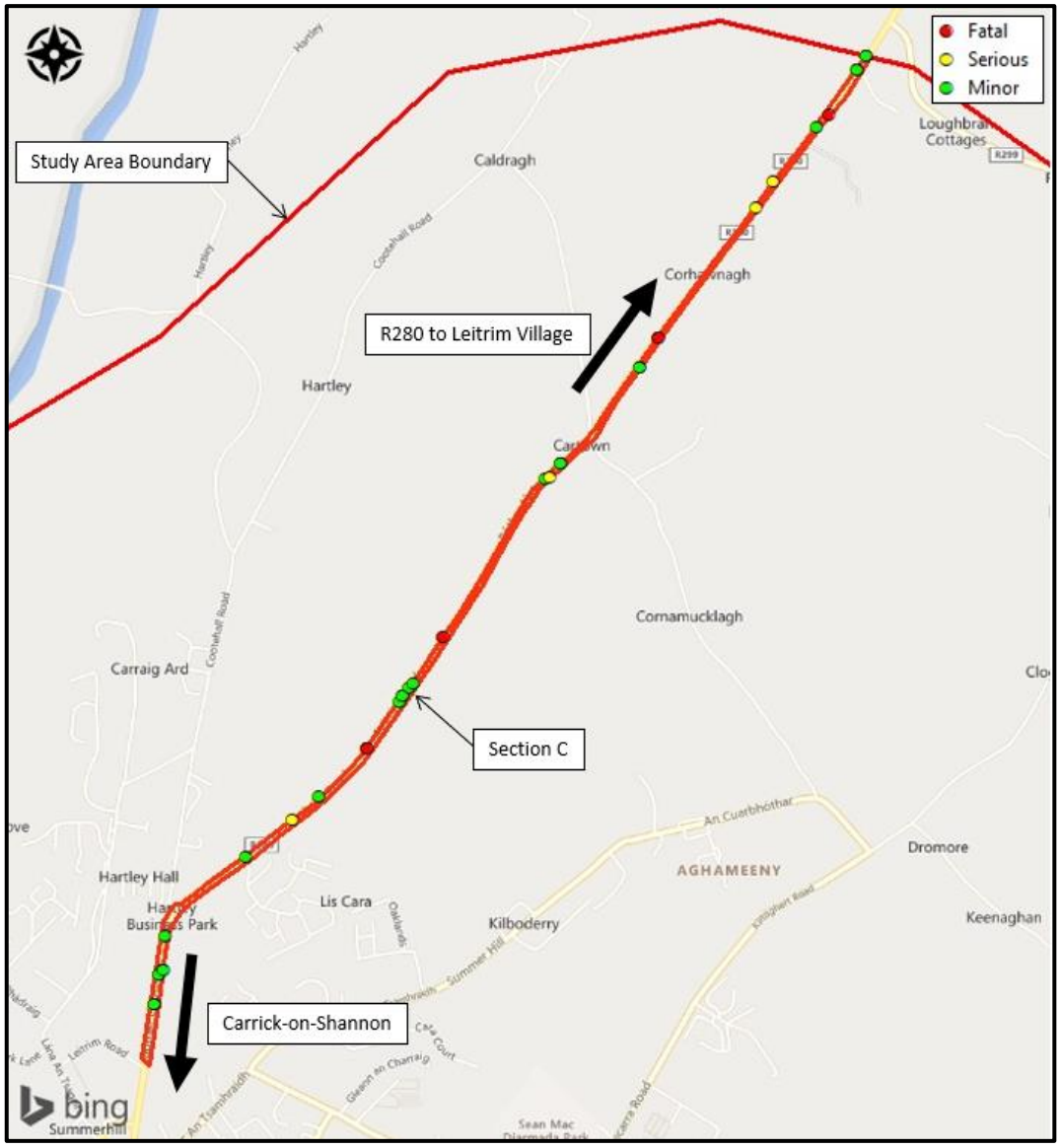


Figure 3.10: Section C Collisions (1996 - 2016)

Note in Figure 3.10 above the cluster of collisions at Ballymony (adjacent to Section C label). This is the location of speed limit signs for 80km/h travelling north, and 60km/h travelling south. Most of these collisions were single vehicle collisions recorded just within the 60km/h zone, which suggests drivers losing control either braking or accelerating suddenly to drive within or match the appropriate speed limit.

A similar pattern is seen where the R280 traffic enters/exits the Carrick-on-Shannon urban area. Although 50km/h signage is provided, the road is straight, of good surface quality and in an open setting which may encourage drivers to exceed or even ignore the specified speed limit.

The recorded injuries and casualties resulting from collisions which occurred from 1996 to 2016 are shown in Table 3.8 below. Table 3.9 presents the collisions statistics for the same collisions.

Dry weather was recorded for over 83% of these collisions (see Table 3.9). This statistic may also support the possibility of drivers' tendency not to adhere to the speed limits; but rather to drive at a speed they assume appropriate based on conditions, experience or otherwise.

Table 3.8: Section C Collision Casualties (1996 - 2016)

Year	Fatalities	Seriously Injured	Minor Injury	Injury (Unknown Severity)
1996	0	0	1	0
1997	0	1	3	0
1998	1	0	1	0
1999	0	1	0	0
2000	0	0	0	0
2001	0	0	0	0
2002	0	0	5	0
2003	1	1	0	0
2004	0	0	3	0
2005	1	0	0	1
2006	0	0	0	0
2007	1	0	2	0
2008	0	0	0	0
2009	0	0	3	0
2010	0	0	1	0
2011	0	0	0	0
2012	0	0	2	0
2013	0	0	0	0
2014	0	1	4	0
2015	0	0	0	0
2016	0	0	0	0
Total	**4**	**4**	**25**	**1**

Table 3.9: Section C Collision Statistics (1996 - 2016)

Total No. Collisions	**24**		
Time of Day			Study Area Averages
AM Peak (07:00 - 10:00)	4	16.67%	8.56%
PM Peak (16:00 - 19:00)	4	16.67%	22.99%
Outside Peaks	16	66.67%	68.45%
Collision Type			
Pedestrian Involvement	7	29.17%	20.86%
Single Vehicle Collision	5	20.83%	21.39%
Rear-End Collision	4	16.67%	19.79%
Head-On Collision	1	4.17%	14.44%
Other	7	29.17%	23.53%
Road Characteristics			
Straight	16	66.67%	61.50%
Bend	1	4.17%	18.18%
Hill / Crest	1	4.17%	1.07%
Gradient	0	0.00%	3.21%
Other	6	25.00%	16.04%
Vehicle Type			
Private Car	28	N/A	N/A
Goods Vehicle	0	N/A	N/A
Other	9	N/A	N/A
Weather			
Dry	20	83.33%	70.05%
Other	4	16.67%	29.95%

Pedestrian involvement was recorded in 29% of collisions on this portion of the R280 regional road, which is particularly high in comparison to the study area average of 20.86%. Of a total of four fatalities recorded on this road from 1996 to 2016, two were pedestrians. Both of the fatalities involving pedestrians were single vehicle collisions and occurred in the early hours of the morning. Five of the collisions in which pedestrians were involved occurred in 80km/h zones where there is no available footpath.

3.2.8 Section D

Section D encompasses approximately 5.3km of the existing N4 between Carrick-on-Shannon and Drumsna and is shown in Figure 3.11, Table 3.10, and Table 3.11 present the casualties and statistics regarding collisions on this route from 1996 to 2016 respectively.

Figure 3.11: Section D Collisions (1996 - 2016)

Table 3.10: Section D Collision Casualties (1996 - 2016)

Year	Fatalities	Seriously Injured	Minor Injury	Injury (Unknown Severity)
1996	0	0	0	0
1997	0	0	0	0
1998	0	0	1	0
1999	0	0	2	0
2000	0	0	0	0
2001	0	0	2	0
2002	0	0	0	0
2003	0	0	2	0
2004	0	0	0	0
2005	1	0	1	0
2006	0	0	0	0
2007	2	0	1	2
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	1	0
2012	0	0	5	0
2013	0	0	1	0
2014	0	0	0	0
2015	0	0	0	0
2016	0	0	0	0
Total	**3**	**0**	**16**	**2**

Table 3.11: Section D Collision Statistics (1996 - 2016)

Total No. Collisions	**13**		
Time of Day			**Study Area Averages**
AM Peak (07:00 - 10:00)	1	7.69%	8.56%
PM Peak (16:00 - 19:00)	3	23.08%	22.99%
Outside Peaks	9	69.23%	68.45%
Collision Type			
Pedestrian Involvement	0	0.00%	20.86%
Single Vehicle Collision	3	23.08%	21.39%
Rear-End Collision	1	7.69%	19.79%
Head-On Collision	7	53.85%	14.44%
Other	2	15.38%	23.53%
Road Characteristics			
Straight	7	53.85%	61.50%
Bend	2	15.38%	18.18%
Hill / Crest	0	0.00%	1.07%
Gradient	1	7.69%	3.21%
Other	3	23.08%	16.04%
Vehicle Type			
Private Car	19	N/A	N/A
Goods Vehicle	1	N/A	N/A
Other	3	N/A	N/A
Weather			
Dry	11	84.62%	70.05%
Other	2	15.38%	29.95%

Arising from a total of 13 collisions, three individuals were fatally injured and 16 sustained minor injuries in this section of the existing N4. Although no serious injuries were confirmed, the severities of two other recorded injuries are unknown.

The three fatalities were a result of two separate head-on collisions in the townland of Mountcampbell, northwest of Drumsna, approximately only 300m apart. This section of the N4 is on a Band C curve and has a speed limit of 100km/h. This section is also of a wide single carriageway cross-section, which is no longer available within the standards. Each of these elements of the existing design contribute to dubious overtaking which was likely the cause of these collisions.

Five other collisions were recorded at junctions during this timeframe: one at the R299 westbound slip road joining the N4, one at the junction between the N4 and local road L7426, and three at the N4/L3656 T-junction. One of the three N4/L3656 junction incidents involved a head-on right turn type collision as the vehicle approached the junction in the turning lane on the N4.

3.2.9 Section E

Section E comprises the section of the existing N4 between Drumsna and Dromod and is outlined in Figure 3.12. The locations of collisions recorded from 1996 to 2016 on this section are also illustrated in Figure 3.12.

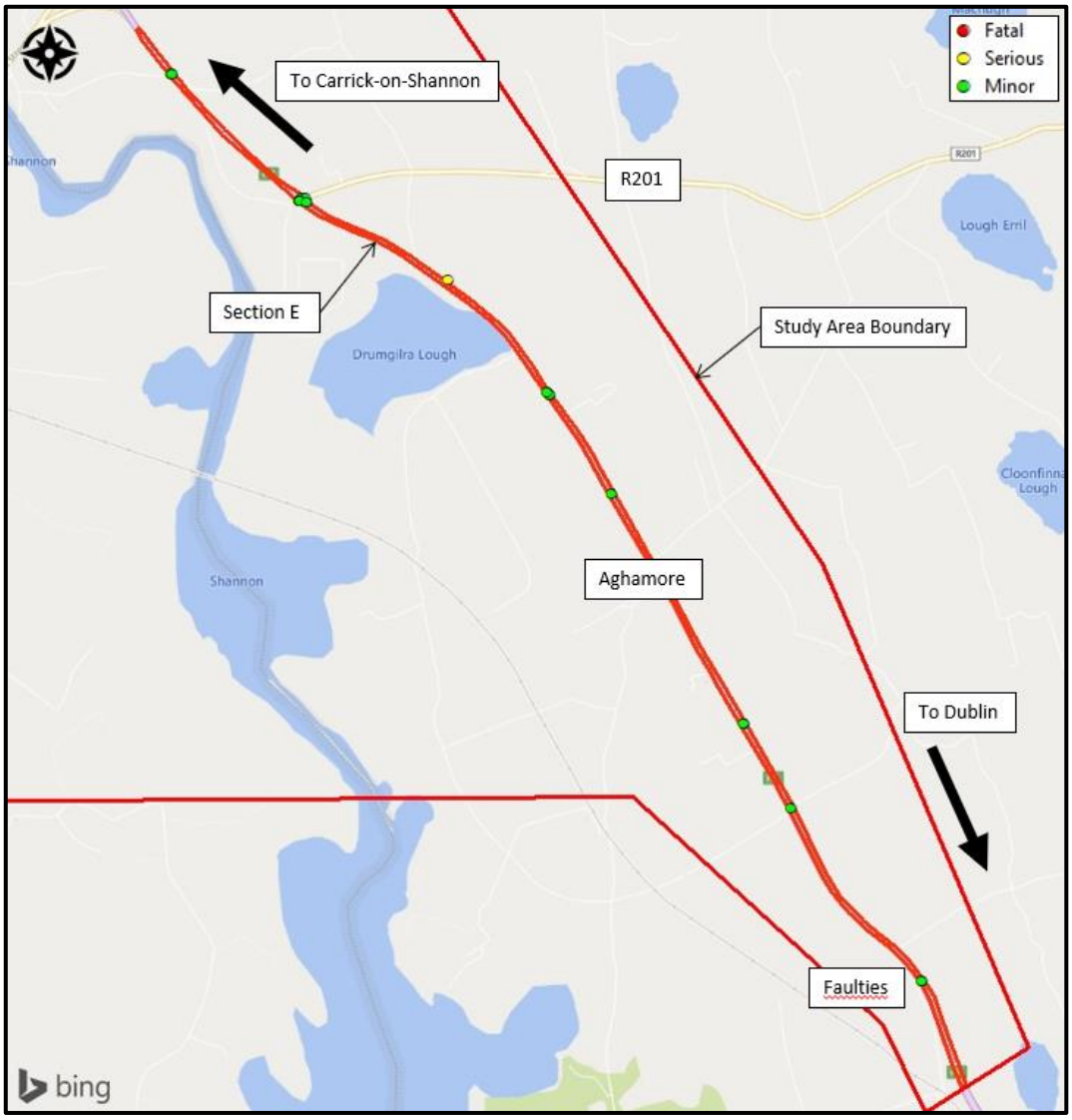


Figure 3.12: Section E Collisions (1996 - 2016)

In Section E 16 collisions and 27 injuries, one serious, were recorded between 1996 and 2016. The sole serious injury was sustained in a collision at a domestic access directly onto the N4. Table 3.12 shows the number of casualties and injuries

sustained from 1996 to 2016 due to road collisions. Table 3.13 shows the collision statistics for those incidents.

Table 3.12: Section E Collision Casualties (1996 - 2016)

Year	Fatalities	Seriously Injured	Minor Injury	Injury (Unknown Severity)
1996	0	0	0	0
1997	0	0	0	0
1998	0	0	0	0
1999	0	0	0	0
2000	0	0	0	0
2001	0	1	0	0
2002	0	0	0	0
2003	0	0	2	0
2004	0	0	0	0
2005	0	0	0	0
2006	0	0	0	0
2007	0	0	0	0
2008	0	0	0	0
2009	0	0	3	0
2010	0	0	5	0
2011	0	0	3	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0
2015	0	0	10	0
2016	0	0	3	0
Total	0	1	26	0

Table 3.13: Section E Collision Statistics (1996 - 2016)

Total No. Collisions	16		
Time of Day			Study Area Averages
AM Peak (07:00 - 10:00)	2	12.50%	8.56%
PM Peak (16:00 - 19:00)	7	43.75%	22.99%
Outside Peaks	7	43.75%	68.45%
Collision Type			
Pedestrian Involvement	0	0.00%	20.86%
Single Vehicle Collision	5	31.25%	21.39%
Rear-End Collision	2	12.50%	19.79%
Head-On Collision	0	0.00%	14.44%
Other	9	56.25%	23.53%
Road Characteristics			
Straight	16	100.00%	61.50%
Bend	0	0.00%	18.18%
Hill / Crest	0	0.00%	1.07%
Gradient	0	0.00%	3.21%
Other	0	0.00%	16.04%
Vehicle Type			
Private Car	21	N/A	N/A
Goods Vehicle	0	N/A	N/A
Other	5	N/A	N/A
Weather			
Dry	9	56.25%	70.05%
Other	7	43.75%	29.95%

Many of the collisions recorded in Section E occurred at junctions. Seven of the total 16 collisions occurred at the staggered crossroads between the N4, R201 and L3630 in the Annaduff townland. This junction includes raised islands, is within a *Do Not Pass* section and has a mainline speed limit of 100km/h. Other incidents at junctions were recorded at the junctions between the N4 and L7661, L7472, and L1601, in the townlands of Annaduff, Fearnaght and Faulties respectively.

Although no collisions were recorded within the village of Aghamore between 1996 and 2016, it is noted that the speed limits vary significantly over a short distance. The initial N4 speed limit is 100km/h, which is reduced to 60km/h for 180m

approaching the village, and further reduced to 50km/h for 250m within the village. Exiting Aghamore, the speed limit is increased to 60km/h for 180m once again before returning to 100km/h. Rear-end shunt type collisions are symptomatic of incidences where vehicles are travelling too closely for adequate stopping distance. Sudden and significant reductions in speed, 40km/h in this instance, may result in this collisions type.

3.2.10 Section F

This section comprises the remaining areas of the study area outside of the sections already discussed from 3.2.5 to 3.2.9. The area is outlined along with the collisions recorded from 1996 to 2016 in Figure 3.13. It is examined to assess the collision data of the regional and local road network of the study area.

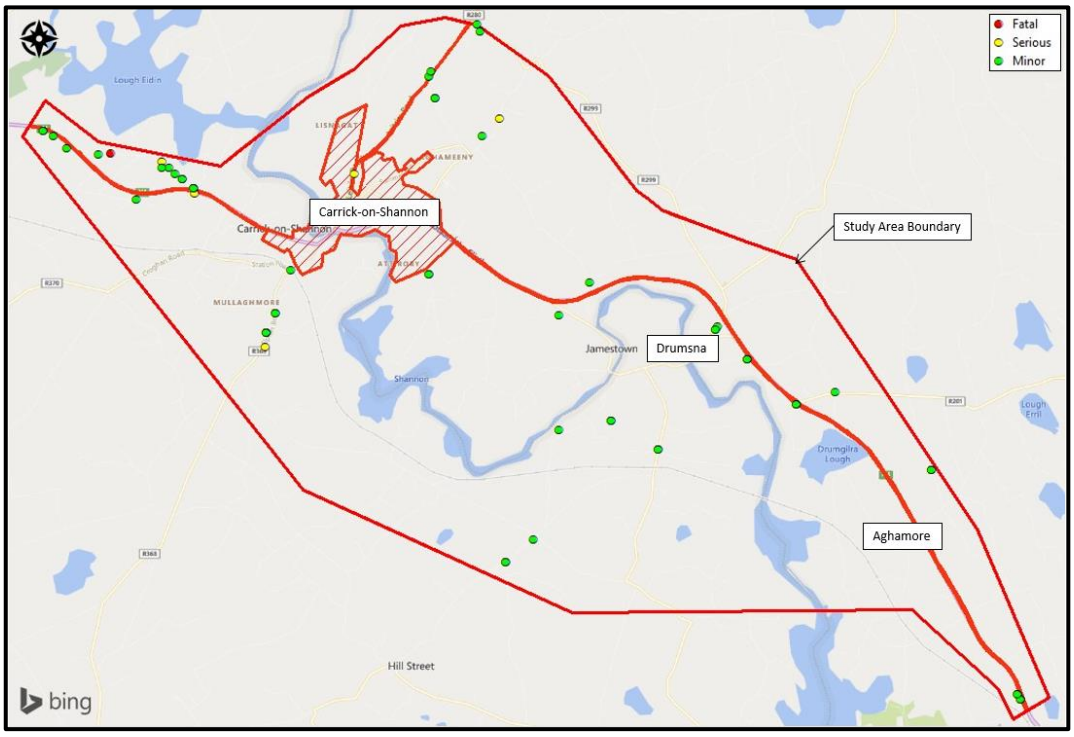


Figure 3.13: Section F Collisions (1996 - 2016)

Table 3.14: Section F Collision Casualties (1996 - 2016)

Year	Fatalities	Seriously Injured	Minor Injury	Injury (Unknown Severity)
1996	0	0	1	0
1997	0	0	0	0
1998	1	0	2	0
1999	1	1	7	1
2000	0	2	7	0
2001	0	3	6	1
2002	0	1	14	0
2003	0	0	3	0
2004	0	0	3	0
2005	0	0	11	0
2006	0	0	0	0
2007	0	0	3	0
2008	0	0	0	0
2009	0	0	3	0
2010	0	0	0	0
2011	0	0	2	0
2012	0	0	0	0
2013	0	0	2	0
2014	0	1	1	0
2015	0	0	2	0
2016	0	0	3	0
Total	2	8	70	2

Table 3.15: Section F Collision Statistics (1996 - 2016)

Total No. Collisions	**48**		
Time of Day			Study Area Averages
AM Peak (07:00 - 10:00)	4	8.33%	8.56%
PM Peak (16:00 - 19:00)	11	22.92%	22.99%
Outside Peaks	33	68.75%	68.45%
Collision Type			
Pedestrian Involvement	4	8.33%	20.86%
Single Vehicle Collision	14	29.17%	21.39%
Rear-End Collision	9	18.75%	19.79%
Head-On Collision	10	20.83%	14.44%
Other	11	22.92%	23.53%
Road Characteristics			
Straight	20	41.67%	61.50%
Bend	17	35.42%	18.18%
Hill / Crest	1	2.08%	1.07%
Gradient	2	4.17%	3.21%
Other	8	16.67%	16.04%
Vehicle Type			
Private Car	58	N/A	N/A
Goods Vehicle	5	N/A	N/A
Other	13	N/A	N/A
Weather			
Dry	31	64.58%	70.05%
Other	17	35.42%	29.95%

48 collisions out of the overall study area total of 187 collisions fall into Section F. Figure 3.13 shows the geographical distribution of these collisions to be quite well dispersed and spread out over the entire area. One more densely populated cluster is identified north of the existing N4, northwest of Carrick-on-Shannon. This is the original alignment of the N4, which has been reclassified as L5131 prior to 2005 (see 3.2.6). The most recent of these collisions was recorded in 2005, meaning they would have occurred on the N4 at the time. It is evident that the reasoning for the realignment was that eight collisions, one of which fatal and another serious, occurred on such as short section of the mainline, and the issue had to be addressed.

As the portion of the old N4 has been realigned, the cause of the collision cluster identified in Section F has been resolved and is no longer an issue.

3.2.11 Additional Collision Data 2017-2019

The most recent verified collision data available from the RSA covers up to 2016. Figure 3.14, Figure 3.15 and Figure 3.16 below show the collisions which have occurred on the national primary road, within the study area for the period from 2017 to 2019; received from TII, however, yet to be verified by the RSA. The geographical distribution and severity of these collisions is available, however information on the number of casualties involved in each collision is not currently available.

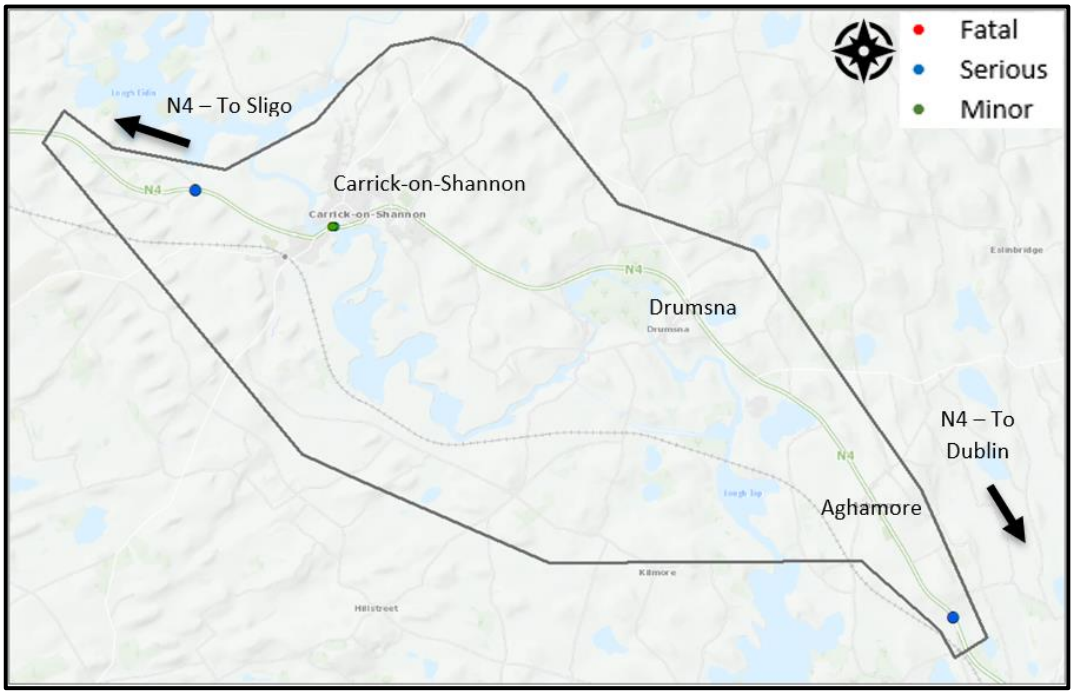


Figure 3.14: Study Area Collisions 2017

Figure 3.14 shows two serious and two minor collisions. One serious collision occurred northwest of Carrick-on-Shannon at the junction with the L5131 road (Section B), a second occurred in Faulties at the junction with L1601 (Section E) while both minor collisions occurred in Carrick-on-Shannon town (Section A).

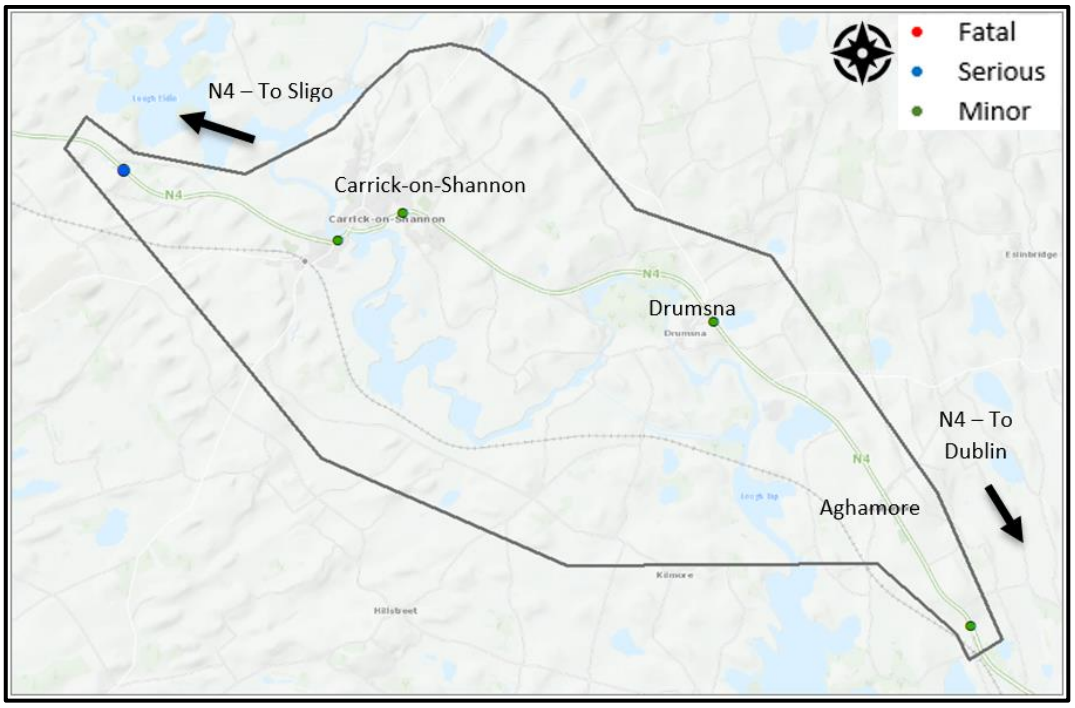


Figure 3.15: Study Area Collisions 2018

In 2018 there were five collisions on the N4 mainline within the study area; a serious collision northwest of Carrick-on-Shannon (Section B), two minor collisions in Carrick-on-Shannon town (Section A), one minor collision in Drumsna (Section D) and another minor collision in the townland of Faulties (Section E).

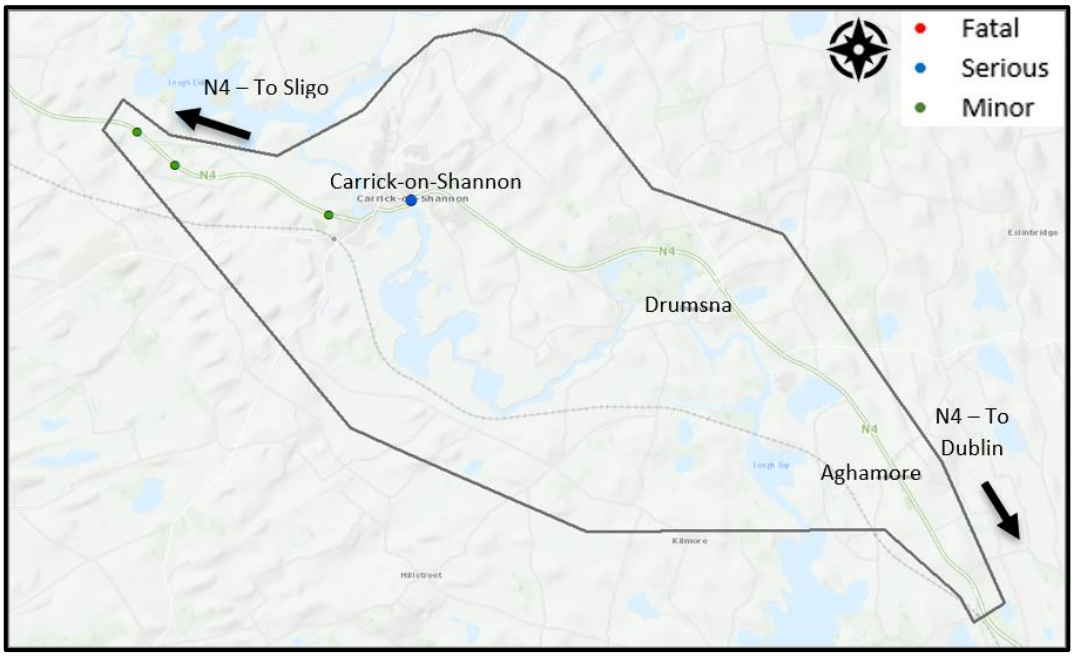


Figure 3.16: Study Area Collisions 2019

Figure 3.16 shows that three minor collisions occurred on the N4 northwest of Carrick-on-Shannon (Section B) and a fourth serious collision occurred in Carrick-on-Shannon town (Section A) in 2019 and involved a pedestrian.

The figures above illustrate that 13 collisions occurred on the N4 mainline from 2017 to 2019, four of which caused serious injuries.

4 Description of Transportation Solutions

4.1 Overview of Potential Transportation Solutions

Numerous alternatives and options, or combinations thereof, can be considered as solutions to the transportation issues along the study area. These combinations may have the potential to relieve the problems outlined above and deliver on the goals, objectives and specific transportation problems identified in Phase 1.

Potential options include both road based options and non-road based options. These are outlined below.

4.2 Do-Nothing Option

One of the first steps in the option selection process was the consideration of the Do-Nothing Option. This option assumes that there will be no other investment in the transport network (other than regular maintenance) during the appraisal period The Do-Nothing Option comprises an examination of the existing transportation network and infrastructure and its ability to meet future transportation demands, in the absence of any upgrade works other than routine maintenance. This option does not provide for any investment in the transportation network and infrastructure along this section of the N4. However, as there are planned and committed schemes along this corridor, the **Do-Nothing Option** is not considered further. The **Do-Minimum Option** provides the baseline against which all other options are tested (see Section 4.3).

4.3 Do-Minimum Option

The Do-Minimum scenario follows on from the Do-Nothing Option and comprises maintenance of the existing N4 as well as constructing planned and committed projects along this corridor. This option provides the baseline against which all other options are tested. All elements of the Do-Minimum will be part of each proposed Do-Something Option.

4.4 Do-Something – Options[1]: Range of road based elements

A number of Option Corridors with the potential for road based solutions have been taken forward to the Stage 1 Preliminary Options. Of these, six Option Corridors are to the west of Node J at Drumsna Junction (Blue, Black, Dark Green, Purple, Cyan and Orange) and four Option Corridors are to the east of Node J (Purple, Green, Yellow and Blue).

A description of the option corridors west of Drumsna follows below.

[1] Option, as defined by PE-PAG-02013-01.

- **Blue Option Corridor:** The Blue Option, or Management Option, considers interventions on the existing infrastructure to address identified transport problems. Interventions may include rationalising access points and restructuring junctions among other measures. It commences at Node O in Usna and follows the existing N4 to Drumsna.
- **Black Option Corridor:** The Black Route Option has been identified as a missing link in Carrick-on-Shannon and provides connectivity by interconnecting connect the R280 to the Summerhill Road and on to the Castlecara Road.
- **Dark Green Option Corridor:** The Dark Green Corridor Option deviates from the existing N4 at Tumna. It continues north-eastwards, crossing the River Shannon at Corryolus, and meets the R280 at Cartown. It continues south-eastwards through Lisdauky, rejoins the existing N4 at Mountcampbell and follows the existing N4 to Drumsna.
- **Purple Option Corridor:** The Purple Option Corridor aligns closely to the previous emerging preferred route that was identified in 2011. The option deviates from the existing N4 at Tumna. It continues north-eastwards, crossing the River Shannon at Corryolus, and meets the R280 at Cartown. It continues south-eastwards, rejoining the existing N4 at Tully and closely follows the existing N4 to Drumsna.
- **Cyan Option Corridor:** The Cyan Option Corridor deviates from the existing N4 at Cloongownagh. It continues eastwards hugging the railway line, crossing the R368 to the east of the railway station. It crosses the River Shannon at Cordrehid and rejoins back to the existing N4 at Lisseeghan before following the existing N4 to Drumsna.
- **Orange Option Corridor:** The Orange Option Corridor deviates from the existing N4 at Meera. It continues to the rear of the West Gate Business Park, crossing the R368 to the east of the railway station. It crosses the River Shannon at Cordrehid and rejoins the existing N4 at Lisseeghan before following the existing N4 to Drumsna.

Below is a description of the option corridors east of Drumsna.

- **Blue Option Corridor:** The Blue Option, or Management Option, considers interventions on the existing infrastructure to address identified transport problems. Interventions may include rationalising access points and restructuring junctions among other measures. It commences at Node J in Drumsna and follows the existing N4 to Faulties.
- **Purple Option Corridor:** From Node J, at Drumsna, the Purple Option Corridor follows the existing N4 to Drumgildra, where a short off-line deviation to the east of Aghamore is proposed. The option corridor then follows the existing N4 to Faulties.
- **Green Option Corridor:** From Node J, at Drumsna, the Green Option Corridor follows the existing N4 through Aghamore and on to Faulties.
- **Yellow Option Corridor:** From Node J, at Drumsna, the Yellow Option Corridor follows the existing N4 through Aghamore and a short off-line

deviation to the west of the existing N4 is proposed in the townland of Fearnaught.

Proposed designs within any of the above Option Corridors shall comply with current standards. This includes cross-section details, components of horizontal and vertical alignment, and junction layouts. Each design will also aim to reduce the number of junctions and direct accesses onto the N4 to further enhance safety on the national primary route.

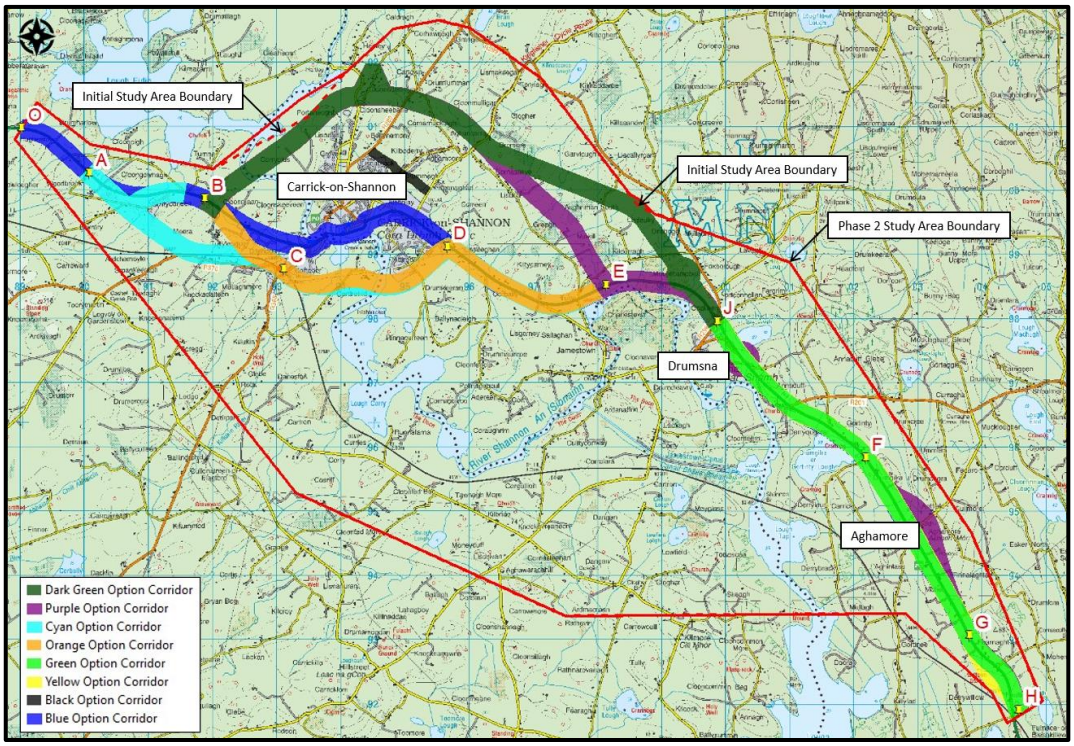


Figure 4.1: Do-Something – Road based options

4.5 Do-Something – Alternatives [2]: Range of non-road based measures

These non-road based alternatives can be stand alone or complimentary to, for example, road based options:

- **Cycling & Walking Proposals:** This alternative would see improvements to the cycling and walking facilities in Carrick-on-Shannon. Possible interventions could see the provisions of a comprehensive cycle network, including a new pedestrian and cycle bridge over the River Shannon, along with adequate cycle parking, changing areas and/or e-bike charging points. Other pedestrian facilities including crossings and footpaths could be improved. It may also be possible to improve permeability within the town which could be enhanced by pedestrianising key streets. Refer to Figure 4.2 and Figure 4.3 for details

[2] Alternatives, as defined by PE-PAG-02013-01.

- **Public Transport Proposals:** Such proposals would seek to enhance the public transport by linking Carrick-on-Shannon with nearby urban settlements. This could be achieved by increasing bus and rail service frequency, introducing a demand responsive mini-bus service and/or creating a mobility hub in the town centre to facilitate interchange with other modes of transport. Refer to Figure 4.4 for details.
- **Demand Reduction Proposals:** Demand reduction would see the rationalisation of parking along the existing N4, particularly the inner relief road. The provision of Park & Stride (P&S) sites, remote working hubs and centrally located mixed use developments could work together towards a car free town centre. Refer to Figure 4.5 for details.

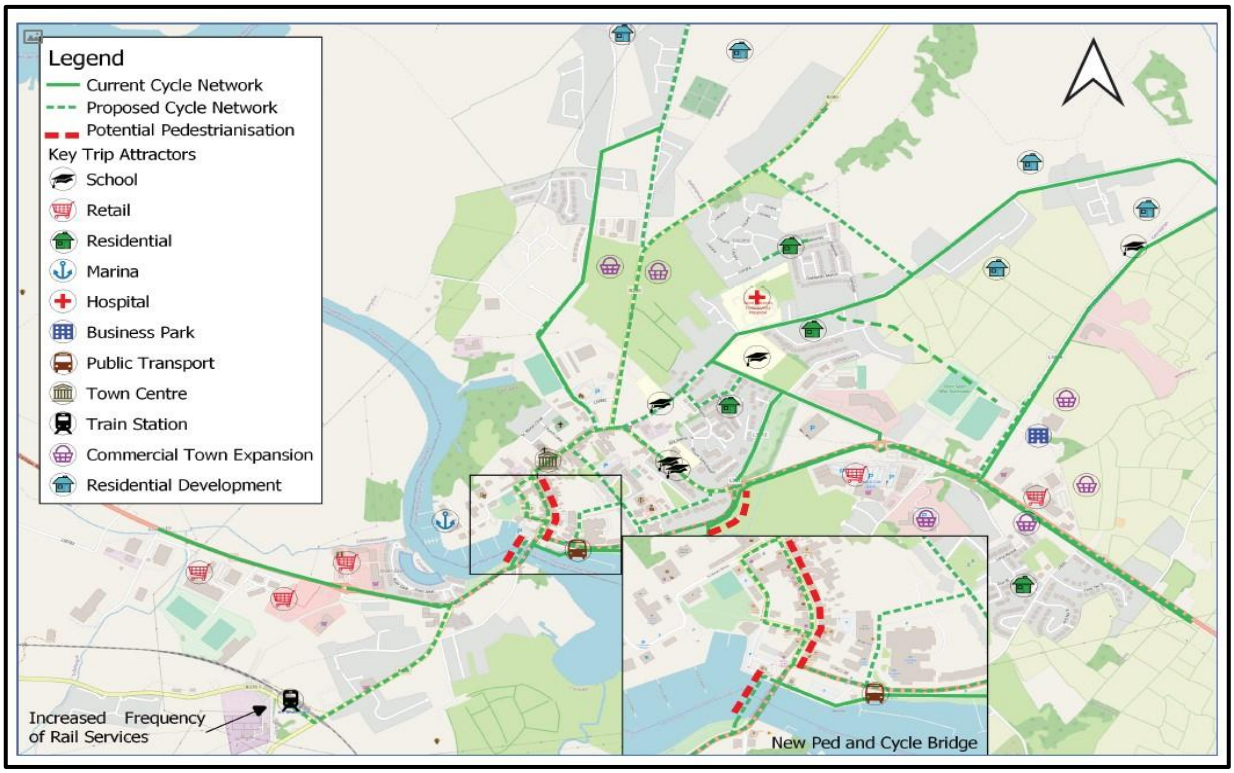


Figure 4.2: Potential Active Travel Measures within Carrick-on-Shannon and Cortober

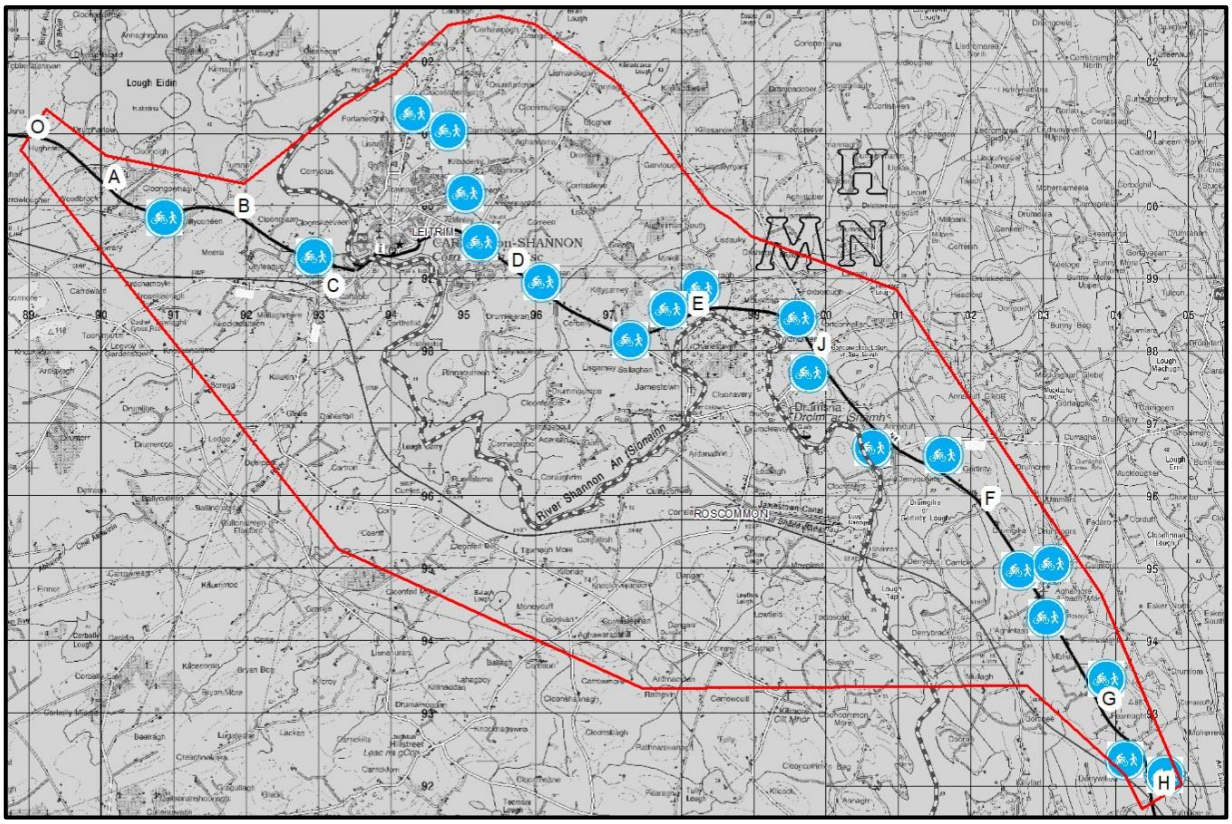


Figure 4.3: Locations of potential Active Travel Measures (i.e. Walking and/or Cycling Facilities) outside the Urban Areas of Carrick-on-Shannon and Cortober

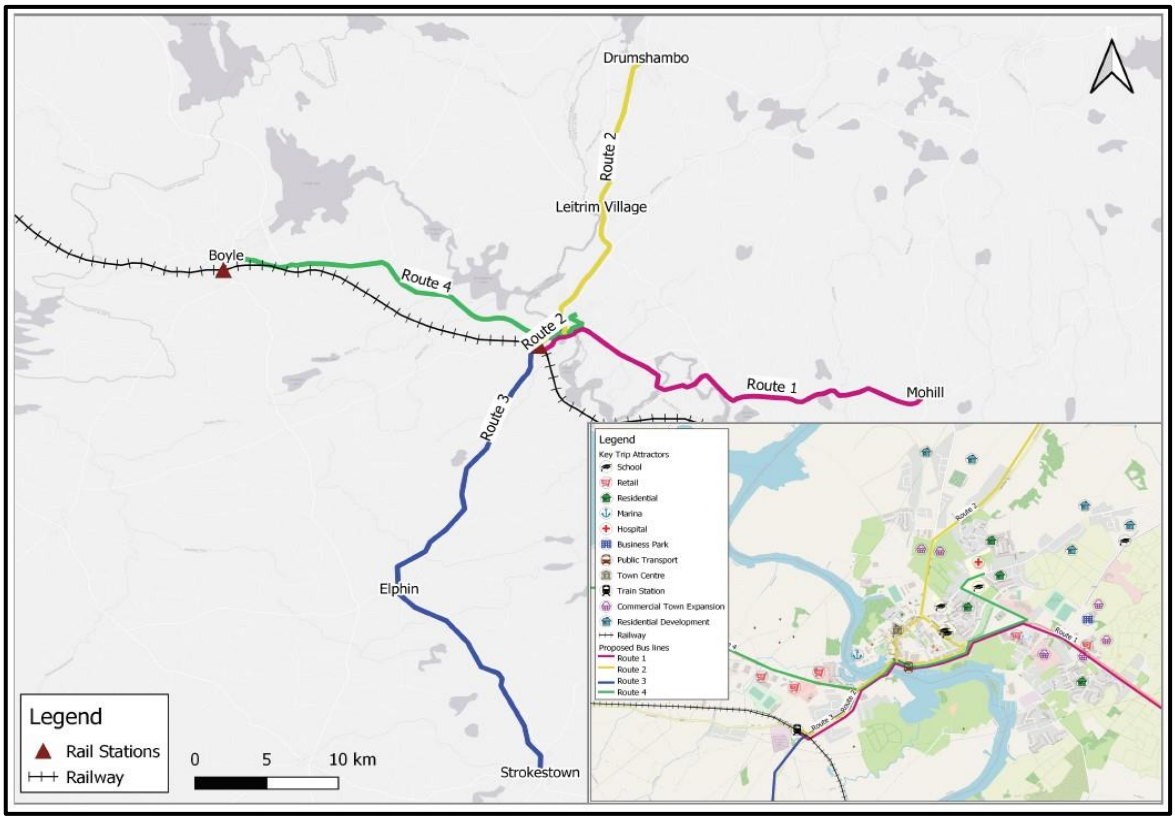


Figure 4.4: Public Transport Network Improvements

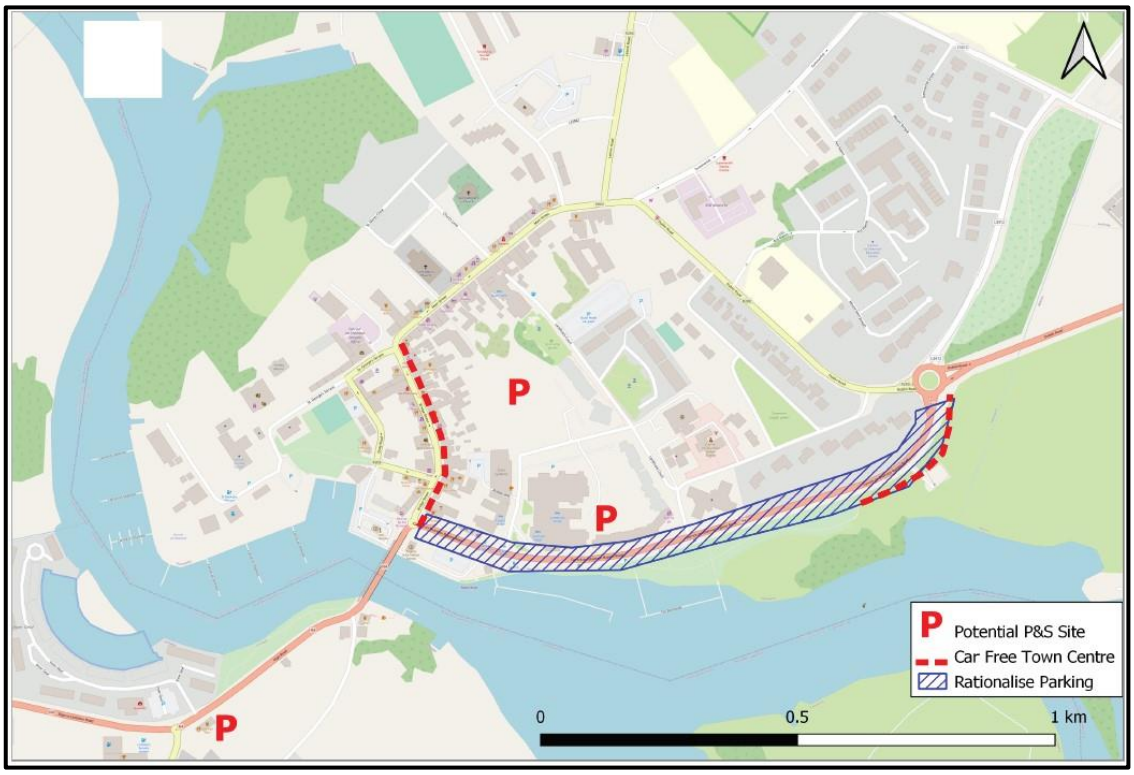


Figure 4.5: Demand Reduction Measures

5 Safety Consequences of Minimal Intervention

5.1 Road Safety Consequences of 'Do-Nothing' and 'Do-Minimum' Scenarios

In the 'Do-Nothing' and 'Do-Minimum' scenarios, the existing infrastructure will essentially be maintained in its current state without further investment or improvement. Any committed projects within the study area would be included within the 'Do-Minimum' scenario, however an examination of these committed projects shows that they are typically minor in nature when considered in the context of the overall study area and anticipated impact on the N4 corridor. As such, these options would, at best result in a continuance of the current transportation and safety issues experienced on the N4 corridor and wider study area over time.

Current trends and growth projections point to increasing traffic volumes and heightened congestion continuing. Existing issues with heavy traffic volumes and congestion are amplified during AM and PM peak traffic periods and also during busy holiday periods with increased visitors and tourism in Carrick-on-Shannon, resulting in raised occurrences of collisions during these periods. Within the 'Do-Nothing' and 'Do-Minimum' scenarios there is little to no scope for these issues to be alleviated and the potential for them to worsen is likely.

The 'Do-Nothing' and 'Do-Minimum' scenarios would not address existing junction issues on the N4 and consequently these types of collisions are expected to continue.

Pedestrians and other vulnerable road users within the study area require further consideration. Collision statistics indicate pedestrian involvement in 21% of all collisions within the study area. In the 'Do-Nothing' and 'Do-Minimum' scenarios, these vulnerable road users will at best remain at high risk.

6 Consequences of 'Do-Something' Transportation Solutions (Options and Alternatives)

6.1 Road Safety Objectives

The Project Objectives are outlined in Section 2 of this report. The objectives specifically relating to 'Road Safety' are further expanded below:

- To provide a transportation solution that is designed in accordance with national and international best practice
- To provide a consistent and intuitive layout for drivers and to minimise and avoid unexpected and confusing layouts
- To reduce road traffic collisions
- To relieve areas of congestion and improve safety levels on all public roads
- Providing a safer environment for vulnerable road users

The potential 'Do-Something' road based options align with the safety objectives of the project to varying degrees for the following reasons:

- **Blue West, Blue East and Black Option Corridors** – The development of the urban street network and management of existing travel demand by small scale interventions would reduce the level of through traffic in Carrick-on-Shannon town centre, increase junction capacity, reduce congestion, improve journey time and improve safety for vulnerable road users; thus, resulting in safety benefits.
- **Cyan and Orange Option Corridors**– An off-line option south of Carrick-on-Shannon would reduce the level of through traffic in the town and therefore increase junction capacity, reduce congestion, improve journey time and improve safety for vulnerable road users; thus, resulting in safety benefits.
- **Dark Green and Purple West Option Corridors** – An off-line option north of Carrick-on-Shannon would also reduce the level of through traffic in the town and therefore increase junction capacity, reduce congestion, improve journey time and improve safety for vulnerable road users; thus, resulting in safety benefits.
- **Purple East, Green and Yellow Option Corridors** – An on-line upgrade of the existing N4 south of Carrick-on-Shannon would result in safety benefits. Such benefits could be achieved by reducing the number of direct accesses and junctions onto the N4, and by providing safe overtaking sections through minor realignments. The Purple East Option Corridor also proposes a bypass of Aghamore which would add further benefits in terms of safety.

The potential 'Do-Something' non-road based alternatives align with the safety objectives of the project to varying degrees for the following reasons:

- **Cycling & Walking Proposals:** The introduction of a comprehensive cycle network and proper pedestrian facilities could have major safety benefits, particularly in Carrick-on-Shannon town. Table 3.5 outlines a very high volume of pedestrian involvement in incidents in the town centre, which may be partially attributed to poor pedestrian facilities. As more people opt for walking and cycling for local trips, congestion could also reduce, resulting in further safety benefits.
- **Public Transport Proposals**: This alternative includes various approaches to improve and/or introduce public transport services and public transport infrastructure. These measures would relieve congestion and therefore improve safety for road users and pedestrians.
- **Demand Reduction Proposals**: Demand reduction proposals such as rationalising parking along the N4, the provision of P&S sites and a car free town centre, to name a few, would result in safety benefits as it would reduce conflicts between the motorised road user and the pedestrian in Carrick-on-Shannon town.

6.2 Assessment of Effects on Traffic Flow

Each of the road based options have the potential to reduce congestion and improve traffic flow on the section of N4 under consideration. The **Black Option Corridor** would develop the urban street network in Carrick-on-Shannon and provide better connectivity between the national and regional road network. This would reduce the level of traffic congestion in the town centre, especially that caused by traffic from the R280 Leitrim Road, which was identified by the local population as a priority during the public consultation of the previous 2001 scheme.

The introduction of an N4 off-line route, north (**Dark Green or Purple West Option Corridors**) or south (**Cyan or Orange Option Corridors**) of Carrick-on-Shannon, would lead to significant reductions in the level of traffic congestion in the town centre. Either solution would provide a new bridge crossing of the River Shannon for through traffic, which is currently routed on the N4 inner relief road to the south of the town centre. The reduction in journey times offered by an off-line route would attract through traffic away from the town centre, and would hence reduce the adverse effects associated with traffic congestion in the centre, making it a safer, cleaner and more attractive place in which to live, work and visit for all users.

The improvement of cycling & walking facilities would see an uptake in these modes of transport, especially for local trips, which would reduce congestion in Carrick-on-Shannon. The introduction of a new pedestrian and cycling bridge would primarily provide enhanced safety for vulnerable roads users on the existing River Shannon Bridge but would not result in a reduction in congestion and delays either side of the bridge.

Enhanced public transport services and infrastructure would reduce AADT and in turn improve congestion. Rationalising parking along the N4 and the provision of P&S sites would also reduce congestion by removing a large number of local trips from the town centre and offering road space to the strategic through traffic. Such

local trips could be catered for by the enhanced walking & cycling infrastructure and public transport services.

The proposed 'Do-Something' options would assist in improving journey time reliability, increasing junction capacity and improving the overall operational performance of the N4. Improved traffic flows leading to reduced congestion would result in a reduction in rear-end shunt type collisions and other collisions resulting from erratic driving behaviour during flow breakdown. The benefits of these improvements to traffic flow would be reflected in improved overall road safety.

6.3 Assessment of Effects on Road Users

Any potential transportation solution which would involve the modification of, or addition to road infrastructure, would be designed with the aim of removing the existing safety issues and would seek to avoid the creation of new safety issues. Data relating to collisions is based on 20 years of data from 1996 to 2016. This is the most recent and up to date data available from the Road Safety Authority. This data includes the number of fatal, serious and minor injuries along with a summary of particular collision statistics for each area. It is noted that the total number of collisions is less than the overall number of casualties due to multiple people involved in a single collision.

The current road network, which would be affected by any proposed road based transportation solution, contains a variety of safety issues and these are discussed below in individual sections. An analysis of the recorded collisions in each section is presented earlier in Section 3.2.4 above, and this section presents the assessment of how the proposed road based solution could impact this collision rate.

6.3.1 Section A

Section A comprises the boundary of the Carrick-on-Shannon urban / town area. The Option Corridors and collision locations in the vicinity recorded from 1996 to 2016 and the are shown in Figure 6.1. Section 3.2.5 presents the collision casualties and statistics for the Carrick-on-Shannon Town area during this time.

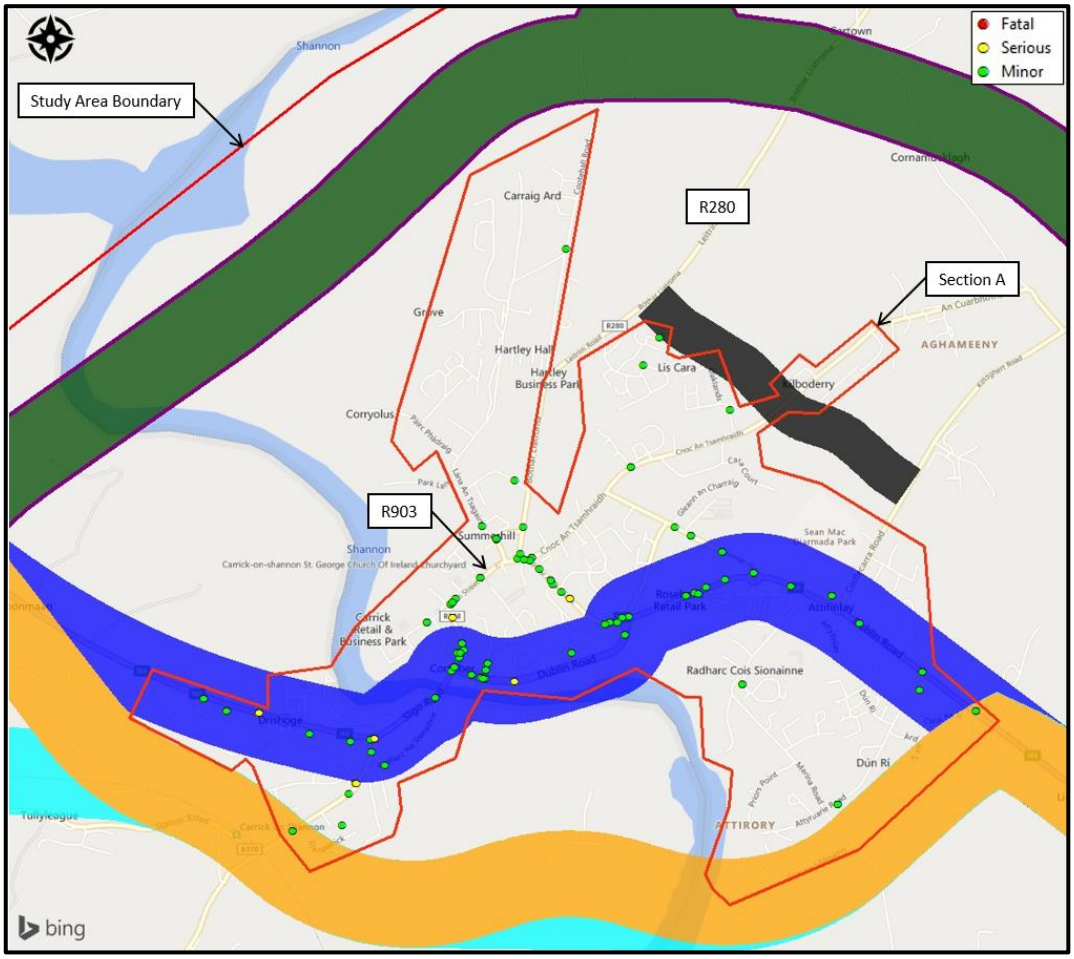


Figure 6.1: Section A Collisions (1996 - 2016) and Option Corridors

Each of the road based options would see a reduction in through traffic in Carrick-on-Shannon. A reduced AADT through the town could result in a reduction in incidents, rear-end shunt type collisions and single vehicle collisions.

The **Blue Option Corridor**, or Management Option, considers interventions on the existing infrastructure to address identified transport problems. Although this option would not reduce through traffic within the town centre it aims to improve safety by rationalising access points and restructuring junctions among other measures. This may improve safety for all roads users and would seek to reduce the high pedestrian involvement in collisions and accidents as outlined in Table 3.5.

The **Black Option Corridor** would reduce the level of traffic congestion in the town centre, especially that caused by traffic from the R280 Leitrim Road. Note the clusters of collisions at the junctions of R280 and R903 (Cnoc an tSamhraidh label in Figure 6.1) and R280 and the existing N4. The Black Option Corridor would take

traffic travelling between the R280 and the N4 away from Carrick-on-Shannon town centre which may reduce the likelihood of these collisions in the future.

A northern bypass, the **Dark Green or Purple West Option Corridor**, would lead to significant reductions in the level of traffic congestion in the town centre as the scheme would provide a new bridge crossing of the River Shannon for through traffic, which is currently routed on the N4 inner relief road to the south of the town centre. A northern bypass would also cater for the traffic from the R280 Leitrim Road.

A southern bypass, the **Cyan or Orange Option Corridor** would also lead to reductions in the level of traffic congestion in the town centre as the scheme would also provide a new bridge crossing of the River Shannon for through traffic. The reduction in journey times offered by any off-line route would attract through traffic on the N4 away from the town centre and hence would reduce the adverse effects associated with traffic congestion in the centre. A southern bypass alone however would not cater for the R280 traffic entering Carrick-on-Shannon town.

All of the Do-Something Alternatives would likely improve safety in this section. Table 3.5 demonstrates a high volume of pedestrian involvement in collisions from 1996 to 2016. As such, improving the safety of vulnerable road users and pedestrians is a priority in Section A. This is also outlined in the Project Objectives (see Section 2.3). It is envisaged that the implementation of enhanced public transport services would reduce the level of private vehicle usage in the town. As a result of reduced congestion, and therefore likely collisions, traffic flows and the safety of vulnerable road users is expected to improve.

Similar results could be achieved by the provision of further cycling and walking facilities. Greater numbers opting for active travel would also reduce the level of private vehicle usage in the town. Addressing the issue of poor segregation between pedestrians and the road network by introducing traffic management measures such as the reallocation of road space and vehicle restrictions in Carrick-on-Shannon would be a positive from a road safety perspective of the vulnerable road users. The introduction of P&S sites on the periphery of the town would also see less congestion in the town, further encouraging active travel.

6.3.2 Section B

Section B encompasses approximately 4.2km of the existing N4 northwest of Cortober, County Roscommon, and is shown in Figure 6.2, along with the Option Corridors in the area. Collision casualties and statistics from 1996 to 2016 are presented in Section 3.2.6.

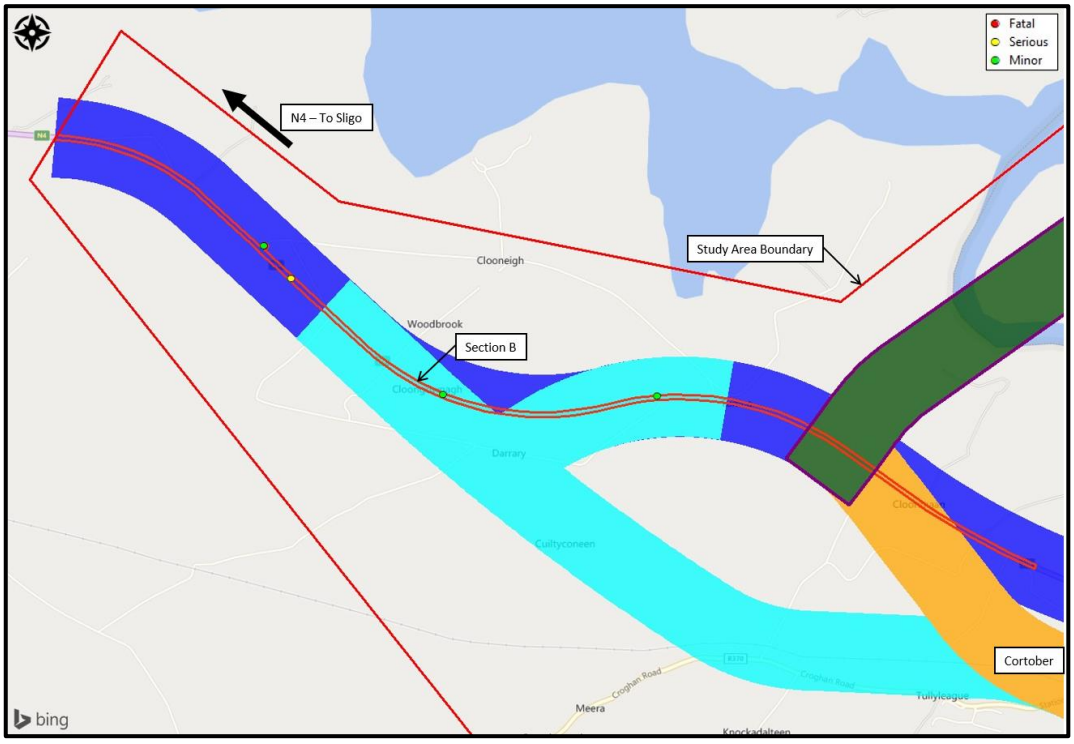


Figure 6.2: Section B Collisions (1996-2016) and Option Corridors

Each of the off-line options would deviate from the existing N4 in Section B, either at Cloongownagh or Tumna. A junction would be necessary to split the traffic into those who wish to enter/exit Cortober and Carrick-on-Shannon, and the through traffic who choose the off-line route itself. This intervention would be beneficial for all road users in Cortober and Carrick-on-Shannon, especially for the safety of vulnerable road users.

The Do Something Alternatives would not have as much impact on safety in Section B as in Section A due to a lack of physical intervention. However, it is envisaged that the implementation of enhanced public transport services and the provision of improved cycling and walking facilities in and around the town would encourage some change towards public transport and active travel; in turn reducing the level of private vehicle usage throughout the study, which would result in safety benefits.

6.3.3 Section C

Section C encompasses the extents of the R280, Carrick-on-Shannon to Leitrim Village road, within the study area and is outlined in Figure 6.3.The relevant Option Corridors are

also shown in Figure 6.3 and Section 3.2.7 details collision casualties and statistics from 1996 to 2016.

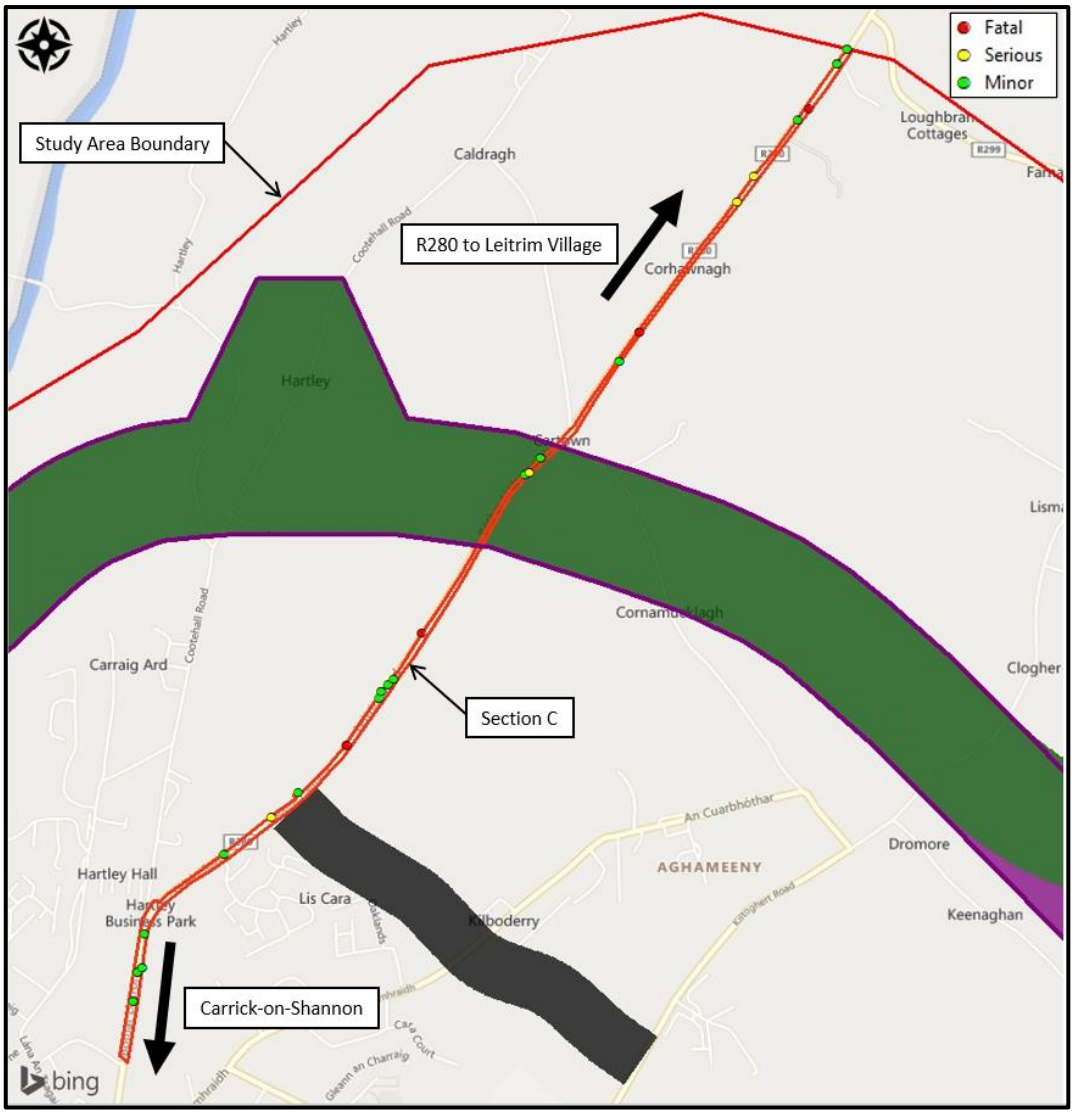


Figure 6.3: Section C Collisions (1996 - 2016) and Option Corridors

To provide a link and better connectivity between the R280 and the N4, as proposed by the **Black Option Corridor**, a new junction would be required along this section of the R280. A junction north of Lis Cara housing estate would provide the shortest link around the northwest of Carrick-on-Shannon. This intervention would be beneficial for all road users in Carrick-on-Shannon, especially for the safety of vulnerable road users.

The implementation of an off-line bypass option to the north of Carrick-on-Shannon, either by the **Dark Green or Purple West Option Corridors,** would see the introduction of a new junction on the R280. This junction would be in the vicinity of the townland of Cartown. This additional junction would be required to cater for the connection between the R280 and the N4 off-line bypass.

The implementation of a northern off-line bypass would see a reduction in through traffic in Carrick-on-Shannon for journeys to the east or west of Carrick-on-

Shannon. A reduced AADT on this regional road and into the town may possibly result in a reduction in incidents, rear-end shunt type collisions and single vehicle collisions. It would also facilitate the provision of improved infrastructure for vulnerable road users and more sustainable transport modes.

The implementation of one of the southern bypass options alone, the **Cyan or Orange Option Corridors,** would not have the potential to improve the road safety on this section of the R280 due to a lack of a physical intervention.

It is envisaged that the implementation of enhanced public transport services and the provision of improved cycling and walking facilities in and around Carrick-on-Shannon would encourage a modal shift towards public transport and active travel. This section of the R280 could see the introduction of new cycling infrastructure to cater for travel between Carrick-on-Shannon and the residential areas along this road. Such infrastructure would provide safe segregation between road users resulting in safety benefits. It may also be possible to provide designated cycle and walking infrastructure between residential areas and radial routes to improve permeability. The R280 would be the primary route for an enhanced public transport service between Carrick-on-Shannon and Leitrim Village / Drumshanbo which could also see a reduction in private car usage in the area.

6.3.4 Section D

Section D encompasses approximately 5.3km of the existing N4 between Carrick-on-Shannon and Drumsna and is shown in Figure 6.4 along with the Option Corridors in the area. Collision casualties and statistics from 1996 to 2016 in the area are presented in Section 3.2.8.

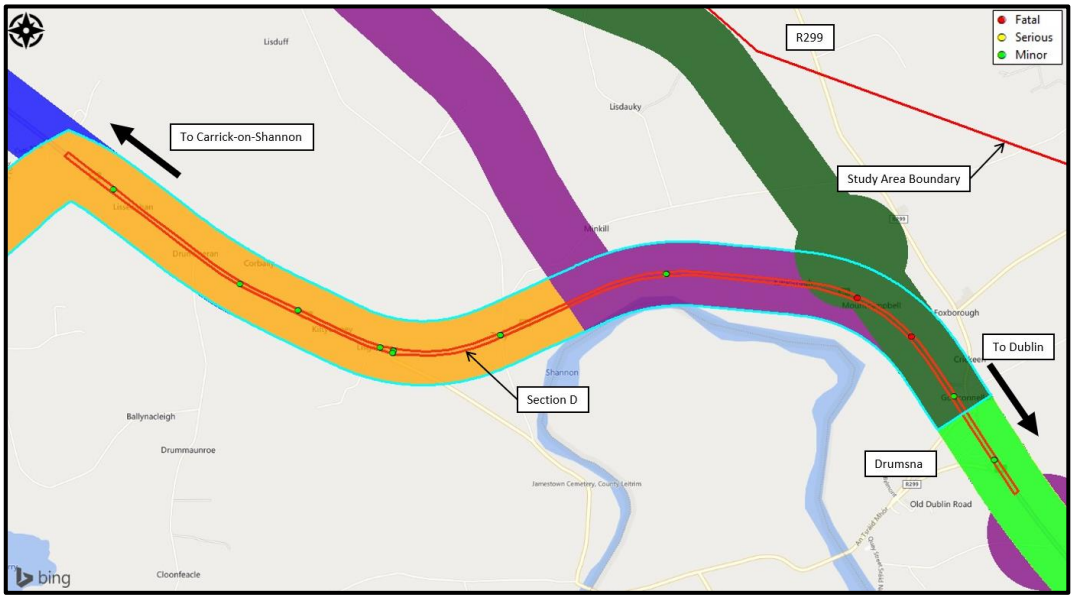


Figure 6.4: Section D Collisions (1996 - 2016) and Option Corridors

The **Black Option Corridor** has been identified as a missing link in Carrick-on-Shannon and would connect the R280 to the Summerhill Road and on to the Castlecara Road. Therefore, this option alone would not have the potential to improve the road safety on this section due to lack of a physical intervention.

In the event of the implementation of an off-line road based option, a new junction would be introduced somewhere along this section to connect to the existing N4. It is proposed that a southern bypass of Carrick-on-Shannon, the **Cyan or Orange Option Corridor**, would reconnect with the existing N4 to the west of this section at Lisseeghan, while a northern bypass by the **Purple West or Dark Green Option Corridor** would reconnect at Tully or Mountcampbell respectively.

Either of the southern option corridors or the **Blue Option Corridor** would entail on-line upgrades and the rationalisation of junctions in this area, which would improve safety. However, the northern option corridors, particularly the **Dark Green Option Corridor**, would remove the national primary traffic from most of this section which may have even greater safety impacts.

Upgrading the existing single carriageway cross-section to a dual carriageway cross-section could solve the safety issues associated with the fatal head-on collisions recorded at Mountcampbell. A contemporary dual carriageway design would also reduce the number of crossing movements arising at junctions and accesses. If single carriageway on-line upgrades were to be proposed, this Band C curve would be tightened to remove the dubious overtaking section.

The alternatives would not have as much impact on safety in Section D as in Section A. Although it is envisaged that the implementation of enhanced public transport services and the provision of improved cycling and walking facilities in and around Carrick-on-Shannon would encourage some change towards public transport and active travel throughout the study area, there would be minimal improvement to road safety on this section due to lack of a physical intervention on geometric parameters or at junctions.

6.3.5 Section E

Section E comprises the section of the existing N4 between Drumsna and Dromod. This section and nearby Option Corridors are outlined in Figure 6.5. Casualties and statistics of collisions from 1996 to 2016 in this section are presented in Section 3.2.9.

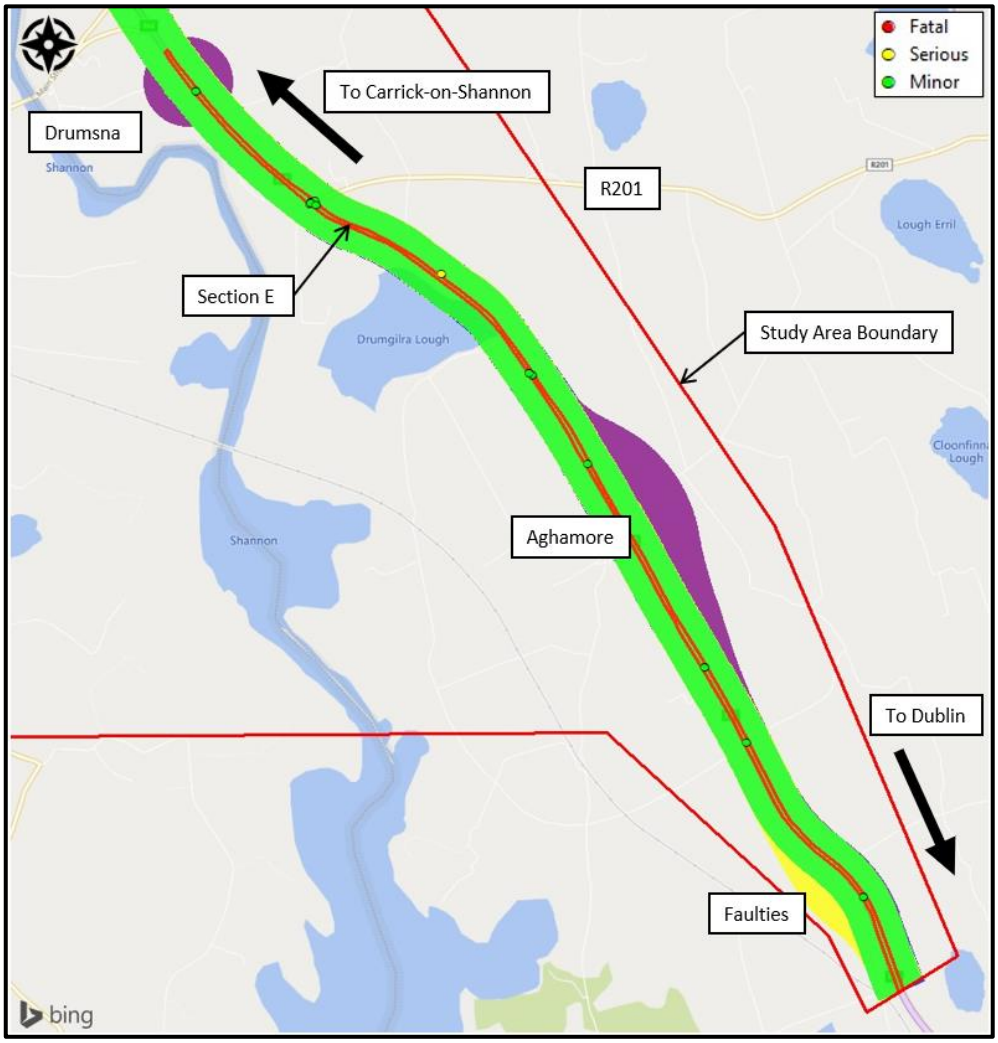


Figure 6.5: Section E Collisions (1996 - 2016) and Option Corridors

As mentioned for Section D (6.3.4) above the **Black Option Corridor** alone would not have the potential to improve the road safety on this section due to lack of a physical intervention. Similarly, whether Carrick-on-Shannon was to be bypassed to the north or to the south, is irrelevant in terms of safety to this section. Therefore, the Purple, Green, Yellow and Blue Option Corridors are the only road based solutions which could have a positive impact on safety in this section.

The **Green Option Corridor** proposes on-line upgrades along the existing mainline, whereas the **Yellow Option Corridor** offers the opportunity for enhanced overtaking with a short off-line realignment to the south of the study area. The **Purple East Option Corridor** sets out provisions for a bypass of Aghamore Village and has more potential to improve the road safety on this section as bypassing the village could reduce the risk of collisions while also providing a safer environment for non-motorised road user in the village.

As in Section D (Section 6.3.4) upgrading this section of the N4 to a dual carriageway cross-section would reduce the number of crossing movements arising at junctions and accesses. This should improve safety for all road users.

The alternatives would not have as much impact on safety in Section E as in Section A. Although it is envisaged that the implementation of enhanced public transport services and the provision of improved cycling and walking facilities in and around Carrick-on-Shannon would encourage some change towards public transport and active travel throughout the study area, there would be minimal improvement to road safety on this section due to lack of a physical intervention on geometric parameters or at junctions.

6.3.6 Section F

This section comprises the remaining areas of the study area outside of the sections already discussed from 6.3.1 to 6.3.5. Collision data for this section is presented in Section 3.2.10. The area and Option Corridors are outlined along with the collisions recorded from 1996 to 2016 in Figure 6.6.

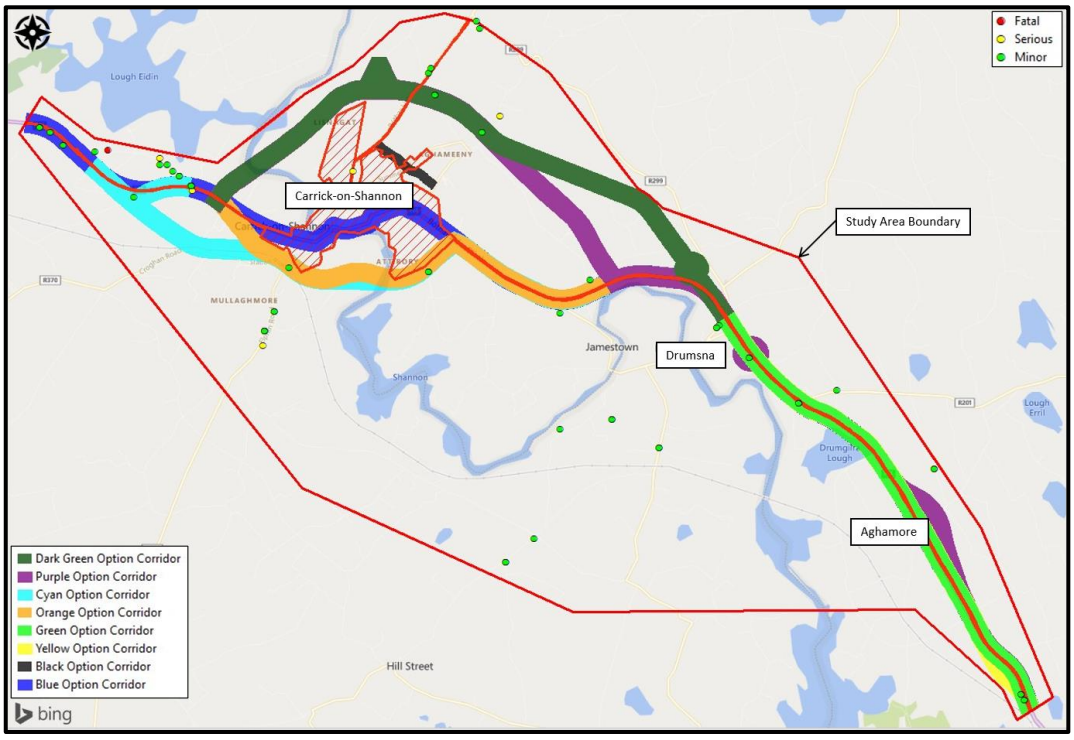


Figure 6.6: Section F Collisions (1996 - 2016) and Option Corridors

As the portion of the old N4 has been realigned, the cause of the collision cluster identified in Section F has been resolved and is no longer an issue. As the remaining collisions are dispersed throughout the study area, the options and alternatives have equal potential to improve the overall safety of the study area.

7 Climatic and Seasonal Influences on Safety

The variable weather conditions in Ireland throughout the year can have a direct influence on road safety. Variable weather conditions can cause flooding and icy conditions on the road network which in turn can lead to collisions due to aquaplaning or skidding. Sustained poor weather conditions can also cause maintenance issues such as potholes and other road defects. Variable weather conditions combined with the resultant defects can result in collisions of all severities to occur. This has a significant impact on road safety as discussed under the headings below.

7.1 Flooding

Regular, well documented flood events occur within the study area and pose a significant flood risk to the existing road network. Any design solution will have to take cognisance of the existing flooding trends from the outset as well as provide for more extreme flood events going forward as a result of climate change. This will ensure that flooding on any potential future transport infrastructure does not arise and therefore does not contribute in any way to road safety issues.

A detailed flood risk assessment for any proposed transportation solution will be prepared during Phase 3 of the Project.

7.2 Icy Conditions

Maintenance of major regional and national routes is a priority during icy weather due to the large volumes of traffic which use these routes. Therefore, the construction or upgrade of a national route would ensure enhanced safety to drivers during icy conditions by providing a well maintained, standard and predictable route for road users.

8 Comparison of Solutions

8.1 Overview

At the stage of this project when the RSIA has been undertaken i.e. during the Stage 1 Assessment of options, there is no approved transport model to assess the potential reduction in the number of collisions and thereafter appraise the potential monetary benefits accruing from improved safety on each of the transportation options under consideration. During Phase 2 Stage 2 Assessment, a detailed Cost and Benefit to Collisions – Light Touch (COBALT) assessment is undertaken to assess and quantify the change in the number of collisions and causalities as a direct result of the project. A summary of the conclusions of the COBALT assessment undertaken as part of the Stage 2 Assessment has been provided in Section 8.4. It is noted that the options for assessment at Stage 2 have been refined following the findings of the Stage 1 Assessment and public consultation on Alternatives and Options.

This Stage 1 appraisal is based on the qualitative assessment of the impacts of each option / alternative against the current situation as noted above and summarised below. A scaling statement is used to rank the options ranging from:

- Major or highly positive
- Moderately positive
- Minor or slightly positive
- Not significant or neutral
- Minor or slightly negative
- Moderately negative
- Major or highly negative

In general terms, the implementation of each alternative or option in isolation may not necessarily have a fully positive impact on safety in the greater area, but when implemented in conjunction with other alternative(s) or option(s), may result in a positive effect on road safety in the surrounding area. It should also be noted that a proposed alternative or option may only realise road safety benefits if applied in a certain area at a specific time.

8.2 Safety

The **Do-Nothing** scenario is not considered as there are planned and committed schemes along this section of the N4, included in the **Do-Minimum** scenario. When future growth projections for the study area are considered, there is potential that current safety issues may worsen if nothing is done to address the transportation issues.

However, the **Do-Minimum** scenario will not offer any major improvement as the existing situation could remain along the vast majority of road.

8.2.1 Options (Road Based Solutions)

The **Blue and Black Option Corridors** seeks to manage the existing travel demand by developing the urban street network through small scale interventions, which includes provisions for additional links roads and junction and traffic management infrastructure upgrades. Such interventions would improve road safety within Carrick-on-Shannon town centre, especially for pedestrians and other vulnerable road users.

The Dark Green, Purple West, Cyan and Orange Option Corridors each include sections of new off-line road alignment and a new bridge crossing the River Shannon. This may see benefits in terms of road safety; especially within the Carrick-on-Shannon urban limits as a result of reduced AADT and through traffic. The bypassing of Aghamore proposed in the **Purple East Option Corridor** would see similar road safety benefits there, however on-line upgrades through the village and beyond could also improve safety.

8.2.2 Alternatives (Non-Road Based Solutions)

Provisions for improved public transport services and/or public transport infrastructure would result in reduced AADT in private vehicles. Likewise, the introduction of a comprehensive cycle network and improved walking facilities, including a new pedestrian bridge over the River Shannon, would see a reduction in AADT by private vehicles, particularly through the urban area. Enhanced permeability within Carrick-on-Shannon would also reduce the need for local trips to be made by car. Demand reduction proposals may see the reallocation of road space and vehicle restrictions among other possible traffic management approaches. These alternatives may improve vulnerable road user safety, traffic flows and may reduce congestion in the area. This may then possibly reduce the number of collisions.

8.2.3 Overall Safety Rating

The overall scaling ratings of all Alternatives and Options under the category of Safety range from Not Significant to Highly Positive.

It is deemed that the planned and committed schemes included in the **Do-Minimum Option** would have an insignificant impact on safety overall.

The **Blue Option Corridor** would see the rationalisation and reconfiguration of some junctions. The **Black Option Corridor** would remove some through traffic from the town centre and provide a new link road with facilities for pedestrians and cyclists. Either option corridor would have a slightly positive impact on safety within the study area.

The **Dark Green, Purple, Cyan and Orange Option Corridors** would remove significant traffic from the town onto a contemporary off-line bypass, having a highly positive impact on the safety of all road users, both in the town centre and on the bypass itself.

Table 8.1: Section 1 Options Safety Rating

	Do-Min	Blue	Black	Dark Green	Purple	Cyan	Orange
Safety Rating	Not Significant	Slightly Positive	Slightly Positive	Highly Positive	Highly Positive	Highly Positive	Highly Positive

The **Blue Option Corridor** would see the rationalisation of junctions which would have a slightly positive impact on safety.

The on-line upgrades to the east of Carrick-on-Shannon and bypass of Aghamore proposed by the **Purple Option Corridor** would have a highly positive impact on safety. As there are no provisions for such a bypass by the **Green and Yellow Option Corridors**, it is deemed that these options would have a moderately positive impact.

Table 8.2: Section 2 Options Safety Rating

	Do-Min	Blue	Purple	Green	Yellow
Safety Rating	Not significant	Slightly Positive	Highly Positive	Moderately Positive	Moderately Positive

Either of the **Alternatives** would have a moderately positive impact on safety, by providing new dedicated infrastructure for pedestrians and cyclists, by removing traffic through public transport services or reducing demand on the existing national primary route.

Table 8.3: Alternatives Safety Rating

	Cycling & Walking Proposals	Public Transport Proposals	Demand Reduction Proposals
Safety Rating	Moderately Positive	Moderately Positive	Moderately Positive

8.3 Benefit

The off-line road based options would alleviate congestion and associated delays on the N4, which would reduce the likelihood of collisions especially in the urban centre of Carrick-on-Shannon.

The **Blue Option Corridor** may improve safety by rationalising the number of direct accesses and junctions onto the national primary route. Works encompassed in this option may also see the reconfiguration of junctions from roundabouts to signalised junctions which could have an impact on the safety of vulnerable roads users, pedestrians in particular.

The **Black Option Corridor** would improve connectivity between the national and regional road network while drawing traffic away from the town centre by providing a new link road. This would improve road safety within Carrick-on-Shannon, especially for pedestrians and other vulnerable road users.

The **Dark Green, Purple, Cyan and Orange Option Corridors** would reduce congestion, which would improve journey time reliability, which in turn could

potentially serve to reduce driver frustration, improve driver behaviour and create a safer road environment in Carrick-on-Shannon.

On-line upgrades proposed by the **Green, Yellow and Purple Option Corridors** would improve safety by enhancing the existing infrastructure. This may be done through improving the alignment to remove dubious overtaking sections and provide safe sections, rationalising junctions and accesses to reduce conflicts with the national primary route, upgrading the existing single carriageway cross-section to dual carriageway, and/or providing a bypass of Aghamore village.

The provision of improved public transport facilities serving Carrick-on-Shannon town and the surrounding area could reduce the AADT on the existing road network, thus lowering collision rates which in turn would lead to safer urban roads. A reduction of traffic in urban areas would assist in creating more desirable spaces for cyclists, pedestrians and other vulnerable road users. Walking and cycling could be further encouraged by the introduction of improved pedestrian infrastructure including a new designated River Shannon crossing.

The provision of additional infrastructure or upgrade and reconfiguration of the existing infrastructure could potentially reduce the number of road users choosing to use the local road network or residential streets over the intended main roads in and out of townlands and could reduce the number of associated collisions on the regional and local road network.

8.4 Summary of the Stage 2 – Light Touch (COBALT)

8.4.1 Overview of the Stage 2 Alternatives and Options

The conclusion of the Stage 1 Assessment of the Alternatives and Options was to carry forward the majority of the alternatives and options as described in the below sections for more detailed consideration as part of the Stage 2 Assessment. As detailed in Section 4.3 above, the Do-Minimum Option which considers all of the projects that are already planned and committed in the vicinity of the study area forms the base case against which all Options are assessed in the Stage 2 Assessment. The Stage 2 Option Corridors are also assessed west and east of Drumsna, in line with the Stage 1 Assessment.

The options and alternatives taken forward to the Stage 2 Assessment include some refinements to those described in Sections 4.4 and 4.5. These refinements are outlined in Sections 8.4.1.1 and 8.4.1.2.

8.4.1.1 Stage 2 Do-Something – Alternatives

The conclusion of the Stage 1 assessment of Alternatives is that the majority of the Stage 1 Alternatives are progressed to Stage 2 with the exception of the additional cycle/pedestrian bridge over the River Shannon and the further improvements to the rail service. The Stage 2 Alternatives are described below.

Alternative A: Active Travel

- Development of a comprehensive cycle network
- Cyclists facilities – parking, changing areas, e-bike charging
- Pedestrians facilities – footpath provision and crossing facilities
- Permeability for non-motorised use in the area

Alternative B: Public transport improvements

- Improved parking at railway station with signage and line marking
- Increase frequency of bus services to 20 minutes/hour at peak
- Develop mobility hub in town centre facilitating mode interchange
- Demand responsive mini-bus services connecting isolated areas
- Additional bus-stops/furniture on the existing street network

Alternative C: Reducing Demand

- Formal pedestrian crossings at existing roundabout junctions
- Reduced junction radii and public realm enhancements
- 30km/h speed limit on existing N4
- Parking reduction on Bridge Street
- Time plated pedestrianisation of Main Street

8.4.1.2 Stage 2 Do-Something – Options

Both the Blue West and Blue East Option Corridors have been discounted following the Stage 1 Assessment of the Alternatives and Options and have not been carried forward to the Stage 2 Assessment.

West of the River Shannon, a direct connection was introduced between the Cyan Option Corridor and the R368 Elphin Road. This short link road diverges from the R368 at Killukin before crossing over the railway line and connecting to the Cyan Option Corridor in the townland of Cortober.

The remaining Orange, Purple West, Dark Green, Black, Yellow, Green and Purple East Option Corridors have all been progressed to the Stage 2 Assessment as they were in Stage 1. The Stage 2 Do-Something – Options are presented in Figure 8.1.

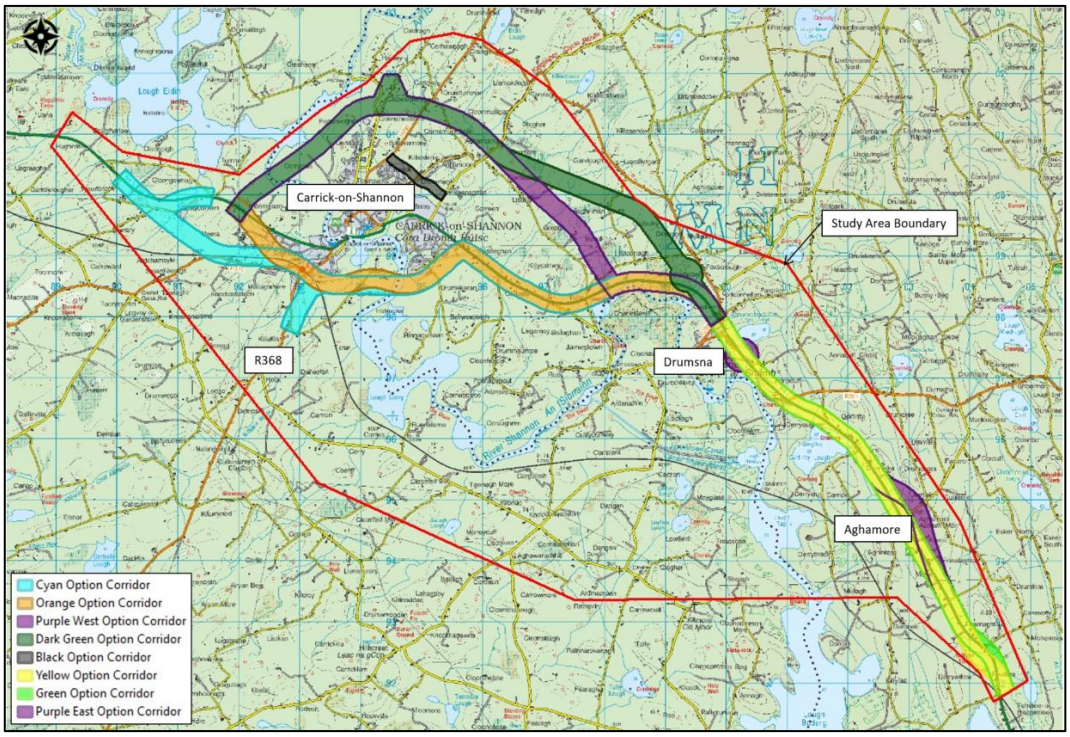


Figure 8.1: Stage 2 Do-Something – Option Corridors

8.4.2 Light Touch Cobalt

As outlined in TII PAG, the Stage 2 safety appraisal typically refers to the forecast reduction in vehicle collision and the associated safety benefits that will accrue.

An assessment of potential safety benefits has been undertaken using the Irish version of COBALT (**CO**st and **B**enefit to **A**ccidents – **L**ight **T**ouch), a computer program developed by the UK Department for Transport to undertake the analysis of the impact on accidents as part of economic appraisal for a road scheme. The COBALT analysis uses details of road cross-section, collision rates, casualty costs and projected traffic volumes to derive a monetised safety benefit as a result of the interventions delivered by the alternatives and options. The monetised safety benefits are added to the other benefits that are derived from time savings etc. to give an overall value of benefits which is then used and detailed in the Economy assessment and ranking in the Stage 2 Assessment detailed in Chapter 8 of the Option Selection Report (OSR).

Within each option corridor west of Drumsna, apart from the Black Option Corridor, both a single carriageway and dual carriageway design scenario have been assessed. East of Drumsna the Yellow and Green Option Corridors have been assessed as single carriageways and the Purple East Option Corridor as a dual carriageway. Varying combinations of the design scenarios were modelled in the Do-Something traffic models to attain the monetised safety benefits associated with each scenario via COBALT analysis.

The COBALT analysis found that all of the dual carriageway option scenarios produced broadly similar results (€6.8M - €8.5M of benefits). Equally, so do all of

the single carriageway options with negative €0.7M - €1.1M of benefits due to the similar levels of traffic transferred by each option within each type of cross-section.

The marginally negative benefits for each of the single carriageway options can be attributed to how COBALT calculates benefits i.e. it uses a simplistic approach whereby collisions are calculated on the basis of an assumed collision rate which varies across a very minimal range of link types and link speeds.

While the results are negative for the single carriageway options, the benefits are very small in terms of the difference compared to a 'Without-Scheme' scenario. These figures are also over the 30-year appraisal period and as such, the year-on-year differences are marginal. It should be remembered that all of the options involve the introduction of a lower 30km/h speed limit in the town centre which will likely have a positive benefit in terms of improving safety, although this is not quantifiable through COBALT due to the simplicity of the assessment i.e. the lack of an accident rate in COBALT for a link of a lower speed than 60km/h.

The negative benefits associated with the single carriageway options are likely in fact to be offset by a reduction in the number of, and accident severity, experienced by non-motorised users in the centre of Carrick-on-Shannon, attributed to lower vehicle speeds on the N4 i.e. vehicles will be traveling at 30km/h through the town given the presence of demand management measures.

9 Conclusions and Summary

A high-level examination of the transportation issues which affect road safety along the extents of the N4 Carrick-on-Shannon to Dromod corridor has been carried out.

The following issues are the major contributory factors to road safety in the study area:

- Significant congestion exists along the N4 corridor especially across the River Shannon bridge crossing in Carrick-on-Shannon
- Single river crossing is sub-standard in terms of alignment and cross-section
- Journey time unreliability due to uncertain quantum of delay
- Journey time variability throughout the day
- Peak hour traffic delay

Each of the issues above could be addressed to varying degrees by the each of the options and alternatives as outlined above. Carrick-on-Shannon town centre is the major conflict with the national primary route traffic within the study area. By providing an off-line bypass of Carrick-on-Shannon, which would offer a second crossing point of the River Shannon, safety would be improved for all road users within the town, including pedestrians and the vulnerable. Journey time reliability and peak hour delays would also improve as a result of removing through traffic from the town centre to an appropriate route designed to cater for the strategic traffic. Conversely, local traffic could be targeted to alleviate congestion by encouraging a modal shift to active travel or public transport through the introduction of appropriate infrastructure, thus freeing space for the strategic traffic through Carrick-on-Shannon.

The following are the key performance targets which the project intends to achieve to deliver on the objectives, resolve the transportation issues and enhance safety:

- Improve the efficiency of the N4 corridor
- Improve connectivity with the west and northwest of Ireland
- To reduce the frequency and severity of collisions on the N4 corridor and within Carrick-on-Shannon town
- To complement wider government policy
- To support the Government's Road Safety Strategy
- To support the transition to more sustainable travel and the policies outlined in the Climate Action Plan
- To manage noise impacts in populated areas
- Generate positive economic benefits to road users
- To provide a corridor that will encourage and support investment and employment in the wider area
- To improve road based public transport journey time

- To be compatible with adopted land use objectives
- To promote walking and cycling by providing a safer environment for non-motorised road users.

This concludes the road safety impact assessment as part of the first stage of Phase 2, Option Selection. This will be continually reviewed through the design phases, particularly as the project progresses through Phase 2, as options are further developed to determine the Preferred Option.

Appendix A

Existing Road Condition Assessment

A.1 Existing Road Condition Assessment

Leitrim County Council

N4 Carrick-on-Shannon to Dromod Project

Existing N4 - Road Condition Assessment

274219-ARUP-01-CF-RP-CH-000001

P02 | 23 June 2020

Job number 274219-00

Ove Arup & Partners International Ltd
Corporate House
City East Business Park
Ballybrit
Galway
www.arup.com

ARUP

Document verification

ARUP

Job title		N4 Carrick-on-Shannon to Dromod Project			**Job number** 274219-00
Document title		Existing N4 - Road Condition Assessment			**File reference**
Document ref		274219-ARUP-01-CF-RP-CH-000001			
Revision	**Date**	**Filename**	274219-ARUP-01-CF-RP-CH-000001.docx		
P01	12 Jun 2020	**Description**	First Draft		
			Prepared by	Checked by	Approved by
		Name	Ciarán Ward	Hazel King	Eileen McCarthy
		Signature			
P02	23 Jun 2020	**Filename**	274219-ARUP-01-CF-RP-CH-000001.docx		
		Description	Phase 1 - Issue		
			Prepared by	Checked by	Approved by
		Name	John O'Toole	Hazel King	Eileen McCarthy
		Signature	John O'Toole	Hazel King	Eileen McCarthy.
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
				Issue Document verification with document	✓

Contents

Appendices

Appendix A

Junction and Access Schedule

Appendix B

Pavement Condition Survey

1 Background to Scheme

Arup has been commissioned to deliver consultancy services for the N4 Carrick-on-Shannon to Dromod Project for Phases 1-4 in accordance with the TII Project Management Guidelines. Phase 1 involves reviewing all existing studies, data, constraints and surveys to establish clear objectives for the advancement of a project to resolve the transportation issues on this corridor.

The N4 national primary road, Dublin to Sligo, is a strategic corridor from Dublin to the northwest and border counties and is approximately 198km in length. The section of the N4 under consideration falls within two local authority administrative areas with the River Shannon acting as the boundary. The area to the west of the River Shannon lies within County Roscommon and to the east of the River Shannon within County Leitrim. The town of Carrick-on-Shannon lies on the eastern side of the River Shannon while the town of Cortober lies on to the west of the river. For the purposes of this report, where Carrick-on-Shannon is referred to it is taken to encompass both Carrick-on-Shannon and Cortober. The section of the N4 under consideration passes through both rural and urban environments, is approximately 21km long and extends from Drumharlow townland north of Carrick-on-Shannon to Faulties townland south of Aghamore (refer to Figure 1.1 below). Major towns and villages along the road are Carrick-on-Shannon, Cortober and Aghamore.

The N4 carries both long-distance traffic from the east of the country to the north-west of the country and significant regional and inter-urban traffic flows between Mullingar, Longford, Carrick-on-Shannon, Boyle and Sligo. The section of the N4 through Carrick-on-Shannon also provides regional connections to the towns of Elphin (R368), Frenchpark (R370) and Manorhamilton (R280) and to the west and east N4. The N4 currently crosses the River Shannon at Carrick-on-Shannon to Cortober via a narrow masonry arch bridge, dating from 1846, which is sub-standard in terms of alignment and cross-section.

Significant lengths of the N4 have been improved / upgraded to dual carriageway cross-section in the recent past. With these upgrades, especially the opening of N4 Dromod to Roosky bypass, Carrick-on-Shannon has become a bottleneck for long distance and regional traffic. Carrick-on-Shannon remains the only regional strategic centre on the N4 between Dublin and Sligo which has not been bypassed to date.

A previous project consisting of a bypass of Carrick-on-Shannon was progressed to Route Selection stage before being suspended in 2007. Subsequently an extended project, was also progressed to Route Selection before it was suspended in 2012 due to the unprecedented economic downturn.

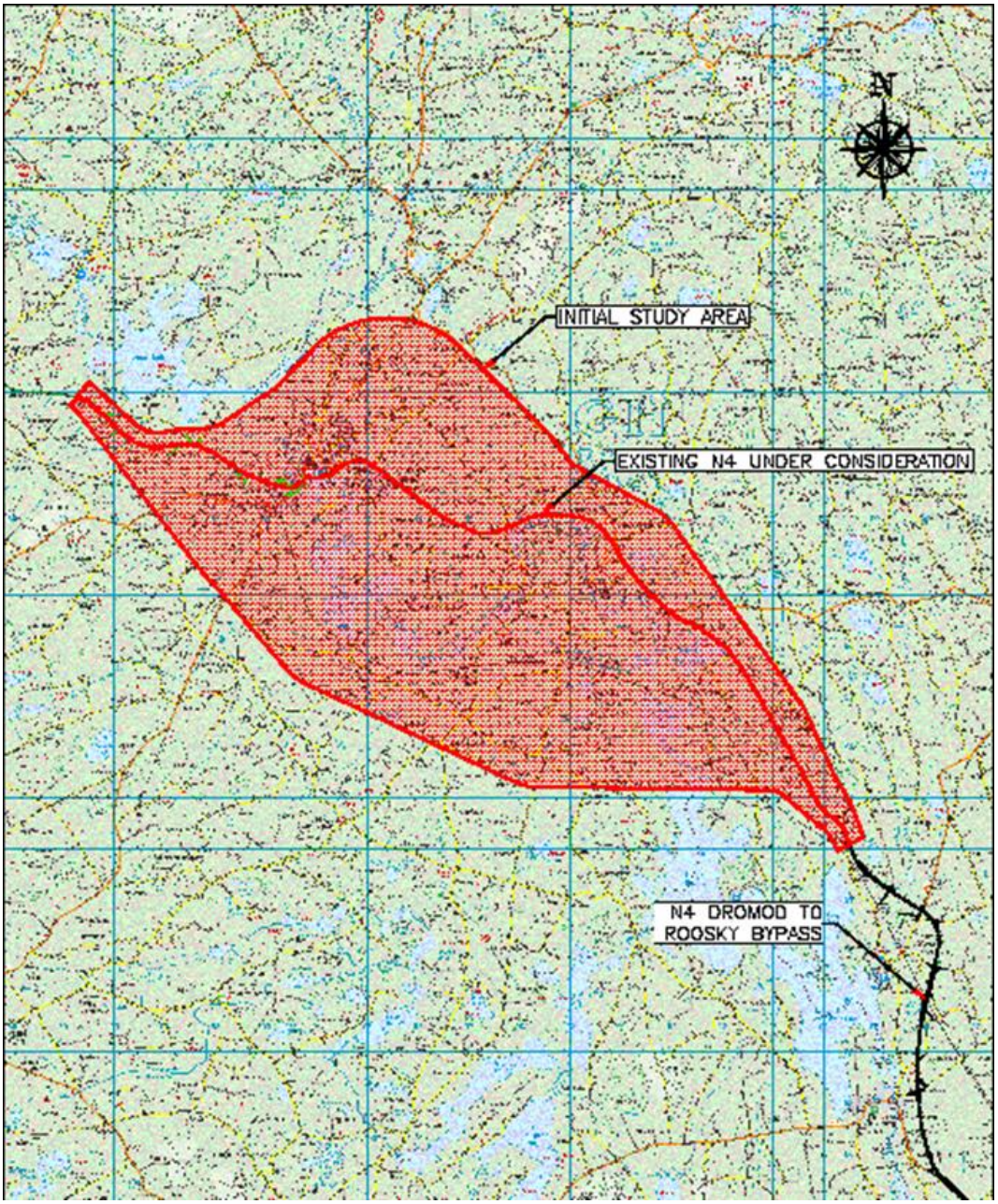


Figure 1.1: Section of the N4 Under Consideration

1.1 Reference Documents

The following historic reports were assessed and referenced for the purpose of this study:

- List – Check historic data received from client in external folder
- DN-GEO-03031 – Rural Road Link Design (TII)
- AM-PAV-06045 – Management of Skid resistance (TII)
- N4 Carrick-on-Shannon to Dromod Road Project Constraints Study Report – February 2010 (Roughan & O'Donovan Consulting Engineers)

- N4 Carrick-on-Shannon to Dromod Road Project Route Corridor Report – February 2011 (Roughan & O'Donovan Consulting Engineers)

2 Purpose of this Report

The purpose of this report is to assess the existing characteristics of the existing N4 road through the scheme extents from Drumharlow to Faulties. The scope of the assessment includes an assessment of the following:

- Geometry
- Road safety
- Pavement condition
- Structures condition
- Drainage extents and condition
- Utilities

3 Geometry

The geometry assessment of the existing road will be carried out along the N4 road identified in Figure 3.1 below. The length of the existing N4 within the study area is approximately 21km.

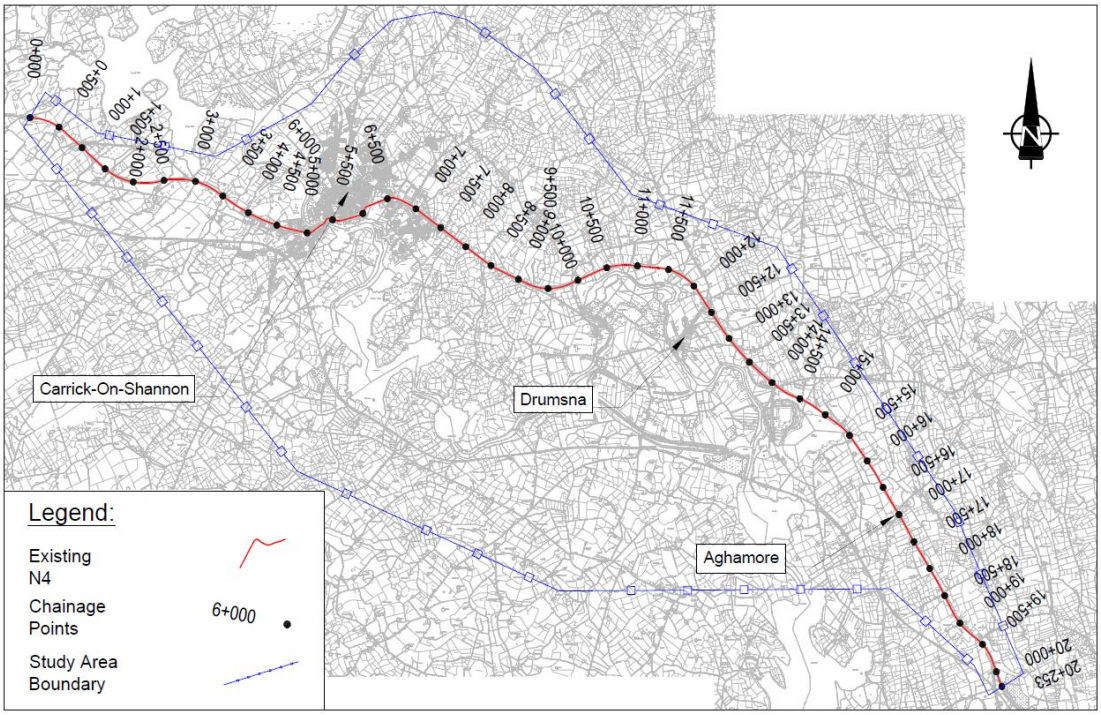


Figure 3.1: N4 Geometry assessment extents

3.1 Speed Limit

The speed limits for the N4 within the study area boundary are shown on Figure 3.2 and Figure 3.3 below. The majority of the alignment has a speed limit of 100km/h. This reduces to 50km/h through Carrick-on-Shannon and Aghamore. There is an intermediate speed limit of 60km/h on the western side of Carrick-on-Shannon and also north and south of Aghamore.

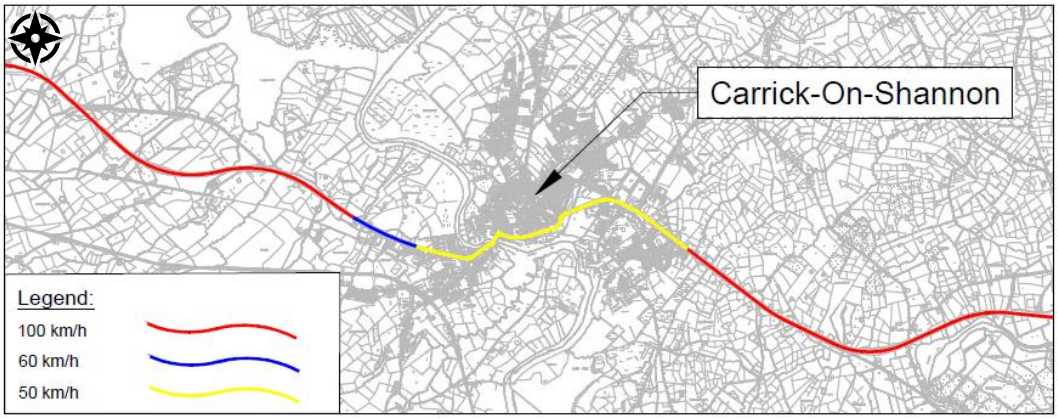


Figure 3.2: Speed limits on the existing N4

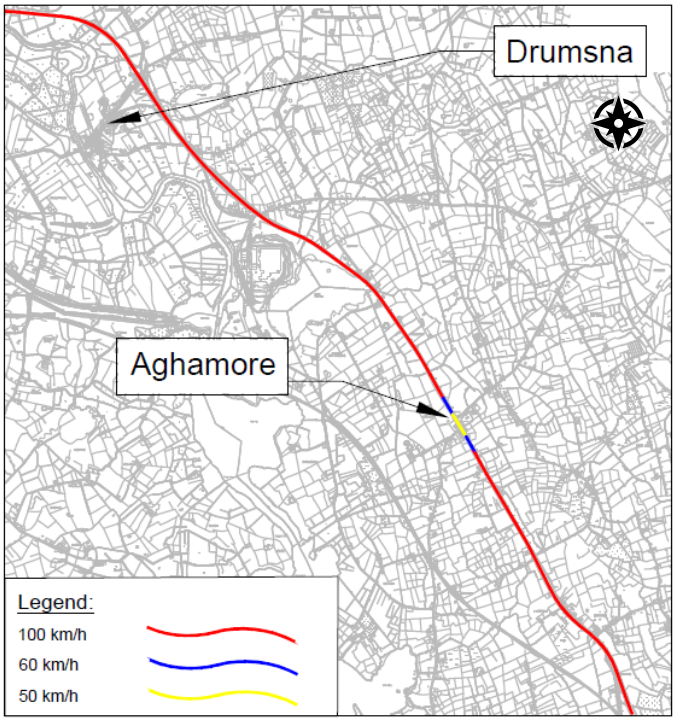


Figure 3.3: Speed limits on the existing N4

3.2 Horizontal Alignment

Table 3.1 below details the horizontal alignment of the existing N4 within the study area boundary. In total there are 13 of the 27 curves or 17.4% of the total length of alignment within the study area boundary which falls below the TII standard for horizontal geometry. Of these, three fall two steps or further below TII's desirable

minimum radius with super elevation of 7%. All three can be found in Carrick-On-Shannon's 50km/h speed limit zone with two lying just west of Carrick-On-Shannon bridge at chainages 5+243 and 5+282 with approximate radii of 42m and 63m. This is below the desirable minimum for a 50kph design speed. The third can be found at chainage 5+960 at the southern approach to the Shannon roundabout with a radius of 96m.

The remaining ten sub-standard curves fall within band C of TII's horizontal curve design diagram found in DN-GEO-03031. Curves falling within band C provide long sections with dubious overtaking conditions and as such are not recommended. For design speeds of 100km/h, band C includes curves with radii between 1020m and 2880m, and 255m to 720m for a design speed of 50km/h.

Table 3.1: Horizontal Alignment of the existing N4

Chainage (m)	**Feature Type**	**Speed Limit (km/h)**	**Approx. Radius (m)**	**Length (m)**	**Compliance with TII Standards (DN-GEO-03031-10)**
0+000	Straight	100	n/a	57	
0+057	Curve	100	859	565	OK given superelevation of 5%
0+622	Straight	100	n/a	816	
1+437	Curve	100	1005	1005	OK given superelevation of 5%
2+443	Curve	100	1074	943	Band C curve Not recommended
3+385	Straight	100	n/a	282	
3+667	Curve	100	2293	196	Band C curve Not recommended
3+863	Straight	60	n/a	27	
3+890	Curve	60/50	2817	901	OK
4+791	Straight	50	n/a	194	
4+985	Roundabout	50	Roundabout	111	
5+096	Straight	50	n/a	148	
5+243	Curve	50	63	21	Four Steps below Desirable Min R with Superelevation of 7%
5+264	Straight	50	n/a	18	
5+282	Curve	50	42	30	More than Four Steps below Desirable Min R with Superelevation of 7%
5+312	Straight	50	n/a	91	
5+403	Roundabout	50	Roundabout	25	
5+428	Straight	50	n/a	19	
5+447	Curve	50	377	260	Band C curve

Chainage (m)	Feature Type	Speed Limit (km/h)	Approx. Radius (m)	Length (m)	Compliance with TII Standards (DN-GEO-03031-10)
					Not recommended
5+707	Straight	50	n/a	253	
5+960	Curve	50	96	120	Two Steps below Desirable Min R with Superelevation of 7%
6+079	Roundabout	50	Roundabout	57	
6+136	Straight	50	n/a	325	
6+461	Roundabout	50	Roundabout	243	
6+704	Straight	50	n/a	117	
6+821	Curve	50	790	155	OK
6+976	Straight	50/100	n/a	1435	
8+412	Curve	100	1129	226	Band C curve Not recommended
8+638	Straight	100	n/a	511	
9+149	Curve	100	801	701	OK given Superelevation of 5%
9+850	Straight	100	n/a	516	
10+336	Curve	100	1025	537	Band C curve Not recommended
10+903	Straight	100	n/a	465	
11+368	Curve	100	798	715	OK given Superelevation of 5%
12+083	Straight	100	n/a	727	
12+810	Curve	100	4015	1364	OK
14+174	Curve	100	881	224	OK given Superelevation of 5%
14+398	Straight	100	n/a	106	
14+504	Curve	100	1113	287	Band C curve Not recommended
14+791	Straight	100	n/a	463	
15+254	Curve	100	879	294	OK given Superelevation of 5%
15+549	Straight	100	n/a	580	
16+129	Curve	100	1745	192	Band C curve Not recommended
16+321	Straight	100	n/a	105	
16+426	Curve	100/60	7780	364	OK
16+790	Straight	60/50	n/a	288	
17+078	Curve	50/60	2464	135	OK

Chainage (m)	Feature Type	Speed Limit (km/h)	Approx. Radius (m)	Length (m)	Compliance with TII Standards (DN-GEO-03031-10)
17+214	Straight	60/100	n/a	166	
17+380	Curve	100	2820	139	Band C curve Not recommended
17+519	Straight	100	n/a	329	
17+848	Curve	100	40935	231	OK
18+079	Straight	100	n/a	200	
18+279	Curve	100	766	49	OK given Superelevation of 5%
18+328	Straight	100	n/a	459	
18+786	Curve	100	1063	451	Band C curve Not recommended
19+237	Straight	100	n/a	147	
19+384	Curve	100	775	423	OK given Superelevation of 5%
19+807	Straight	100	n/a	328	
20+136	Curve	100	1577	117	Band C curve Not recommended

3.3 Overtaking Value

The overtaking value for the existing N4 was calculated using the methodology detailed in TII standard DN-GEO-03031. The overall overtaking value for the section of N4 under consideration is 25%. There is a 27% value heading southeast from chainage 0+000 and a 23% value heading northwest towards chainage 0+000. The southeast direction value is slightly higher due to the higher number of right-hand bends. There were no overtaking zones in the 50km/h Carrick-on-Shannon and Aghamore sections of the N4 due to the prevalence of junctions and horizontal curves.

3.3.1 Sinuosity Index

Sinuosity is the ratio of actual length over the shortest path. It has been shown to be a good proxy for road bendiness. The sinuosity index shall be calculated as follows:

$$\text{Sinuosity Index (SI)} = \frac{\text{Actual section length between A and B}}{\text{Shortest path between A and B}}$$

The sinuosity index values for various chainages along the N4 within the study area boundary are displayed in Table 3.2. DN-REQ-03034 divides sinuosity into three rankings as follows:

- High (H) - Sinuosity Index > 1.02

- Medium (M) – 1.004 ≤ Sinuosity Index ≤ 1.02
- Low (L) - Sinuosity Index < 1.004

Sections with a sinuosity index value of below 1.008 are considered straight whereas sinuosity values greater than 1.031 are considered bendy roads. It has been put forward by Smith et al. (2006, 22nd ARRB conference proceedings) that drivers experience concentration difficulties on roads with a low sinuosity index. Taking cognisance of this, a medium sinuosity index would be desirable as it maintains driver focus without being too taxing.

The average sinuosity across the 21km of N4 within the study area boundary is 1.025 as shown in Table 3.2. This would place the road in the high sinuosity ranking. From further inspection of the alignment, it is clear that the highest values are found within the urban centre of Carrick-on-Shannon and inside the 50km/h speed limit zone between chainages 4+000 and 7+000. When the sinuosity indexes between these chainages are omitted the average value falls to a medium ranking of 1.014. The other notable areas with a high sinuosity index along the alignment include:

- The section between chainages 0+070 and 3+870, through Cloongownagh and Cuiltyconeen which has an average sinuosity index of 1.031
- The section between chainages 9+067 and 12+067, through Jamestown and Mountcampbell which has an average sinuosity index of 1.038
- The section between chainages 19+065 and 20+253, through Faulties and Fearnaght which has an average sinuosity index of 1.023

Table 3.2: Sinuosity index values for the existing N4

Approx. Chainage	Length (m)	Sinuosity Index
0+000	70	1.001
0+070	1000	1.023
1+070	1000	1.022
2+070	1800	1.048
3+870	840	1.004
4+710	593	1.095
5+303	760	1.124
6+063	1324	1.075
7+387	680	1
8+067	1000	1.004
9+067	1000	1.043
10+067	1000	1.022
11+067	1000	1.051
12+067	1000	1.001
13+067	1000	1.003
14+067	1000	1.005

Approx. Chainage	Length (m)	Sinuosity Index
15+067	1000	1.008
16+067	500	1
16+567	638	1
17+205	860	1
18+065	1000	1.005
19+065	1000	1.026
20+065	188	1.021
Total	20253	1.025

3.4 Vertical Alignment

Table 3.3 below details the vertical alignment of the existing N4 within the study area boundary. The vertical alignment of the existing road is generally good, with the majority of K values in excess of the desirable minimum curvature as quoted in TII standards DN-GEO-03031 for the design speeds. In total there are only four curves which fall one step or further below TII's desirable minimum K values, all of which are crest curves. There is one crest curve located on the River Shannon Bridge in Carrick-on-Shannon at chainage 5+313 with an approximate crest value of 6 placing it two steps below the minimum desirable crest K value of 10 for a 50km/h design speed. The other three sub-standard curves are located in the 100km/h speed limit zone to the east of Carrick-on-Shannon. These fall just one step below the minimum desirable crest K value of 100 for a 100km/h design speed They can be found at chainages 8+521, 14+943 and 18+708 with K values of 58, 92 and 96 respectively.

Table 3.3: Vertical Alignment of the existing N4

Chainage (m)	Feature Type	Speed Limit (km/h)	Gradient (%)	K	Compliance with TII Standards (DN-GEO-03031-10)
0+000	Gradient	100	0.4	n/a	OK
0+194	Sag Curve	100	n/a	311	OK
0+434	Crest Curve	100	n/a	-217	OK
0+735	Gradient	100	-0.22	n/a	OK
1+474	Crest Curve	100	n/a	-291	OK
1+513	Gradient	100	-0.35	n/a	OK
1+958	Sag Curve	100	n/a	671	OK
2+138	Gradient	100	-0.08	n/a	OK
2+552	Sag Curve	100	n/a	2039	OK
3+178	Gradient	100	0.22	n/a	OK
3+817	Crest Curve	100/60	n/a	-582	OK

Chainage (m)	Feature Type	Speed Limit (km/h)	Gradient (%)	K	Compliance with TII Standards (DN-GEO-03031-10)
4+180	Gradient	60	-0.4	n/a	OK
4+389	Sag Curve	60/50	n/a	1024	OK
5+104	Gradient	50	0.3	n/a	OK
5+247	Sag Curve	50	n/a	14	OK
5+313	Crest Curve	50	n/a	-6 (Carrick-on-Shannon Bridge)	Two Steps below Desirable Min Crest K Value
5+387	Sag Curve	50	n/a	10	OK
5+439	Gradient	50	-0.95	n/a	OK
5+525	Sag Curve	50	n/a	31	OK
5+573	Gradient	50	0.57	n/a	OK
5+788	Crest Curve	50	n/a	-25	OK
5+820	Gradient	50	-0.69	n/a	OK
5+921	Sag Curve	50	n/a	46	OK
6+014	Gradient	50	1.3	n/a	OK
6+074	Crest Curve	50	n/a	-14	OK
6+141	Gradient	50	-3.22	n/a	OK
6+157	Sag Curve	50	n/a	14	OK
6+203	Gradient	50	-0.08	n/a	OK
6+462	Sag Curve	50	n/a	26	OK
6+520	Crest Curve	50	n/a	-45	OK
6+572	Gradient	50	0.99	n/a	OK
6+620	Crest Curve	50	n/a	-13	OK
6+643	Sag Curve	50	n/a	43	OK
6+769	Gradient	50	2.21	n/a	OK
6+803	Crest Curve	50	n/a	-103	OK
7+112	Gradient	50/100	-0.77	n/a	OK
7+521	Sag Curve	100	n/a	85	OK
7+668	Gradient	100	1.18	n/a	OK
8+026	Crest Curve	100	n/a	-265	OK
8+218	Gradient	100	0.46	n/a	OK
8+312	Sag Curve	100	n/a	99	OK
8+436	Gradient	100	1.71	n/a	OK

Chainage (m)	Feature Type	Speed Limit (km/h)	Gradient (%)	K	Compliance with TII Standards (DN-GEO-03031-10)
8+521	Crest Curve	100	n/a	-58	One Step below Desirable Min Crest K Value
8+660	Gradient	100	-0.65	n/a	OK
9+586	Crest Curve	100	n/a	-798	OK
9+815	Gradient	100	-0.93	n/a	OK
10+201	Sag Curve	100	n/a	237	OK
10+556	Gradient	100	0.56	n/a	OK
10+997	Crest Curve	100	n/a	-412	OK
11+463	Gradient	100	-0.57	n/a	OK
11+741	Sag Curve	100	n/a	78	OK
11+847	Gradient	100	1.13	n/a	OK
11+997	Crest Curve	100	n/a	-363	OK
12+650	Gradient	100	-0.66	n/a	OK
13+045	Sag Curve	100	n/a	179	OK
13+345	Gradient	100	1.01	n/a	OK
13+525	Crest Curve	100	n/a	-210	OK
14+078	Gradient	100	-1.61	n/a	OK
14+182	Sag Curve	100	n/a	217	OK
14+574	Gradient	100	0.2	n/a	OK
14+701	Sag Curve	100	n/a	89	OK
14+751	Gradient	100	0.76	n/a	OK
14+769	Crest Curve	100	n/a	-758	OK
14+846	Gradient	100	0.66	n/a	OK
14+943	Crest Curve	100	n/a	-92	One Step below Desirable Min Crest K Value
15+061	Gradient	100	-0.63	n/a	OK
15+102	Sag Curve	100	n/a	54	OK
15+117	Gradient	100	-0.35	n/a	OK
15+278	Crest Curve	100	n/a	-179	OK
15+356	Gradient	100	-0.78	n/a	OK
15+391	Sag Curve	100	n/a	46	OK

Chainage (m)	Feature Type	Speed Limit (km/h)	Gradient (%)	K	Compliance with TII Standards (DN-GEO-03031-10)
15+479	Gradient	100	1.39	n/a	OK
15+582	Crest Curve	100	n/a	-221	OK
15+946	Gradient	100	-0.25	n/a	OK
16+069	Sag Curve	100	n/a	51	OK
16+111	Gradient	100	0.58	n/a	OK
16+133	Crest Curve	100	n/a	-1114	OK
16+269	Gradient	100	0.46	n/a	OK
16+338	Sag Curve	100	n/a	51	OK
16+622	Gradient	100	5.99	n/a	Relaxation
16+688	Crest Curve	60/50/60	n/a	-95	OK
17+211	Gradient	60/100	0.47	n/a	OK
17+359	Crest Curve	100	n/a	-205	OK
17+654	Gradient	100	-0.97	n/a	OK
18+009	Crest Curve	100	n/a	-186	OK
18+160	Gradient	100	-1.78	n/a	OK
18+397	Sag Curve	100	n/a	51	OK
18+661	Gradient	100	3.38	n/a	OK
18+708	Crest Curve	100	n/a	-96	One Step below Desirable Min Crest K Value
19+371	Gradient	100	-3.55	n/a	OK
19+876	Sag Curve	100	n/a	98	OK
20+163	Gradient	100	-0.63	n/a	OK

3.5 Junctions and Accesses

197 direct accesses were identified on the N4 mainline; the locations of which are illustrated in Figure 3.4. These included 113 farm access, 58 domestic access, 24 commercial access and 2 pedestrian/cycle accesses. Details of each access are provided in Table A1 in Appendix A.

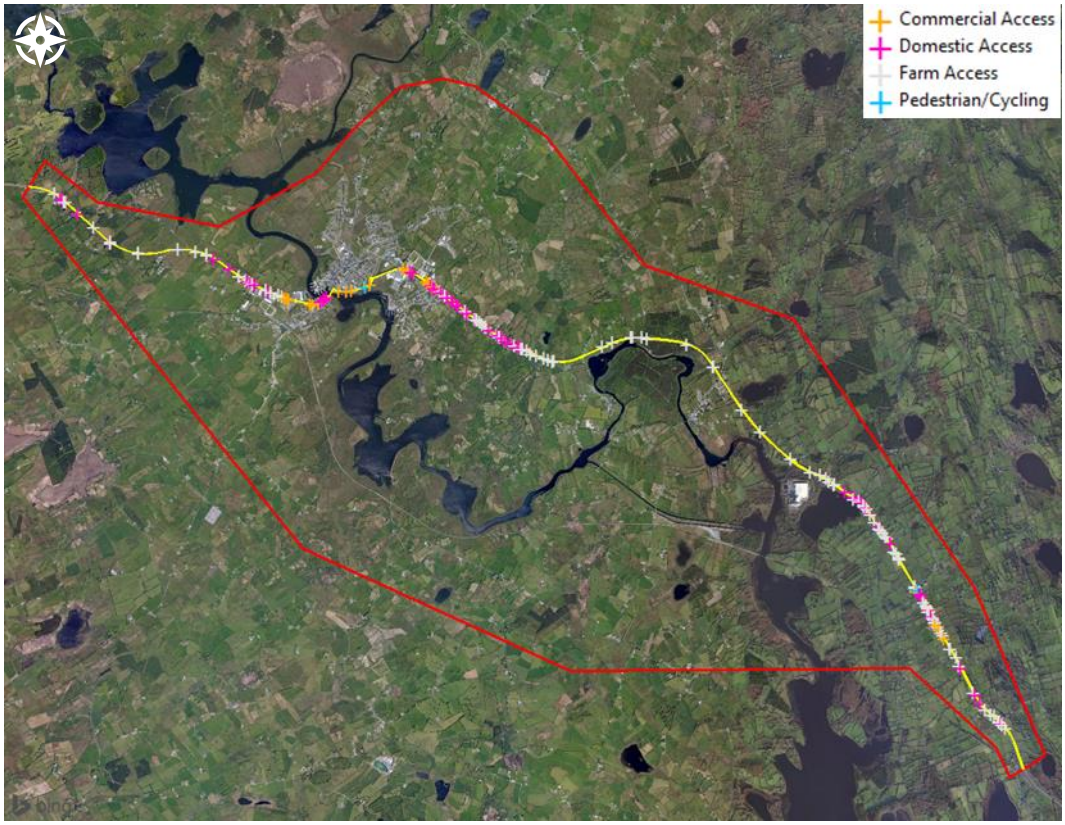


Figure 3.4: Distribution of accesses along existing N4 mainline

In total, 52 junctions were identified along the N4 mainline within the area under consideration. Of this total, 44 junctions were to local roads and 4 were to regional roads. The remaining identified junctions were the 4 on and off slip road junctions at the R299 grade-separated junction. Details of each junction are provided in Table A2 in Appendix A.

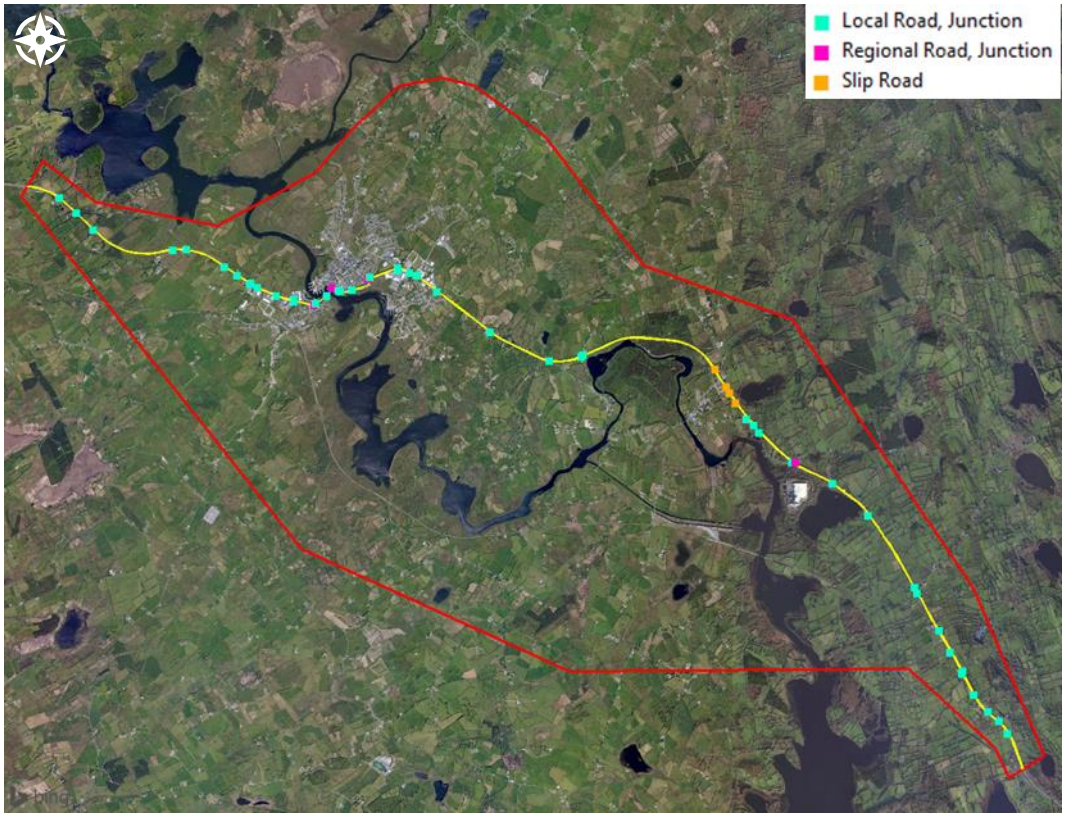


Figure 3.5: Distribution of junctions along existing N4 mainline

3.6 Road Markings and Signage

The existing road markings generally comply with current standards. However, after taking cognisance of the geometry and overtaking value analysis at a number of locations, the non-overtaking markings should be extended. In addition, there are some inconsistencies in the approach to road markings at junctions.

4 Road Safety Assessment

4.1 Collisions Statistics

The section of the N4 under consideration passes through both rural and urban environments, is approximately 21km long and extends from Drumharlow townland north of Carrick-on-Shannon to Faulties townland south of Aghamore. Figure 4.1 below outlines the study area boundary and the path of the existing N4. The N4 currently crosses the River Shannon at Carrick-on-Shannon via a narrow masonry arch bridge, dating from 1846, which is sub-standard in terms of alignment and cross-section. Carrick-on-Shannon remains the only regional strategic centre on the N4 between Dublin and Sligo which has not been bypassed to date.

The geographical distribution of collisions along the existing N4 mainline within the area under consideration, from 1996 to 2016, is also presented in Figure 4.1 below. 59 collisions were recorded by the Road Safety Authority (RSA) along this section of the national road during this time. A red marker denotes a fatal collision. yellow and green markers signify collisions where serious and minor injuries were sustained respectively.

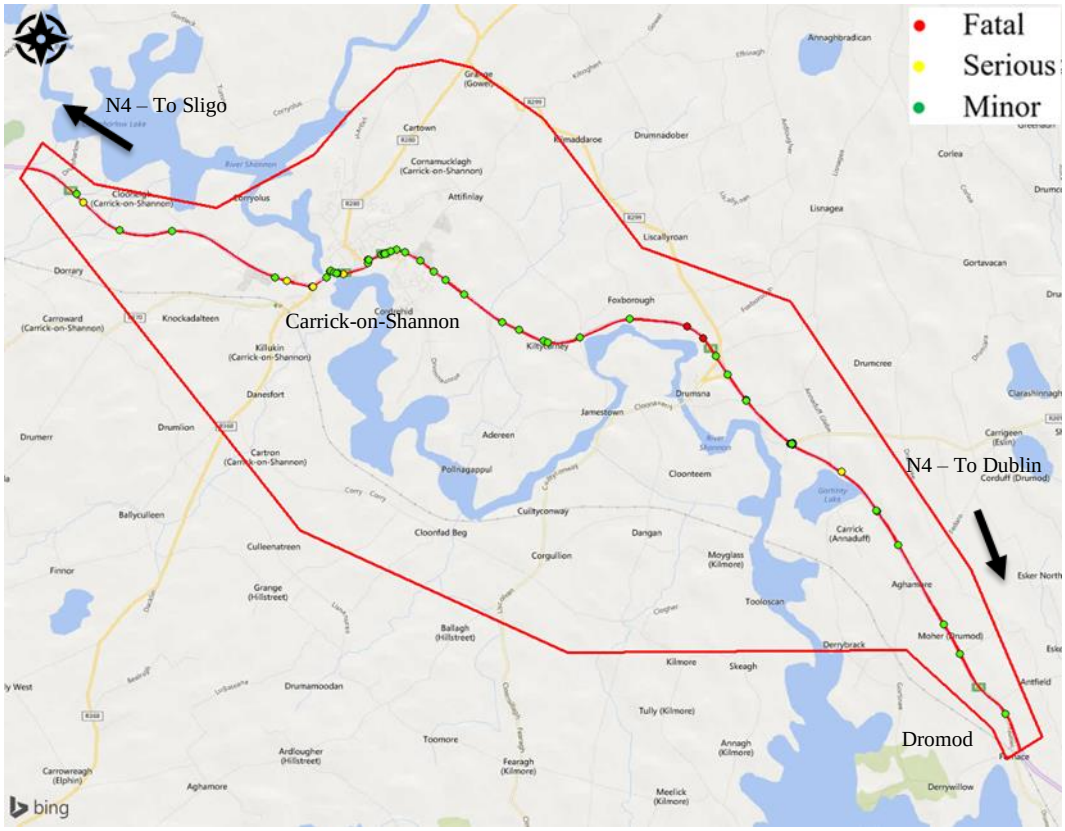


Figure 4.1: Distribution of collisions along existing N4 mainline

The recorded injuries and casualties resulting from collisions which occurred from 1996 to 2016 are shown in Table 4.1 below. Table 4.2 presents the collisions statistics for the same accidents.

Table 4.1: Existing N4 Collision Casualties (1996 - 2016)

Year	Fatality	Serious Injury	Minor Injury	Injury (Unknown Severity)
1996	0	0	1	0
1997	0	0	2	0
1998	0	0	8	0
1999	0	0	2	0
2000	0	0	2	0
2001	0	1	2	0
2002	0	1	1	0
2003	0	0	6	0
2004	0	0	0	0
2005	1	0	4	1
2006	0	2	0	0
2007	2	1	1	2
2008	0	1	2	0
2009	0	0	4	0
2010	0	0	5	0
2011	0	0	13	0
2012	0	0	7	0
2013	0	0	2	0
2014	0	0	0	0
2015	0	0	11	0
2016	0	0	6	0
Total	3	6	79	3

Table 4.2: Existing N4 Collision Statistics (1996 - 2016)

Total No. Collisions	**59**		
Time of Day			***Study Area Averages***
AM Peak (07:00-10:00)	6	10.17%	*8.56%*
PM Peak (16:00-19:00)	17	28.81%	*22.99%*
Outside Peaks	36	61.02%	*68.45%*
Collision Type			
Pedestrian Involvement	7	11.86%	*20.86%*
Single Vehicle Collision	16	27.12%	*21.39%*
Rear-End Collision	11	18.64%	*19.79%*
Head-On Collision	10	16.95%	*14.44%*
Other	15	25.42%	*23.53%*
Road Characteristics			
Straight	44	74.58%	*61.50%*
Bend	7	11.86%	*18.18%*
Hill/Crest	0	0.00%	*1.07%*
Gradient	2	3.39%	*3.21%*
Other	6	10.17%	*16.04%*
Vehicle Type			
Private Car	73	N/A	*N/A*
Goods Vehicle	4	N/A	*N/A*
Other	18	N/A	*N/A*
Weather			
Dry	36	61.02%	*70.05%*
Other	23	38.98%	*29.95%*

The most recent validated available collision data available from the RSA covers up to 2016. Additional data covering 2017 to 2019 received from TII, however, yet to be validated by the RSA, illustrates that 13 further collisions occurred on the N4 mainline from during this period; four of which caused serious injuries. One of these serious collisions happened in 2019 within the Carrick-on-Shannon urban area on the N4 inner relief road.

4.2 Statistical Analysis

3 fatalities were recorded, 6 individuals were seriously injured, while 79 more sustained minor injuries. 3 others were also injured, but the severity of these injuries is unknown. It is noted that the total number of collisions is less than the overall number of casualties on account of multiple people being involved in a single collision.

The most common collision type was a single vehicle collision, accounting for 27.12% of the total. The vast majority of the overall collisions, 44 of 59, occurred where the road was classified as straight on the collision data reports (refer Table 4.2). 73 private cars were involved across the 59 recorded collisions. Approximately 61% of all collisions happened when weather conditions were described as dry.

Between 1996 and 2016 collisions were recorded at 11 of the 197 accesses direct access onto the N4; at 6 farm accesses, at 4 commercial accesses and at 1 domestic access. Such a distribution may be expected as farm access account for the vast majority of access along the road. Although there are more domestic than commercial accesses along the road, the daily footfall through an access to a dwelling would most likely be significantly less than that to a commercial premises.

Other collisions were recorded at the junctions to L5131, L5078, Drishoge Road, R368, Shannon View Road, R903, Cryans Hotel junction, R280, L3412, L3656, L7426, R229, L7661, L3630, R201, L7472, L1601. One or more collisions occurred at each of the junctions to all 4 regional roads along the road under consideration; 3 of which are roundabouts.

4.3 Findings of Analysis

The 3 fatalities that occurred on the N4 within the study area were a result of 2 separate head-on collisions in the townland of Mountcampbell, northwest of Drumsna, approximately only 300m apart. This section of the N4 where both accidents took place is on a bend and has a speed limit of 100 km/h.

Of the 5 collisions that seriously injured 6 individuals (and caused minor injuries to 3 others), 2 were single vehicle accidents, 1 was a head-on conflict, 1 was an angled right turn and 1 involved a pedestrian. The incident involving the angled right turn occurred at the roundabout junction with the R368 in Cortober and seriously injured 2 individuals.

59 collisions were recorded from 1996 to 2016 on the length of the N4 under consideration. 26 of these occurred in the urban area of Carrick-on-Shannon. Single vehicle and straight road accidents were the most common collision and road characteristic type. Such accidents can often be the result of driver error, a deficiency in the road infrastructure and/or weather conditions.

7 collisions occurred at the staggered crossroads between the N4, R201 and L3630 alone, north of Gortinty Lake in the Annaduff townland. This junction includes raised islands, is within a Do Not Pass section and the N4 mainline speed limit is 100 km/h in the area.

5 Pavement Assessment

5.1 Historic N4 Improvement Works / Pavement Schemes

There has been a number of improvement works that have been carried out on the N4 since it was first constructed. Various re-surfacing works have occurred and the N4 road has also changed with new bypasses which were constructed throughout the years. Some of the larger schemes are listed below.

- Mullingar bypass – 1994
- Longford bypass – 1995
- Drumsna, Jamestown bypass– 1997
- Collooney, Ballisodare bypass – January 1998
- Edgeworthstown bypass – July 2006
- Dromod, Roosky bypass – December 2007
- In 2013, a dual carriageway stretching 5km was upgraded to high-quality dual carriageway, between the M4 and the Mullingar bypass
- A re-surfacing scheme for a 2km section of the N4 at Cooleeny in Longford
- During November of 2019, roundabout enhancement works were carried out on the Tomiskey Roundabout, Rooskey.
- Within the town of Carrick-on-Shannon, there has been improvements to the pavement. This can be seen in several parts of the town that they have been re-surfaced
- A section of the N4 within Sligo town has also seen improvements. The scheme consisted of the upgrade of the existing N4-N15 urban dual carriageway

5.2 Existing Pavement Construction

Within the study area of the N4 Carrick-on-Shannon to Dromod Project, there are re-surfacing works which are currently being carried out by Leitrim County Council. This will see a 6km section of the N4 re-surfaced, from the local road L-3657-1 in Corbally to Annaduff.

West of Carrick-on-Shannon, there is another scheme which aims to improve the road conditions of the N4. The scheme will provide just under 14km of Type 2 Dual Carriageway between Collooney and Castlebaldwin. This is currently under construction.

The proposed N4 Mullingar to Longford (Roosky) Road Scheme is currently at Phase 2 Option Selection. It is envisaged that the scheme will determine a transport solution for circa 50km of the N4 national primary road between the N4 Dromod-Roosky Bypass and the N4 Mullingar Bypass.

5.3 Visual Assessment

A windshield survey was undertaken by the project team on Friday 29 May 2020 when the weather was dry and bright. In general, the existing pavement is in fair condition across the scheme. There are some locations however where the surface looks weathered and cracks are found along the surface, these are found particularly on the east side of the study area, close to Drumsna and Annaduff. Road markings are also worn on some parts and can be difficult to see.

Within the town Carrick-on-Shannon the pavement is in very good condition. This is because a number of roads have recently been re-surfaced within the town.

5.4 International Roughness Index (IRI)

From the survey data received from the TII in June 2020, the International Roughness Index (IRI) generally obtained a value of less than 2.5m/km which is considered to be a good condition for roads. There are however a few areas which have poorer conditions, in particular the section of the road from Aghamore Village to the east side of Carrick-on-Shannon. This section of the road received mixed results from the survey with some areas having very poor roughness of 3m/km. The full survey results are attached in Appendix B.

5.5 Sideways Coefficient Routine Investigation Machine (SCRIM)

A Sideway-force Coefficient Routine Investigation Machine (SCRIM) is used to measure the skid resistance of a road. From the SCRIM data received from TII, a Characteristic SCRIM Coefficient (CSC) was obtained for every 100-metre interval of this portion of the N4. The CSC is an estimate of the underlying skid resistance once the effect of seasonal variation has been taken into account. This data presented the results from a SCRIM Survey of the national primary and secondary road network which was carried out in 2017. The average CSC value is 0.457.

The CSC value was then compared to the Investigatory Level to determine the nature of the site and where the skid resistance of the road is at or below the Investigatory Level. The Investigatory Level was obtained from Table 4.1 of TII's AM-PAV-06045. The site category for the N4 is a "Non-event carriageway with two-way traffic" and with traffic greater than 2500 commercial vehicles/ lane/ per day, the Investigatory level at 50km/hr is 0.4.

Site Category and Definition		Investigatory Levels for CSC data (Characteristic Skid Coefficient data speed corrected to 50km/h and seasonally adjusted)						
Rural Site Categories (> 60km/h)		0.30	0.35	0.40	0.45	0.50	0.55	0.60
A	Motorway							
B	Non-event carriageway with one-way traffic							
C	Non-event carriageway with two-way traffic							
Q	Approaches to and across major and minor junctions, Approaches to roundabouts (see note 5)							
K	Approaches to traffic signals, pedestrian crossings and railway crossings (see note 5)							
R	Roundabout (see note 6)							

Traffic ≥ 2500 vehicles per lane per day

Traffic < 2500 vehicles per lane per day

Figure 5.5: Site Categories and Investigatory Levels

Comparing the CSC values with the Investigatory Level values, on average the CSC values are 0.457, which is larger than the Investigatory Level, 0.4. There are however some sections which are below the investigatory level.

5.6 Cracking

From analysing the survey results attached in Appendix B, it was found that there was a very small amount of alligator cracking found along the road. When looking at the longitudinal and transverse cracking there are some small cracks found along the road of less than 2m².

6 Structures

6.1 Existing Structures

There are two large existing structures on the N4 within the study area boundary as shown on Figure 6.1. The Carrick-on-Shannon River Shannon Bridge is located to the northwest of the study area. The five arch stone bridge which has an approximate width of 8m, which includes footpaths and the parapet. The carriageway varies between 5.4 and 5.8m in width and the bridge spans 62m, carrying the N4 across the River Shannon. In 2009, a 2.6m wide cantilevered pedestrian and cycle footbridge was constructed on the northern face of the bridge.

The other large structure in the study area is the Drumsna overbridge which carries the R299 over the N4 carriageway. The R229 which links Drumsna to Leitrim Village also provides access to the grade separated junction with N4. The bridge has an approximate height, width and span of 7m, 10m and 52m. The bridge has a single pedestrian footpath on the northern side of the carriageway.

Figure 6.1: Large Structures on the existing N4

In addition to the large structures described above there are seventeen crossings of minor water courses as shown in Figure 6.2 below and detailed in Table 7.1 of Section 7 – Drainage.

Figure 6.2: Minor water course crossing on the existing N4

7 Drainage

Given the N4's close proximity to the River Shannon and its associated floodplains and extensive flooding issues, careful consideration of the drainage design associated with any works or proposals is required.

7.1 Existing Road Drainage Summary

In general drainage of the existing carriageways consists of a combination of over the edge drainage, open ditches and kerb and gully systems within the urban areas. Surface water storage ponds are not obvious from desktop studies. Further investigation of the existing drainage networks and drainage storage and treatment facilities will be undertaken in subsequent phases.

7.2 Existing Watercourse Crossing

In addition to the River Shannon, the N4 crosses 17 additional watercourses ranging from small rivers and streams to seasonal field drains. Table 7.1 below lists each watercourse by its EPA name and crossing location.

Table 7.1: Existing N4 watercourse crossing within the study area

ID	EPA Name	Approx. Chainage	Description	Point X (ITM)	Point Y (ITM)
1	Ardglass Stream	0+850		589724.5655	800566.3257
2	Woodbrook House Stream	1+400	Field drain	590198.6997	800130.8735
3	Clooneigh 26	2+600	Field drain	591199.2953	799973.5068
4	n/a	3+550	Field drain	592107.9424	799679.6864
5	Knockadalteen 26	4+150	Field drain	592613.5977	799376.6334
6	Knockananima	4+200	Field drain	592665.6157	799351.488
7	Attifinlay	6+350	Field drain	594445.9377	799570.281
8	Aghancarra	7+200	Field drain	595384.5996	799334.1379
9	n/a	7+750	Possible field drain	595765.8011	799045.373
10	Kilmaddaroe	8+300	Field drain	596237.4037	798688.8952
11	Kiltycarney	10+300	Field drain	598012.7791	798476.8285
12	Lismoyle 26	10+900	Field drain	598587.1456	798603.4484
13	Unnamed	11+800	Field drain	599378.1844	798463.8642
14	Kildorragh 26	11+850	Field drain	599449.1597	798421.2132
15	Drumsna	13+300	Field drain	600308.7728	797265.2626
16	Unnamed	14+600	Field drain	601416.2445	796416.22
17	Gortinty	16+400	Field drain	602598.5698	795135.1493

7.3 Flood Risk

Figure 7.1, Figure 7.2 and Figure 7.3 below show the 10%, 0.5% and 0.1% Annual Exceedance Probability (AEP) for fluvial flooding depths and the local river network within the study area. The maps show the maximum estimated extent of flooding for flood events with 10, 200 and 1000 year return periods respectively. It is clear, given the flood extents below and the flooding history in the area there is a significant flood risk within the study area and also along the existing N4. Note that the flood risk zones presented do not include an allowance for climate change and the more extreme flood events associated as a result.

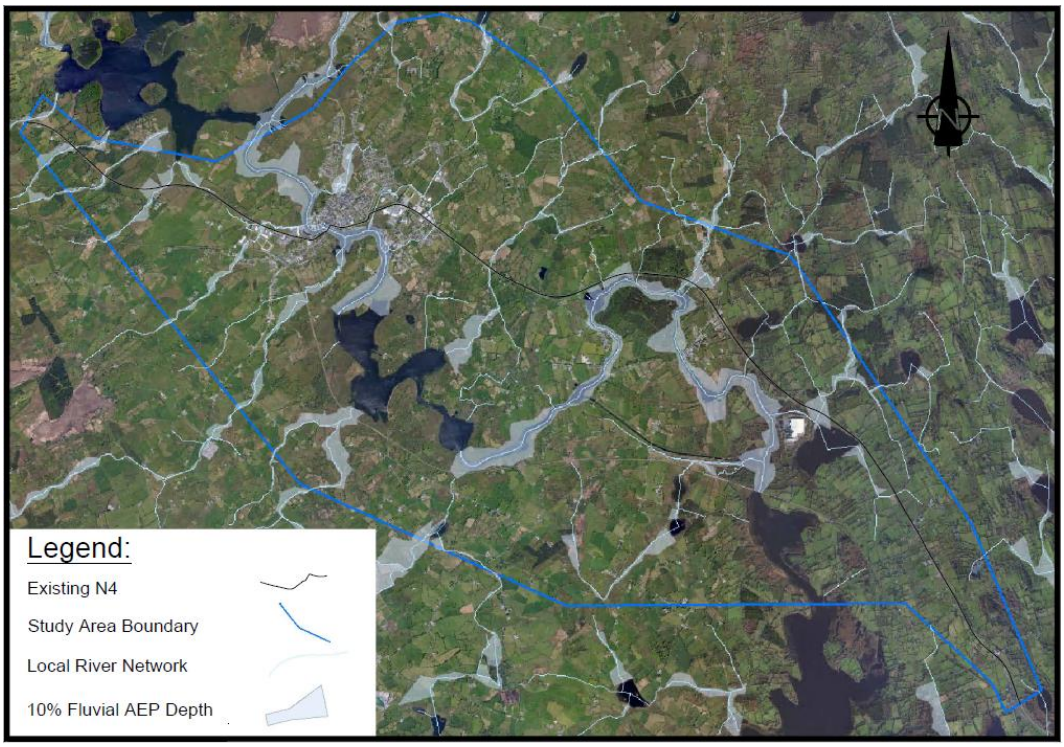


Figure 7.1: Local rivers and 10% fluvial AEP depth for study area

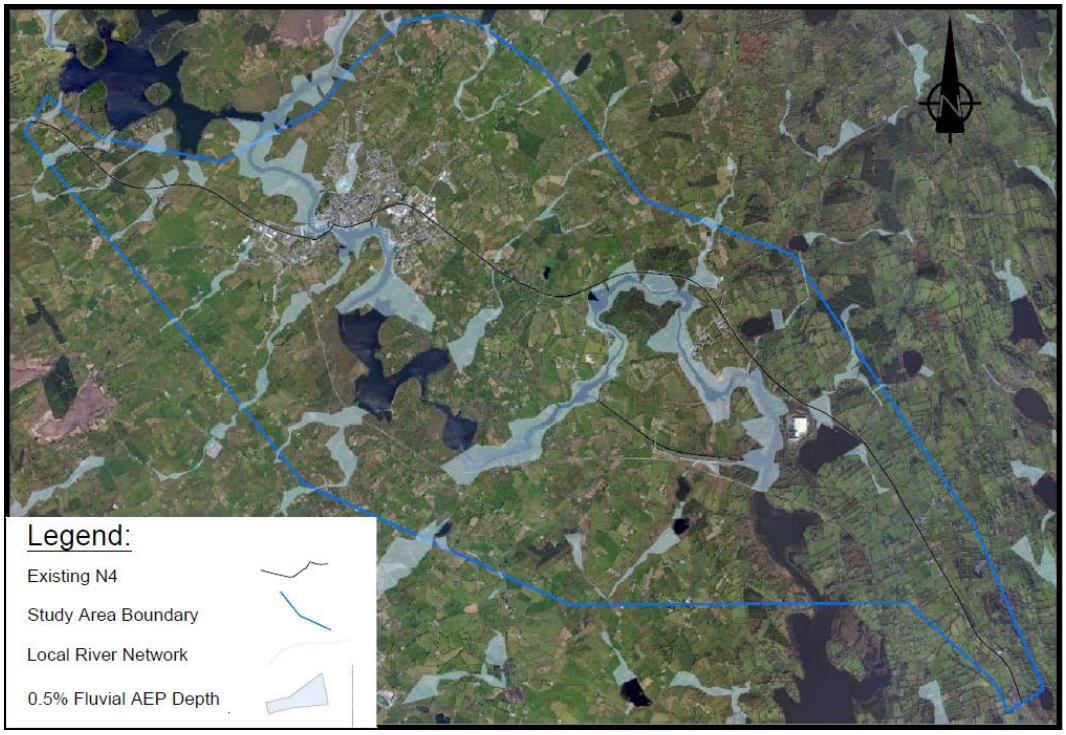


Figure 7.2: Local rivers and 0.5% fluvial AEP depth for study area

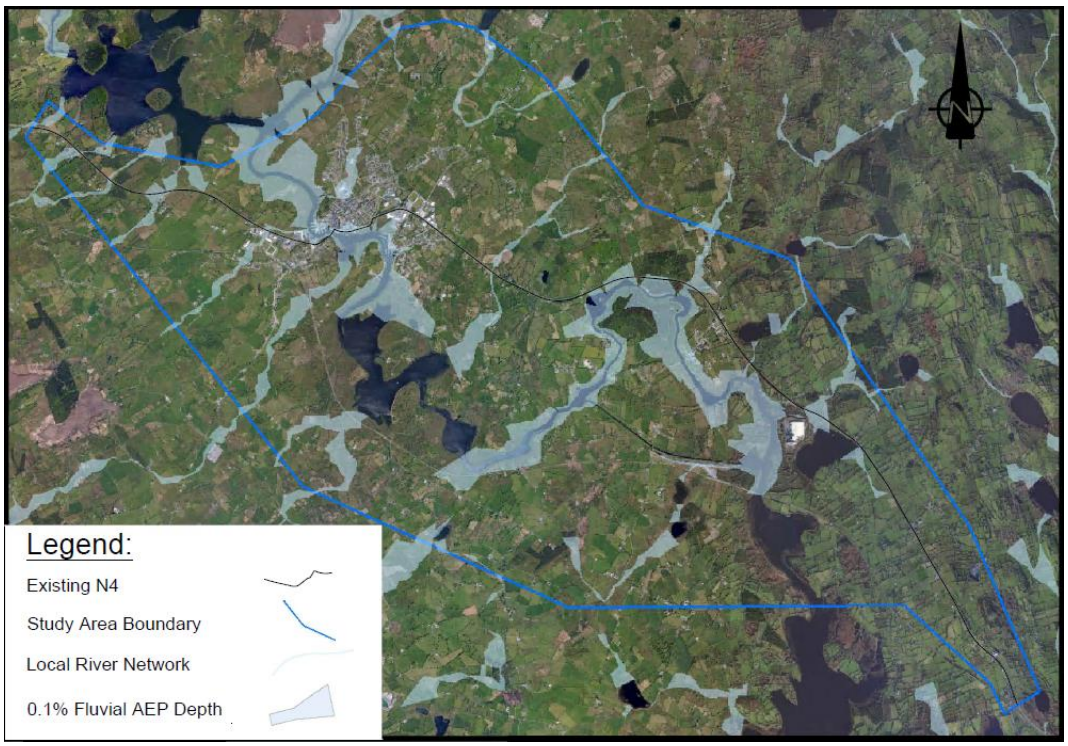


Figure 7.3: Local rivers and 0.1% fluvial AEP depth for study area

There is a flood risk on the existing N4 given that the River Shannon meanders through the study area in a north-south direction with the N4 in close proximity to

the river and its floodplain at various points. In addition to the River Shannon, the N4 crosses 17 additional watercourses ranging from small rivers and streams to seasonal field drains in the study area.

In the period 1999 to 2017, traffic flow and the serviceability of the N4 along the section under consideration was seriously affected for extended durations. Flooding has led to the closure and associated diversion of the road on three separate occasions, with the N4 being closed for a period of 19 days in November 2009.

In December 2017, the closure of the N4 immediately north of the bridge required traffic travelling north to divert via Roosky along the R371 regional road, N5 national primary road and the N61 national secondary road before re-joining the N4 at Boyle adding approx. 20km to the journey. Southbound traffic diverted at Ardcarne along regional roads R285, R284, R280 and R299 before joining the N4 at Drumsna adding approx. 12km to the journey. While the northbound diversion road can accommodate national road traffic in the short term the southbound diversion road is wholly inadequate for anything other than emergencies.

8 Utilities

8.1 Electricity 38kV/110kV/220kV

Figure 8.1 below shows the high voltage 38kV, 110kV and 220kV ESB lines around Carrick-on-Shannon. Many of these lines converge at the 110kV sub-station adjacent to Carrick-on-Shannon railway station.

In total within the study area, there are:

- Three 38kV lines coming from Claremorris, Gorteen and Mohill which converge at the Carrick-on-Shannon 110kV substation
- Six 110kV lines, four of which converge at the Carrick-on-Shannon 110kV substation. Of these four, one connects to Corderry and another to Arva and the final two originate from the large Flagford 220kV station on the L1034 approximately 3km southwest of Carrick-on-Shannon. Two other 110kV lines pass through the study area, both originating from the large Flagford 220kV station, they connect to Sligo and the Masonite site south of Drumsna
- One 220kV line which passes through the southern portion of the study area travelling from Arva to the Flagford 220kV station

All of these lines are overhead lines, except for a 1.5km section of the 38kV line connecting Carrick-on-Shannon and Mohill which goes underground through the Cnoc Na Sí housing estate before emerging on the other side of the N4.

The ESB high voltage network does not follow the path of the existing N4 but crosses the national road in five locations. Two overhead (OH) lines cross the N4 west of Cortober, in Cloonman and Cloonskeevan, one crosses just east of Carrick-on-Shannon in Lisseeghan and one crosses overhead in Moher. One high voltage underground (UG) power line crosses the existing N4 at the Cnoc na Sí housing estate, also in Lisseeghan. Further to the power lines crossing, there is a short 125mm diameter ESB duct that crosses the existing N4 just west of the River Shannon Bridge.

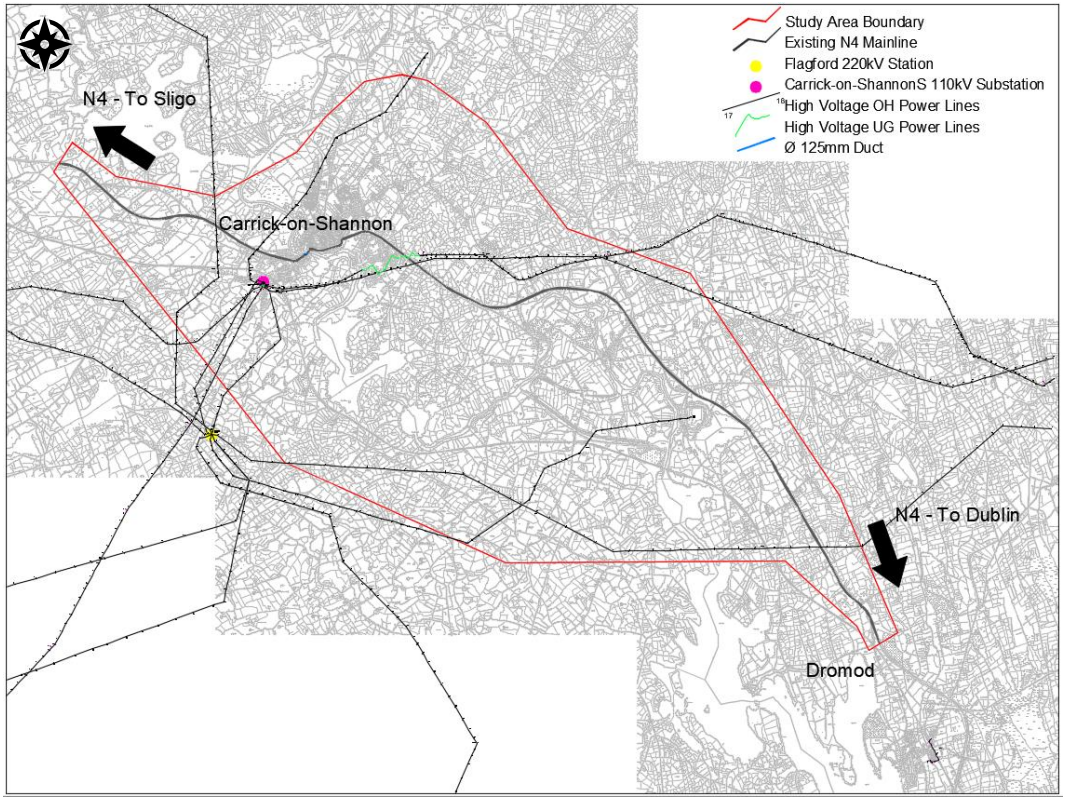


Figure 8.1: High voltage power lines in proximity to Carrick-on-Shannon

8.2 Watermains

The watermains network and group water scheme (GWS) within the study area are shown in Figure 8.2.

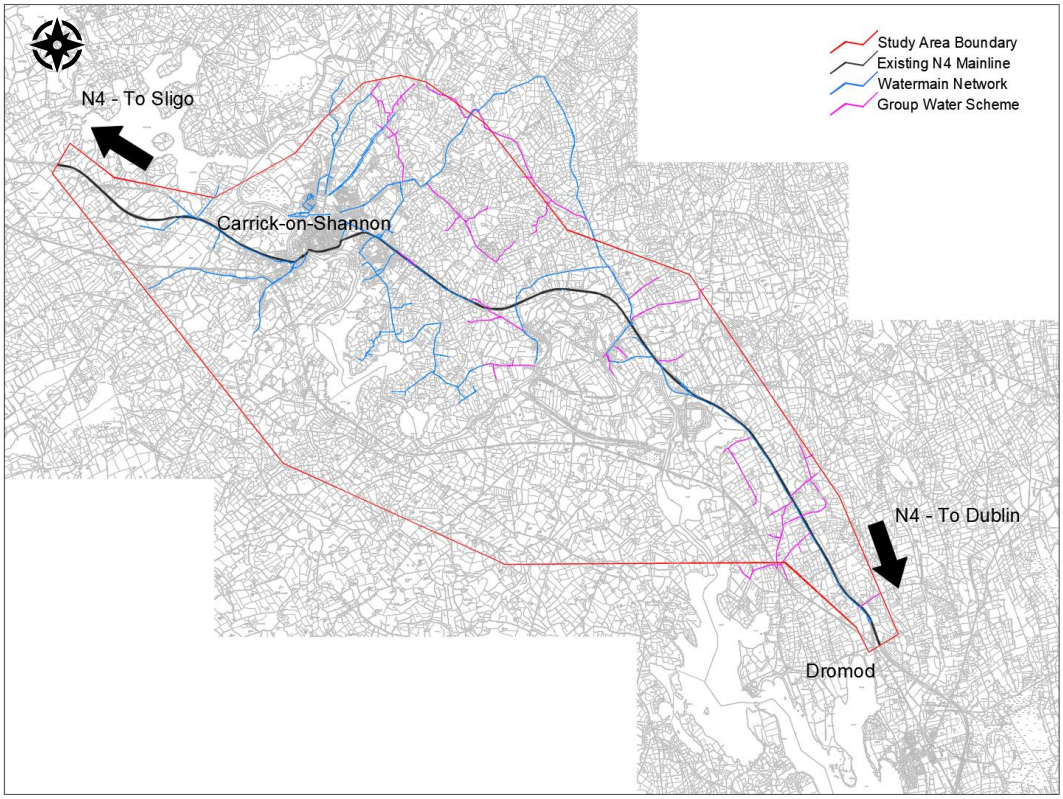


Figure 8.2: Watermains and Group Water Scheme within Study Area

Watermains are shown along much of the N4 mainline; from Cloonman to Cortober, Carrick-on-Shannon to Tully and Mountcampbell to Fearnaght. The GWS branches from the watermains to other areas and connects the watermains in some areas. Aside from the N4, watermains are present along the regional roads R299, R280, R368 and R370, and on many other local roads.

8.3 Public Sewer

The foul water network within the study area is shown in Figure 8.3, where the location of Carrick-on-Shannon wastewater treatment plant (CoS WWTP) is also illustrated.

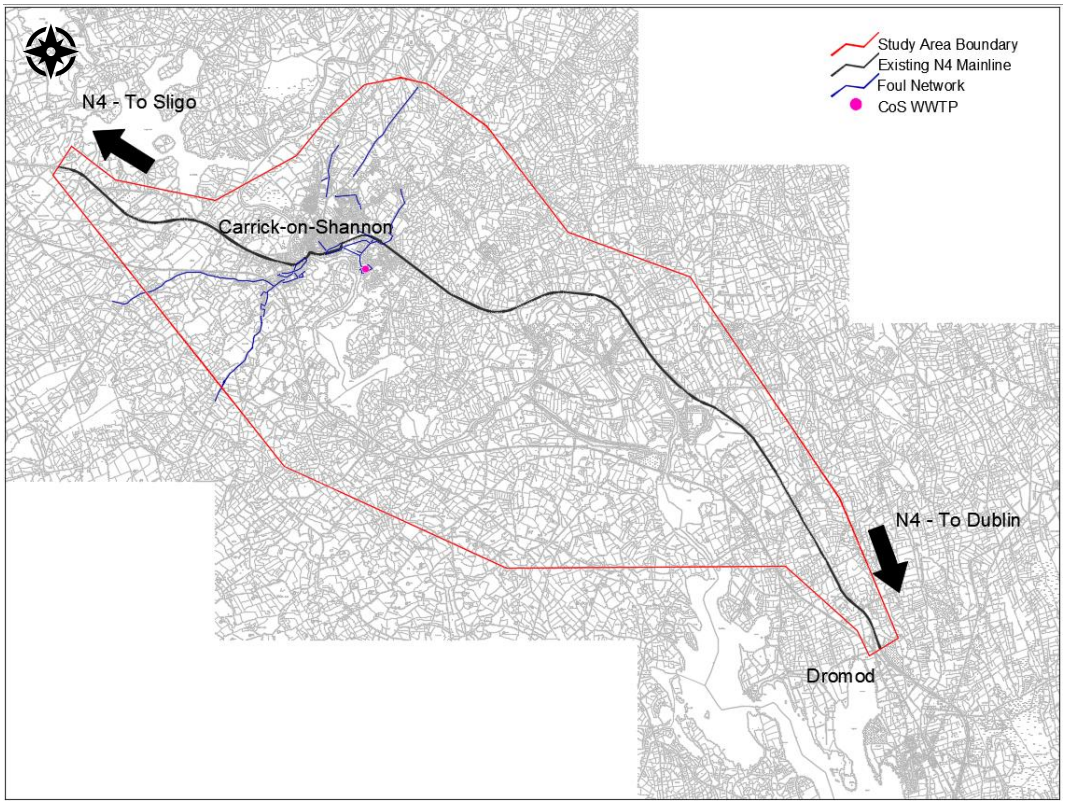


Figure 8.3: Foul water network within Study Area

The foul water network is largely based around Carrick-on-Shannon town, which is indicative of a large number of septic tanks or other private systems in the nearby rural communities. The public network runs by the mainline of the N4 from the R368 junction to the bridge, along the N4 inner relief road to the south of the town and crosses the N4 east of the Castlecara Road (L3408) junction. CoS WWTP is located on the L3655 between Priors Point housing estate and Burke's Funeral Directors in the townland of Attirory.

8.4 Telecoms

The telecommunication networks' infrastructures in the vicinity of the study area are shown in the figures below. Figure 8.4 outlines Eircom's network, Figure 8.5 illustrates the broadband network infrastructure, and Figure 8.6 gives the locations of Vodafone's mobile phone antennas within study area.

Eircom has the most extensive network and follows the path of the existing N4 for most of the road within the study area. The broadband network also follows the path of the N4 from Cloonman, through Carrick-on-Shannon, past the L3408 junction and again from the L7426 junction through to Faulties.

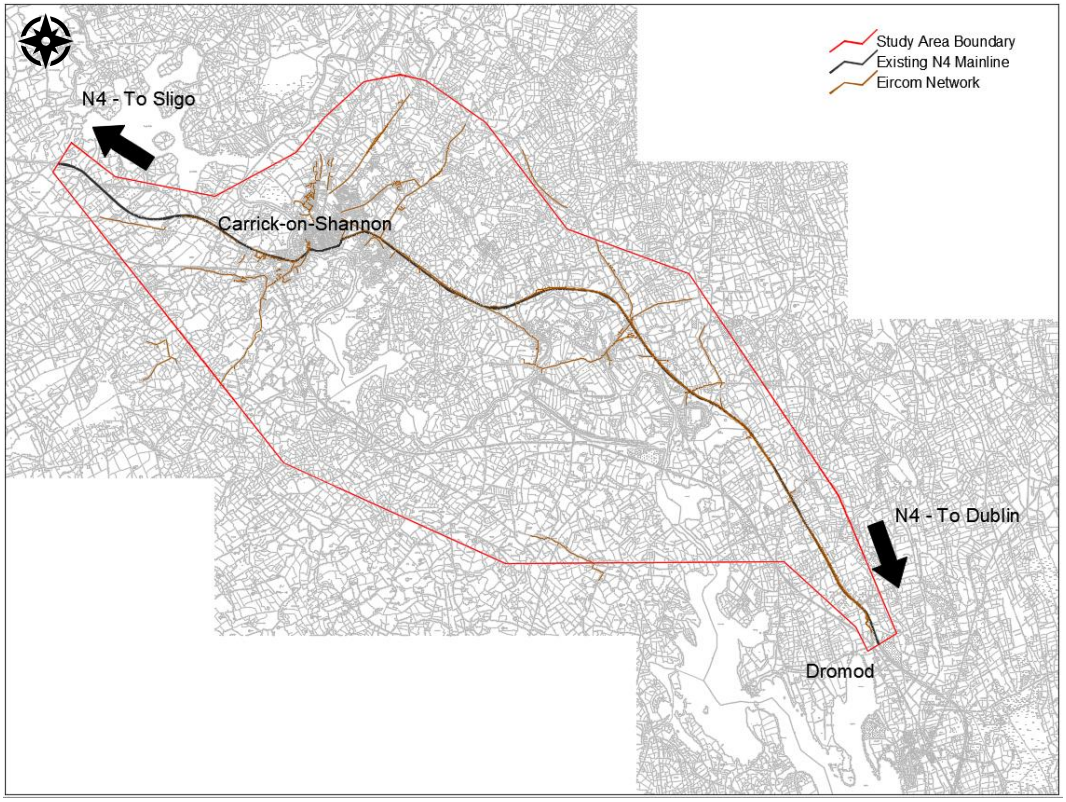


Figure 8.4: Eircom Network within Study Area

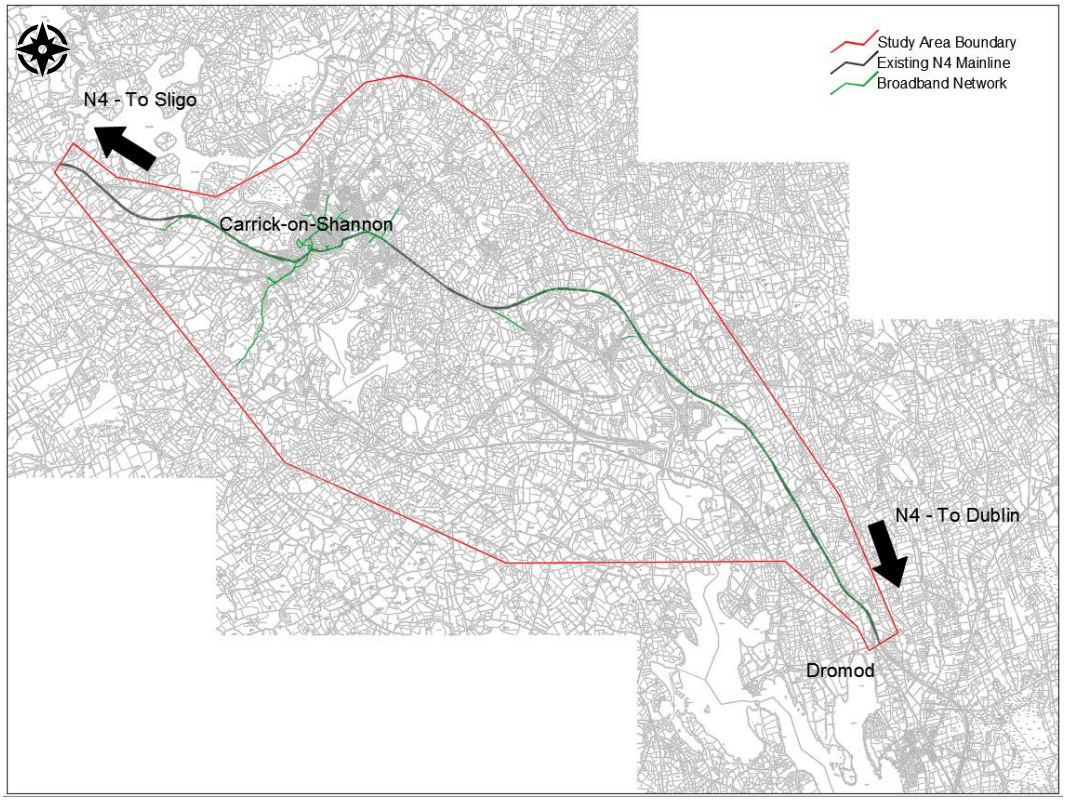


Figure 8.5: Broadband network infrastructure within Study Area

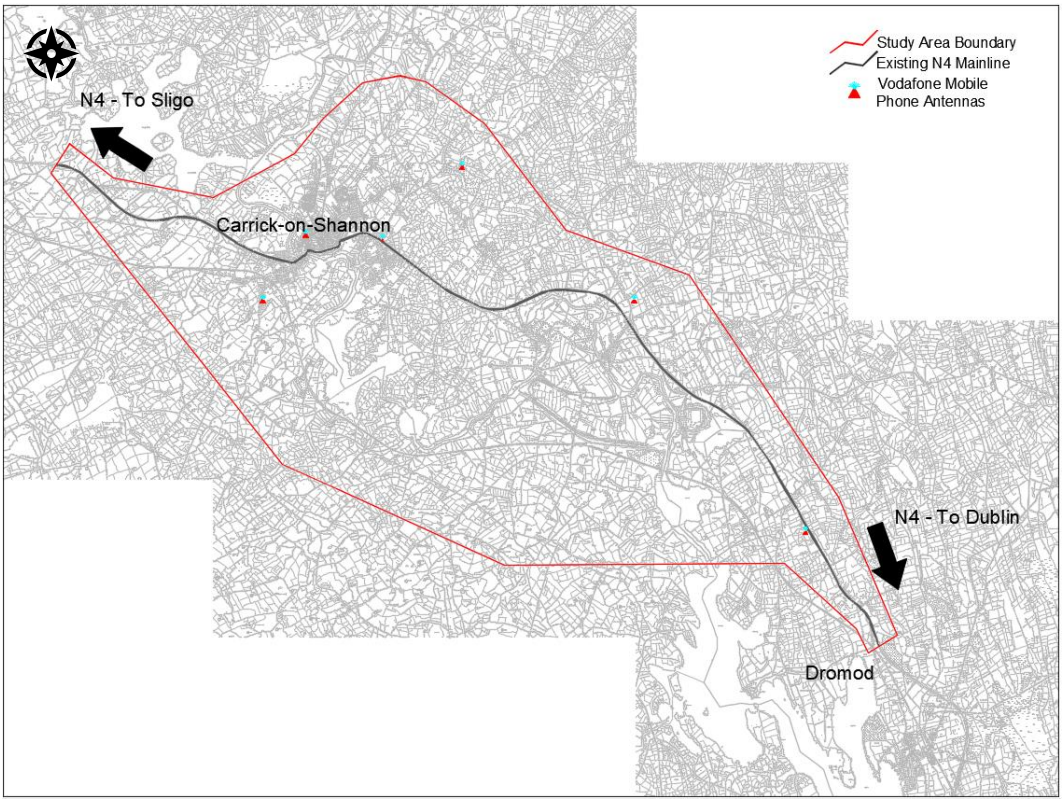


Figure 8.6: Vodafone Mobile Phone Antennas within Study Area

8.5 Gas Networks Ireland

Figure 8.7 below shows Gas Networks Ireland's (GNI) infrastructure across the island of Ireland. The Carrick-on-Shannon to Dromod Project initial study area is shown in red, and there is no conflict between this area of interest and the GNI network.

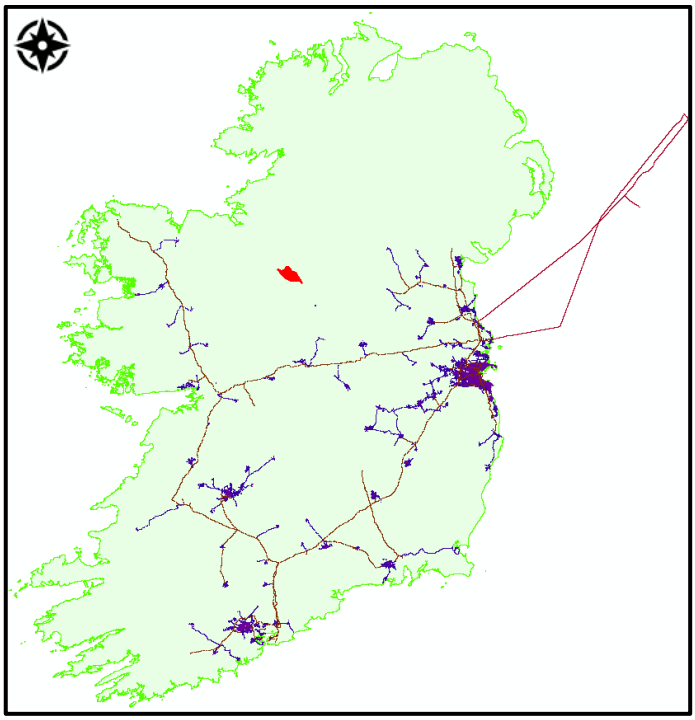


Figure 8.7: Gas Networks Ireland's infrastructure

8.6 Public Lighting

The extents of public lighting within the study area is shown in Figure 8.8.

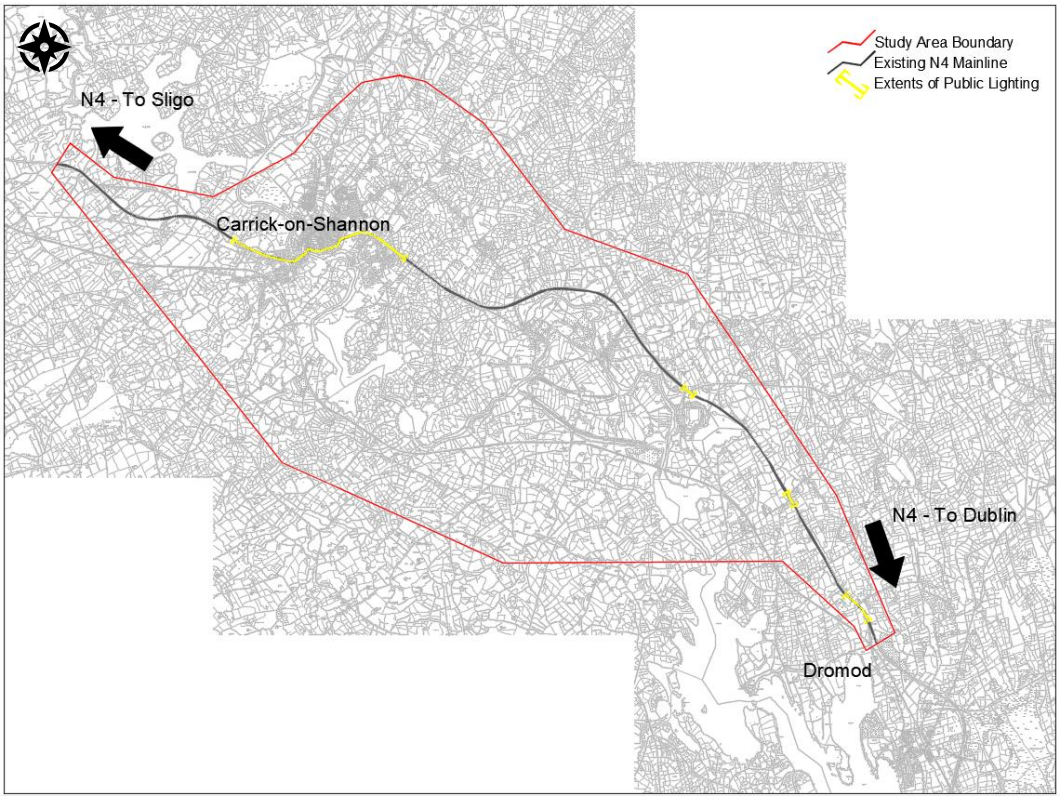


Figure 8.8: Public Lighting within Study Area

Lighting is provided along the existing N4 corridor within the 50km/h and 60km/h zones in Carrick-on-Shannon (between Cloonman and Lisseghan), at the staggered crossroads between the N4, R201 and L3630, Aghamore Village and in the townlands of Fearnaght and Faulties.

9 Summary and Conclusion

This section summarises the findings of the report and concludes with the problems and issues on the existing N4 mainline within the study area.

9.1 Summary of Findings

There are 197 direct access and 52 junctions identified along the 21km of the existing N4 under consideration. The majority of access are farm access (113) while there is also a high number of direct domestic access (58). There are 44 local road junctions and 5 regional road junctions. The R299 grade separated junction includes 4 on and off slip roads. These junctions and access are located along the entire length, however, are most densely populated within or immediately outside the major towns of Carrick-on-Shannon and Aghamore.

The horizontal alignment of the existing N4 under consideration is quite poor, with a high sinuosity index value, and a significant portion of the mainline consisting of substandard curvature.

- Average Sinuosity Index value 1.025
- 13 of 27 curves are substandard in respect of the TII standard
    - Three curves two steps or further below desirable minimum radius
    - 10 Band C curves contributing to dubious overtaking conditions

The vertical alignment of the existing N4 within the study area is generally good, with only four curves which fall below TII's desirable minimum K values.

The primary existing structures on the N4 within the study area are the River Shannon Bridge and the R299 overbridge at Drumsna. Just west of the River Shannon Bridge there are two horizontal curves four steps or more below desirable minimum radius, and the crest curve on the bridge itself is two steps below minimum desirable value. The carriageway varies in width between 5.4m and 5.8m, with narrow footpaths on either side. The River Shannon Bridge and its approaches are extremely sub-standard for a contemporary road.

In general, the existing pavement condition is in fair condition across the scheme. Some areas have been recently upgraded, but in other parts the pavement is weathered, and line markings are worn. This is the case particularly near Drumsna and Aghamore. When looking at the International Roughness Index values for the road, it is clear that the section from Aghamore Village to the east side of Carrick-on-Shannon is in poor condition. The skid resistance of the road is generally at the standard for this type of road.

There is a significant flood risk on the existing N4 as the River Shannon flows through the study area. The N4 is in close proximity to the river and its floodplain at various points. In addition to the above major structures there are 17 existing minor water course crossing along the N4 within the study area. From 1999 to 2017, traffic flow and the serviceability of the N4 along the section under consideration was seriously affected by flooding for extended durations. Flooding has led to the closure and associated diversion of the road on three separate occasions. Necessary

diversions along the regional road network have added up to 20km to journeys as a result of closures due to flooding. While the northbound diversion road along the R371, N5 and the N61 can accommodate national road traffic in the short term, the southbound diversion road along regional roads R285, R284, R280 and R299 is wholly inadequate for anything other than emergencies.

59 collisions were recorded from 1996 to 2016 on the length of the N4 under consideration. 3 fatalities were recorded, 6 individuals were seriously injured, while 79 more sustained minor injuries.

- Two fatal collisions on the 100km/h band C curve in Mountcampbell
- Seven collisions at the staggered crossroads between N4, R201 and L3630

26 collisions in Carrick-on-Shannon urban area; three caused serious injuries Additional data covering 2017 to 2019 received from TII, however, yet to be validated by the RSA, illustrates that 13 further collisions occurred on the N4 mainline during this period; four of which caused serious injuries. A collision on the N4 inner relief road in Carrick-on-Shannon caused serious injury in 2019.

9.2 Conclusions

There are a number of road safety issues along the section of the N4 under consideration, as a result of a high frequency of direct accesses and junctions and a number of sections of poor alignment.

As may be expected, accesses and junctions are most concentrated within urban areas but are found all along the mainline within the study area. Many collisions have occurred at these points and some have caused serious injuries to passengers, pedestrians and other vulnerable road users.

The horizontal alignment of the existing N4 is quite poor, with a significant amount of substandard, Band C, curvature. Band C curves are not recommended as such curves provide long sections with dubious overtaking conditions. Two fatal collisions were recorded on a band C curve in Mountcampbell.

Although the vertical alignment of the N4 in general is quite good, the substandard crest curve on the River Shannon Bridge along with undesirable horizontal curvature on approach, and an extremely narrow carriageway raises safety concerns here. The single, substandard, and outdated river crossing can also be detrimental to traffic flow.

Flooding has led to the closure of the N4 road on several occasions and the associated diversions have been known to add up to 20km to journeys as a result. The existing N4 crosses many small rivers, streams and seasonal field drains in the study area. Given the N4’s proximity to the River Shannon and its associated floodplains, the flood risk and potential for future closures of the national primary road is undesirable.

Appendix A

Junction and Access Schedule

A1

Table A1 – Access Schedule

Reference	Type	Side	Description	POINT_X	POINT_Y
001	Farm Access	LHS	Access to fields	589387.2576	800857.9414
002	Farm Access	RHS	Access to fields and farm yard	589472.8152	800782.6055
003	Domestic Access	RHS	Access to dwelling	589482.8297	800775.1575
004	Domestic Access	RHS	Access to dwelling	589502.2329	800759.7071
005	Farm Access	RHS	Access to fields	589533.1363	800732.1198
006	Farm Access	LHS	Access to fields	589556.2874	800731.3922
007	Domestic Access	RHS	Access to dwelling	589742.819	800538.1799
008	Farm Access	LHS	Access to fields	589993.6357	800327.4873
009	Domestic Access	RHS	Access to dwelling	590239.5391	800092.8799
010	Farm Access	LHS	Access to fields	590253.7208	800099.9708
011	Farm Access	RHS	Access to fields	590251.7099	800084.4132
012	Farm Access	LHS	Access to fields	590692.5807	799932.3304

Reference	Type	Side	Description	POINT_X	POINT_Y
013	Farm Access	RHS	Access to fields	590691.3901	799916.6142
014	Farm Access	LHS	Access to fields	591322.3379	799990.5336
015	Farm Access	RHS	Access to fields	591595.8647	799944.8135
016	Farm Access	RHS	Access to fields and farm yard	591760.7799	799890.0446
017	Farm Access	LHS	Access to fields	591768.4793	799903.6178
018	Domestic Access	RHS	Access to dwelling	591876.6544	799831.5319
019	Domestic Access	LHS	Access to dwelling	592123.4794	799679.1422
020	Farm Access	RHS	Access to fields	592271.4426	799556.7775
021	Farm Access	RHS	Access to fields and farm yard	592378.3715	799492.2587
022	Domestic Access	RHS	Access to dwelling	592402.9778	799477.5187
023	Farm Access	LHS	Access to fields	592439.9535	799472.7385
024	Commercial Access	RHS	Access to commercial premises	592450.214	799449.651
025	Domestic Access	LHS	Access to dwelling	592459.1834	799462.2187

Reference	Type	Side	Description	POINT_X	POINT_Y
026	Farm Access	LHS	Access to fields	592479.5387	799449.7092
027	Domestic Access	LHS	Access to dwelling	592516.0407	799430.6777
028	Farm Access	LHS	Access to fields	592688.2451	799346.2093
029	Domestic Access	RHS	Access to dwelling	592737.6961	799307.7915
030	Farm Access	LHS	Access to fields	592773.0445	799308.8498
031	Farm Access	LHS	Access to fields	592886.4981	799266.5164
032	Farm Access	LHS	Access to fields	592943.6482	799246.8314
033	Commercial Access	RHS	Access to commercial premises	592985.135	799217.833
034	Commercial Access	RHS	Access to petrol station	593024.9284	799206.1913
035	Commercial Access	RHS	Access to petrol station	593053.7151	799197.513
036	Commercial Access	RHS	Access to petrol station	593379.2591	799121.5245
037	Commercial Access	RHS	Access to petrol station	593419.8992	799113.6928
038	Commercial Access	RHS	Access to carpark	593518.1127	799140.5745

Reference	Type	Side	Description	POINT_X	POINT_Y
039	Domestic Access	RHS	Access to dwelling	593555.9508	799169.5517
040	Domestic Access	RHS	Access to dwelling	593588.2301	799195.8514
041	Domestic Access	RHS	Access to dwelling	593600.983	799204.7943
042	Domestic Access	RHS	Access to dwelling	593640.4281	799235.4596
043	Commercial Access	RHS	Access to carpark	593826.2233	799322.8516
044	Commercial Access	LHS	Access to carpark	593947.6143	799322.8516
045	Commercial Access	LHS	Access to carpark	594031.0112	799339.8908
046	Pedestrian/Cycling	RHS	Access to cycle/footpath	594253.7158	799394.0776
047	Commercial Access	RHS	Access to ESB plant	594316.7816	799425.4396
048	Farm Access	LHS	Access to fields and farm yard	594833.5712	799682.4542
050	Domestic Access	LHS	Access to dwelling	594851.2983	799678.4854
051	Commercial Access	LHS	Access to Pairc Sean mac Diarmada	594905.0088	799657.5833
052	Domestic Access	LHS	Access to dwelling	594957.2641	799630.9926

Reference	Type	Side	Description	POINT_X	POINT_Y
053	Domestic Access	LHS	Access to dwelling	594996.0257	799612.3394
054	Commercial Access	LHS	Access to commercial premises	595204.9146	799480.8413
055	Commercial Access	RHS	Access to commercial premises	595229.2564	799446.9745
056	Commercial Access	LHS	Access to commercial premises	595241.5595	799453.06
057	Domestic Access	RHS	Access to dwelling	595265.3721	799418.5318
058	Commercial Access	RHS	Access to commercial premises	595300.8263	799391.015
059	Commercial Access	LHS	Access to petrol station	595310.3513	799398.4234
060	Domestic Access	RHS	Access to dwelling	595315.5107	799380.1671
061	Commercial Access	LHS	Access to petrol station	595349.5097	799370.1129
062	Domestic Access	RHS	Access to dwelling	595339.5878	799360.8525
063	Farm Access	LHS	Access to fields and farm yard	595413.8036	799322.6201
064	Domestic Access	LHS	Access to dwelling	595424.5192	799314.8149
065	Domestic Access	RHS	Access to dwelling	595475.5839	799256.2096

Reference	Type	Side	Description	POINT_X	POINT_Y
066	Farm Access	LHS	Access to fields	595494.2371	799259.9137
067	Domestic Access	LHS	Access to dwelling	595534.4538	799230.2803
068	Domestic Access	RHS	Access to dwelling	595600.0706	799160.5625
069	Domestic Access	LHS	Access to dwelling	595611.58	799170.749
049	Commercial Access	LHS	Emergency Exit from Pairc Sean mac Diarmada	594844.8171	799680.7564
070	Domestic Access	LHS		595627.966	799161.645
071	Domestic Access	LHS		595687.9737	799114.9724
072	Domestic Access	LHS		595703.5312	799104.6537
073	Domestic Access	RHS		595805.6076	799003.371
074	Farm Access	LHS	Appears quite overgrown, rarely used	595817.3552	799016.706
075	Farm Access	RHS	Access to sheds & fields	595834.6312	798981.8471
076	Domestic Access	RHS		595841.1929	798976.9787
077	Farm Access	RHS	Access to fields	595953.5881	798892.1002

Reference	Type	Side	Description	POINT_X	POINT_Y
078	Domestic Access	RHS		595976.3423	798874.6906
079	Farm Access	LHS	Access to Fields	595991.1062	798881.8342
080	Farm Access	LHS	Access to farm yard	595995.7098	798878.1831
081	Farm Access	LHS	Access to fields	596041.5887	798843.5755
082	Farm Access	RHS	Access to fields	596074.2912	798801.8242
083	Farm Access	RHS	Access to fields	596111.9151	798773.0904
084	Farm Access	LHS	Access to fields	596135.4101	798774.3604
085	Domestic Access	RHS		596179.8602	798720.3853
086	Farm Access	LHS	Access to sheds/fields	596308.7655	798643.2326
087	Domestic Access	LHS		596321.9947	798634.3955
088	Farm Access	RHS	Access to fields	596336.8113	798603.9155
089	Farm Access	LHS	Access to field	596352.898	798613.4405
090	Domestic Access	LHS		596380.8381	798595.0255

Reference	Type	Side	Description	POINT_X	POINT_Y
091	Farm Access	RHS	Access to fields	596429.7861	798548.5116
092	Domestic Access	RHS		596436.4536	798544.8604
093	Domestic Access	LHS		596514.8763	798521.8416
094	Domestic Access	RHS		596571.5502	798479.4552
095	Farm Access	RHS	Access to fields	596583.1389	798473.5815
096	Domestic Access	RHS		596634.574	798448.8164
097	Domestic Access	LHS		596668.8641	798448.3402
098	Farm Access	RHS	Access to fields	596689.5016	798421.9876
099	Farm Access	LHS	Access to fields	596716.1717	798426.4326
100	Farm Access	LHS	Access to farm yard	596774.7506	798398.0163
101	Farm Access	RHS	Access to fields	596838.2507	798350.4971
102	Farm Access	LHS	Access to fields	596926.7275	798323.4037
103	Farm Access	LHS	Access to forestry & potential flooded quarry	597043.4718	798275.2874

Reference	Type	Side	Description	POINT_X	POINT_Y
104	Farm Access	LHS	Access to fields	597106.4428	798257.5603
105	Farm Access	RHS	Access to fields	597181.8492	798227.1332
106	Farm Access	LHS	Access to fields	597206.1909	798239.8332
107	Farm Access	LHS	Access to fields, appears disused/overgrown	597957.1328	798459.5933
108	Farm Access	LHS	Access to fields	598118.9656	798532.1289
109	Farm Access	LHS	Access to fields	598408.1028	798606.4241
110	Farm Access	LHS	Access to fields	598435.6195	798608.7524
111	Farm Access	LHS	Access to fields	598582.0932	798610.0224
112	Farm Access	RHS	Commercial forestry	598658.0684	798587.9561
113	Farm Access	RHS	Commercial Forestry	599282.7509	798496.1984
114	Farm Access	RHS	Access to fields	599689.9455	798146.154
115	Farm Access	LHS	Access to fields	599709.4718	798146.4715
116	Farm Access	RHS	Overgrown access to field	600133.4517	797471.471

Reference	Type	Side	Description	POINT_X	POINT_Y
117	Farm Access	LHS	Access to fields	600432.1139	797134.0737
118	Farm Access	LHS	Small road leading to a number of fields	600906.3011	796708.517
119	Farm Access	RHS	Overgrown access to field	601217.0284	796494.3099
120	Farm Access	LHS	Access to fields	601366.0421	796451.1298
121	Farm Access	LHS	Access to fields	601463.4089	796402.0231
122	Farm Access	RHS	Access to fields	601508.7057	796351.223
123	Farm Access	RHS	Access to fields	601584.9058	796296.6129
124	Farm Access	LHS	Access to fields	601601.8392	796307.1962
125	Domestic Access	LHS		601760.1662	796194.5893
126	Domestic Access	LHS		601885.4731	796103.1491
127	Domestic Access	LHS		601894.7864	796099.3391
128	Farm Access	RHS		601892.2464	796073.5158
129	Domestic Access	LHS		601980.935	796050.444

Reference	Type	Side	Description	POINT_X	POINT_Y
130	Farm Access	LHS	Access to Farm Yard	601985.38	796048.2215
131	Domestic Access	LHS		602017.4475	796010.439
132	Farm Access	LHS	Access to fields	602042.5301	795979.9589
133	Farm Access	LHS	Access to Farm Yard	602061.2626	795954.2413
134	Domestic Access	LHS		602083.1702	795931.6988
135	Farm Access	LHS	Access to fields	602094.6002	795919.6338
136	Domestic Access	LHS		602147.9403	795841.8461
137	Farm Access	LHS	Access to fields	602153.3378	795834.8611
138	Farm Access	RHS	Access to fields	602211.7579	795715.1634
139	Farm Access	LHS	Access to Farm Yard	602280.3381	795650.7107
140	Domestic Access	LHS		602282.5606	795647.5357
141	Farm Access	RHS	Access to Fields	602282.8781	795610.7057
142	Farm Access	LHS	Access to Farm Yard	602315.5806	795598.0056

Reference	Type	Side	Description	POINT_X	POINT_Y
143	Farm Access	LHS	Access to Fields	602349.2357	795551.968
144	Farm Access	LHS	Access to Farm Yard	602392.7333	795488.1504
145	Farm Access	LHS	Access to Fields	602410.09	795466.5604
146	Domestic Access	LHS		602466.6051	795376.6019
147	Farm Access	RHS	Access to Fields	602524.1785	795253.6233
148	Farm Access	LHS	Access to Fields	602566.9353	795221.0265
149	Farm Access	LHS	Access to Fields	602603.977	795152.2347
150	Farm Access	RHS	Access to Fields	602597.627	795127.893
151	Farm Access	LHS	Access to Fields	602612.6554	795134.6664
152	Farm Access	LHS	Access to Fields	602855.0142	794706.4639
153	Farm Access	RHS	Access to Farm Yard	602849.7225	794682.5455
154	Farm Access	RHS	Access to Farm Yard	602854.3792	794676.8305
155	Farm Access	RHS	Access to Field	602866.0209	794645.0804

Reference	Type	Side	Description	POINT_X	POINT_Y
156	Commercial Access	RHS	Access to back of Top O'The Hill	602871.7359	794633.4387
157	Pedestrian/Cycling	LHS	Pedestrian Access to Annaduff Church	602891.8443	794646.7737
158	Domestic Access	LHS		602928.6743	794581.5803
159	Domestic Access	LHS		602933.331	794574.3836
160	Domestic Access	LHS		602948.9944	794546.0202
161	Farm Access	RHS	Access to Farm Yard	602979.2628	794460.295
162	Farm Access	LHS	Access to Fields	603022.6545	794419.8666
163	Farm Access	LHS	Access to Fields	603040.4346	794385.5765
164	Farm Access	LHS	Overgrown Access to Field	603052.7113	794364.8332
165	Domestic Access	LHS		603068.5863	794337.3164
166	Commercial Access	LHS	Access to Water Tank	603071.7613	794329.2731
167	Farm Access	RHS	Access to Field	603056.5213	794315.9381
168	Farm Access	RHS	Access to Fields	603058.4263	794312.7631

Reference	Type	Side	Description	POINT_X	POINT_Y
169	Farm Access	LHS	Access to Field	603077.8996	794311.9164
170	Domestic Access	RHS		603102.8764	794230.8479
171	Farm Access	LHS	Access to Fields	603127.2181	794217.5129
172	Domestic Access	RHS	Access to dwelling and farm	603124.2547	794187.4561
173	Farm Access	LHS	Access to Farm Yard	603141.3998	794192.9595
174	Farm Access	RHS	Access to Fields	603150.7131	794143.8527
175	Farm Access	LHS	Access to Fields	603163.8365	794156.9761
176	Farm Access	LHS	Access to Fields	603209.9799	794078.6593
177	Commercial Access	RHS	Leitrim Centre of Excellence	603175.4782	794104.0593
178	Commercial Access	RHS	Access into Annaduff GAA Field	603218.6583	794030.1875
179	Farm Access	LHS	Access to Farm Yard	603265.4367	793985.7374
180	Farm Access	LHS	Access to Field	603293.8001	793936.2073
181	Commercial Access	RHS	Access to Annaduff GAA	603304.3834	793880.5389

Reference	Type	Side	Description	POINT_X	POINT_Y
182	Farm Access	RHS	Access to Fields	603396.2469	793726.2336
183	Farm Access	LHS	Access to Fields	603413.6037	793733.4302
184	Farm Access	LHS	Access to Fields	603495.3072	793592.0367
185	Farm Access	RHS	Access to Fields	603545.8956	793462.708
186	Domestic Access	RHS		603565.369	793422.703
187	Farm Access	RHS	Access to Fields	603761.5843	793034.7172
188	Domestic Access	RHS		603785.2911	792994.0771
189	Domestic Access	RHS	Access to Dwelling and Farm Yard	603868.2646	792868.5585
190	Farm Access	RHS	Access to Fields	603952.0847	792774.5783
191	Farm Access	RHS	Access to Fields	604043.5249	792690.1232
192	Farm Access	LHS	Access to Fields	604090.515	792678.2698
193	Farm Access	RHS	Access to Farm Yard	604162.0585	792591.9096
194	Farm Access	RHS	Access to Field	604173.2768	792580.9029

Reference	Type	Side	Description	POINT_X	POINT_Y
195	Domestic Access	RHS	Old House	604202.0636	792550.8462
196	Farm Access	RHS	Access to Fields	604211.8002	792541.9562
197	Farm Access	RHS	Access to Fields	604267.4687	792484.5944

Table A2 – Junction Schedule

Ref	Type	Side	Description	Side Road Identifier	Comments	POINT_X	POINT_Y
001	Local Road, Junction	LHS	Drumharlow Lake Local Road	n/a		589494.6083	800784.3443
002	Local Road, Junction	LHS	Woodbrook Local Road	L5131		589758.1338	800546.6421
003	Local Road, Junction	RHS	Cloongownagh Local Road	L5078		590020.2306	800281.9524
004	Local Road, Junction	RHS	Dorrary Local Road	L5078		591265.6109	799973.2801
005	Local Road, Junction	LHS	Tumna Local Road	L5131		591471.5313	799983.2178
006	Local Road, Junction	RHS	n/a	n/a		592063.7599	799703.117
007	Local Road, Junction	LHS	Cortober Local Road	n/a		592272.6043	799574.5319
008	Local Road, Junction	RHS	Cloonskeeveen Local Road	L50783		592468.6186	799439.7774
009	Local Road, Junction	LHS	n/a	n/a		592480.6241	799449.0709
010	Local Road, Junction	RHS	Drishoge	n/a		592882.7179	799252.32
011	Local Road, Junction	LHS	Inver Geal	n/a	Roundabout Junction	593159.1445	799194.6407
012	Local Road, Junction	RHS	Carrick View	n/a	Roundabout Junction	593148.8257	799164.1606

Ref	Type	Side	Description	Side Road Identifier	Comments	POINT_X	POINT_Y
013	Regional Road, Junction	RHS	n/a	R368		593473.1526	799110.503
014	Local Road, Junction	LHS	Inver Geal	n/a	Housing Estate	593493.4727	799139.5543
015	Local Road, Junction	RHS	Shannon View	n/a		593675.9456	799249.8858
016	Regional Road, Junction	LHS	Bridge Street	R903		593746.5881	799369.5491
017	Local Road, Junction	LHS	n/a	n/a		593851.7602	799330.2584
018	Local Road, Junction	LHS	n/a	n/a		593881.2613	799325.2313
019	Local Road, Junction	LHS	n/a	n/a		594060.5442	799349.2015
020	Regional Road, Junction	LHS	Dublin Road	R280	Roundabout Junction	594319.9423	799521.6044
021	Local Road, Junction	LHS	Circular Road	L3412	Roundabout Junction	594340.7385	799546.0519
022	Local Road, Junction	LHS	n/a	L3412	Roundabout Junction	594786.4565	799692.0493
023	Local Road, Junction	RHS	n/a	n/a	Roundabout Junction	594784.869	799653.4201
024	Local Road, Junction	RHS	Marina Road	L3655		594964.6097	799612.0568
025	Local Road, Junction	LHS	Castlecara Road	L3408	Roundabout Junction	595081.8732	799569.4588

Ref	Type	Side	Description	Side Road Identifier	Comments	POINT_X	POINT_Y
026	Local Road, Junction	RHS	Ard na Si	L3655		595385.8801	799323.7133
027	Local Road, Junction	RHS	Drishoge	n/a		592583.4883	799379.2901
028	Local Road, Junction	RHS		L3657		596223.0456	798688.9236
029	Local Road, Junction	RHS	Local Road to Jamestown	L3656		597148.7055	798232.2254
030	Local Road, Junction	RHS	Local Road to Jamestown	L7426		597652.3144	798305.3035
031	Local Road, Junction	LHS		L7426		597676.3915	798331.2327
032	Slip Road	LHS	R229 / Drumsna SB Off Slip Road			599736.6134	798105.3575
033	Slip Road	LHS	R229 / Drumsna SB On Slip Road			599918.2767	797822.8348
034	Slip Road	RHS	R229 / Drumsna NB On Slip Road			599964.8435	797726.2617
035	Slip Road	RHS	R229 / Drumsna NB Off Slip Road			600064.5916	797576.2427
036	Local Road, Junction	RHS	Crow Hill Road	L7661		600237.5367	797327.5975
037	Local Road, Junction	LHS		L7429		600351.0432	797230.7598
038	Local Road, Junction	RHS				600431.2121	797110.1095

Ref	Type	Side	Description	Side Road Identifier	Comments	POINT_X	POINT_Y
039	Local Road, Junction	RHS	Leads into Masonite (Ireland) Limited	L3630		600943.9756	796649.7336
040	Regional Road, Junction	LHS	Mohill Road	R201		600997.9507	796650.5274
041	Local Road, Junction	LHS	Connects to R201	L7430		601584.5332	796317.9455
042	Local Road, Junction	RHS	Drumgilra Road	L7464		602138.3336	795820.3426
043	Local Road, Junction	LHS	Antfiels/Federoe Road	L3470	St Marys Church at junction	602864.6163	794694.5912
044	Local Road, Junction	RHS	Aghintass Road	L3467		602899.9647	794593.3085
045	Local Road, Junction	LHS	Moher Road	L7472		603615.0026	793373.6562
046	Slip Road	LHS	Fearnaght Slip Road off N4		Leads to dwellings	603796.2426	793005.3555
047	Slip Road	LHS	Fearnaght Slip Road off N4		Leads to dwellings	604009.2326	792745.2696
048	Local Road, Junction	LHS	Fearnaght/Moherevan Road	L1475		604188.3559	792595.7356
049	Local Road, Junction	RHS	Faulties Road	L1601		604324.8811	792401.0019
050	Local Road, Junction	RHS	Leads into a number of dwellings			603425.2453	793676.0685
051	Local Road, Junction	LHS	Small local road to two houses and farmyard			603248.1944	794012.6901

Ref	Type	Side	Description	Side Road Identifier	Comments	POINT_X	POINT_Y
052	Local Road, Junction	RHS	Small Local Road to two houses and farmyard			603608.5576	793338.0013

Appendix B

Pavement Condition Survey

B1

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet 1

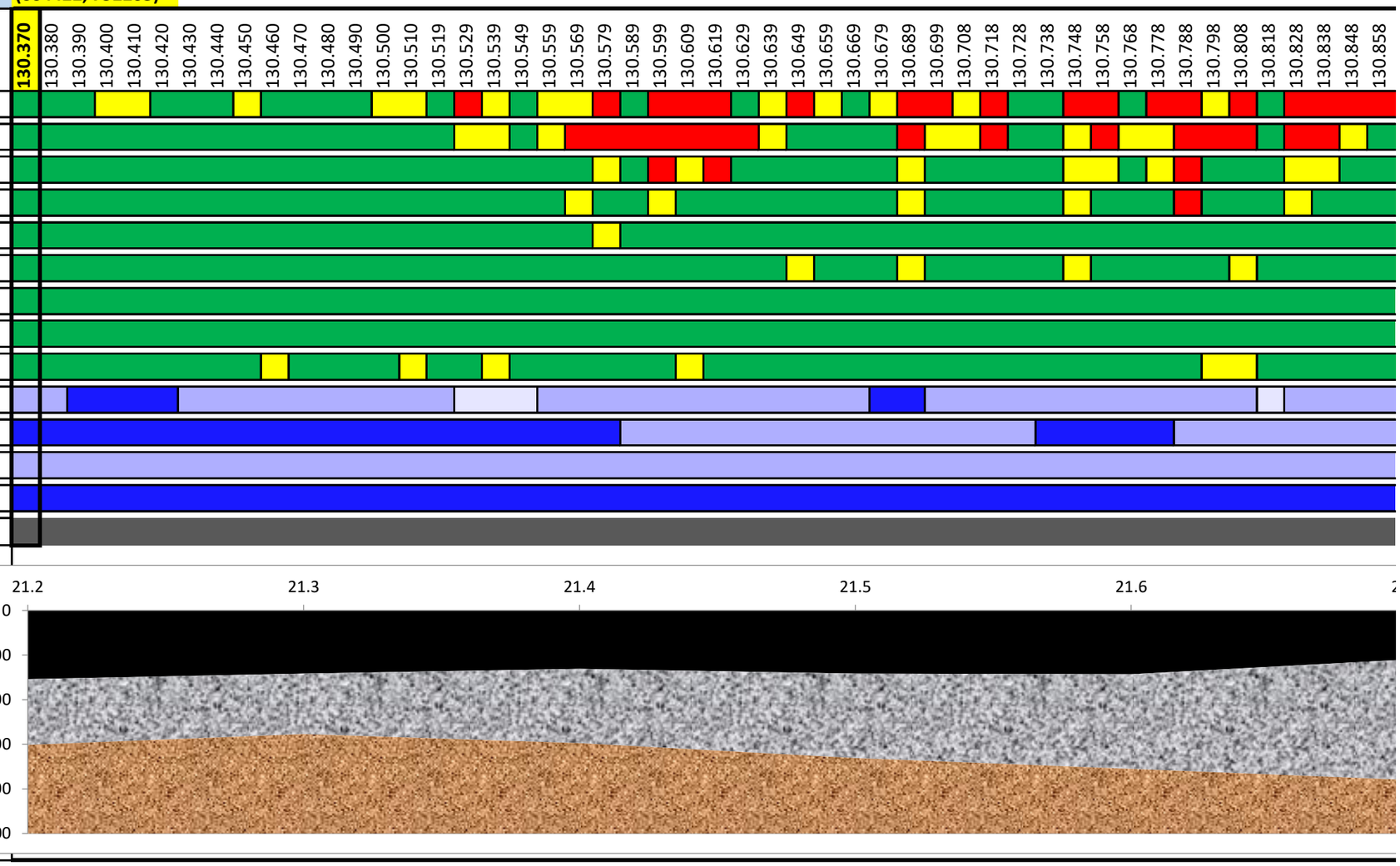
Survey	Parameter	Conditions			
Longitudinal Profile (RSP)	Roughness (IRI)	> 3 m/km	2.5 to 3 m/km	< 2.5 m/km	
	Variance (3m LPV)	> 3	2 to 3	< 2	
Transverse Profile (RSP)	Rut Depth	> 6 mm	5 to 6 mm	< 5 mm	
Cracking (LCMS)	Alligator (per 10m Section)	> 4 m^2	2 to 4 m^2	< 2 m^2	No Cracking
	Long. & Tran. (per 10m Section)	> 4 m	2 to 4 m	< 2 m	No Cracking
Surface Characteristics (LCMS/RSP/SCRIM)	Ravelling (per 10m Section)	> 4 m^2	2 to 4 m^2	< 2 m^2	No Ravelling
	Mean Profile Depth (MPD)	< 1 mm	1 to 1.5 mm	> 1.5 mm	
	Characteristic SCRIM Coefficient (CSC)	< 0.40	0.40 to 0.50	> 0.50	No Data
Geometrics (RSP)	Gradient %	< 3 %	3 to 5 %	> 5 %	
	Crossfall %	< -1.5 %	0 to ± 1.5 %	> 1.5 %	
Pavement Structure	Surface Type	SMA	HRA	Surface Dressing	Urban
	GPR	Bituminous Tickness (mm)		Granular Thickness (mm)	

RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1 **(604422, 792203)**

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound



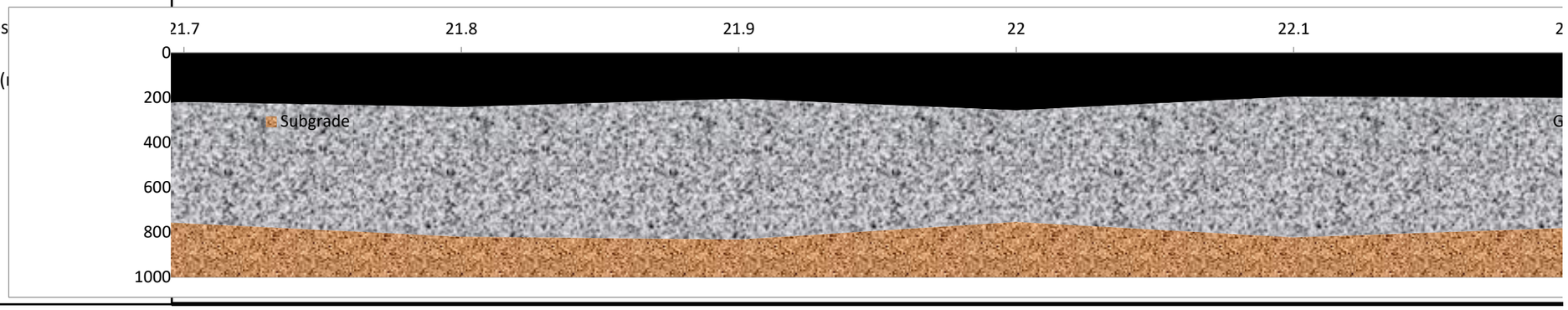
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

130.867 130.877 130.887 130.897 130.907 130.917 130.927 130.937 130.947 130.957 130.967 130.977 130.987 130.997 131.007 131.017 131.027 131.037 131.047 131.057 131.067 131.077 131.087 131.097 131.107 131.117 131.127 131.137 131.147 131.157 131.167 131.177 131.187 131.197 131.207 131.217 131.227 131.237 131.248 131.258 131.268 131.278 131.288 131.298 131.308 131.318 131.328 131.338 131.348 131.358



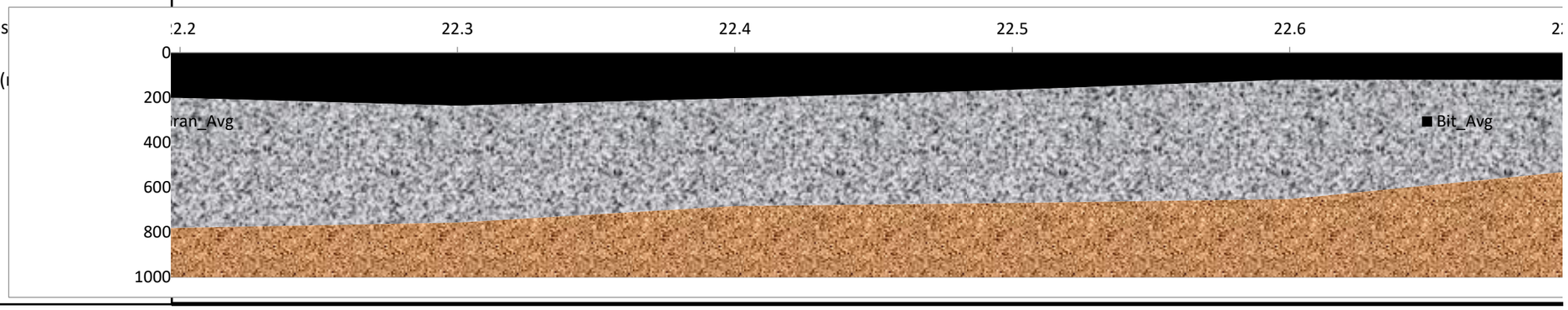
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

131.368 131.378 131.388 131.398 131.407 131.417 131.427 131.437 131.447 131.457 131.467 131.477 131.487 131.497 131.507 131.517 131.527 131.537 131.547 131.557 131.567 131.577 131.587 131.597 131.607 131.617 131.627 131.637 131.647 131.657 131.667 131.677 131.687 131.697 131.707 131.717 131.727 131.737 131.747 131.757 131.767 131.777 131.787 131.797 131.807 131.817 131.827 131.837 131.847 131.857



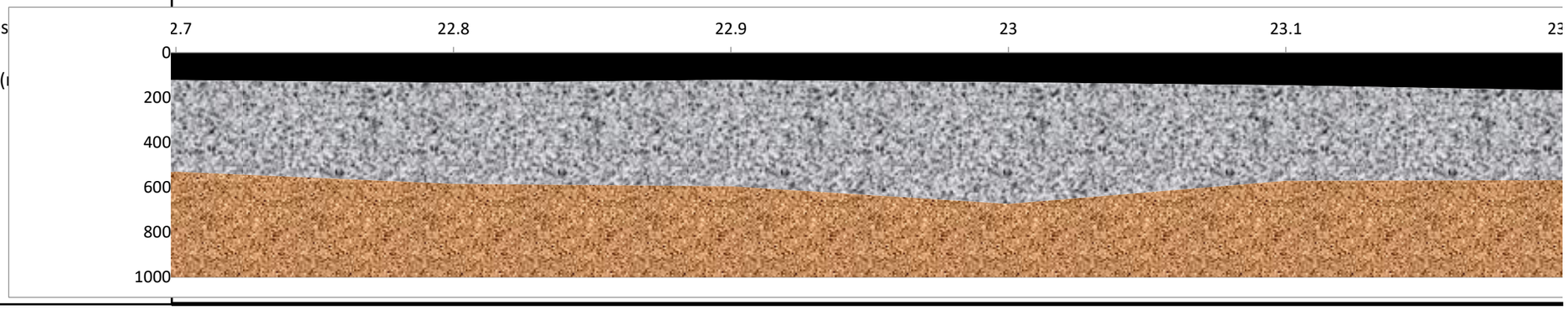
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

131.867 131.877 131.886 131.896 131.906 131.916 131.926 131.936 131.946 131.956 131.966 131.976 131.986 131.996 132.006 132.016 132.026 132.036 132.046 132.056 132.066 132.076 132.086 132.096 132.106 132.116 132.126 132.136 132.146 132.156 132.166 132.176 132.186 132.196 132.206 132.216 132.226 132.236 132.246 132.256 132.266 132.276 132.286 132.296 132.306 132.316 132.325 132.336 132.346 132.356



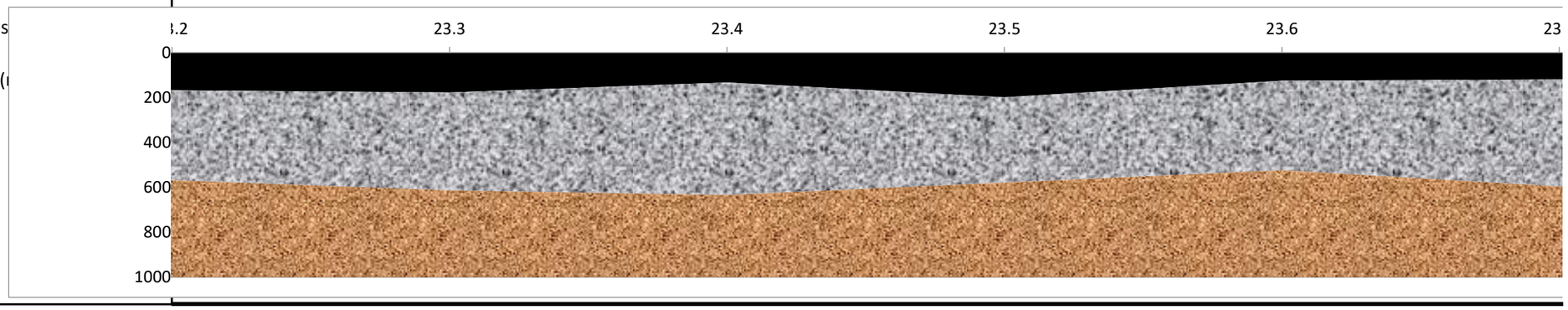
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

132.366 132.376 132.386 132.396 132.406 132.417 132.426 132.436 132.446 132.456 132.466 132.476 132.486 132.496 132.506 132.516 132.526 132.536 132.546 132.556 132.566 132.576 132.586 132.596 132.606 132.616 132.626 132.636 132.646 132.655 132.666 132.676 132.685 132.696 132.705 132.715 132.725 132.735 132.746 132.755 132.765 132.776 132.785 132.795 132.805 132.815 132.825 132.835 132.845 132.855



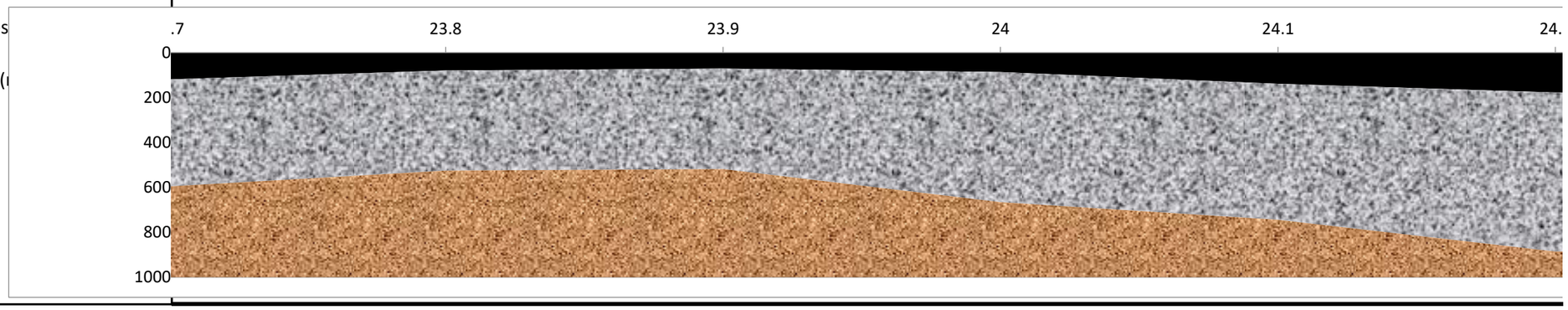
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

132.865 132.875 132.885 132.895 132.905 132.915 132.925 132.935 132.945 132.955 132.965 132.975 132.985 132.995 133.005 133.015 133.025 133.035 133.045 133.055 133.065 133.075 133.085 133.095 133.105 133.115 133.125 133.135 133.145 133.155 133.165 133.175 133.185 133.195 133.205 133.215 133.225 133.235 133.245 133.255 133.265 133.275 133.285 133.295 133.305 133.315 133.325 133.335 133.345 133.355



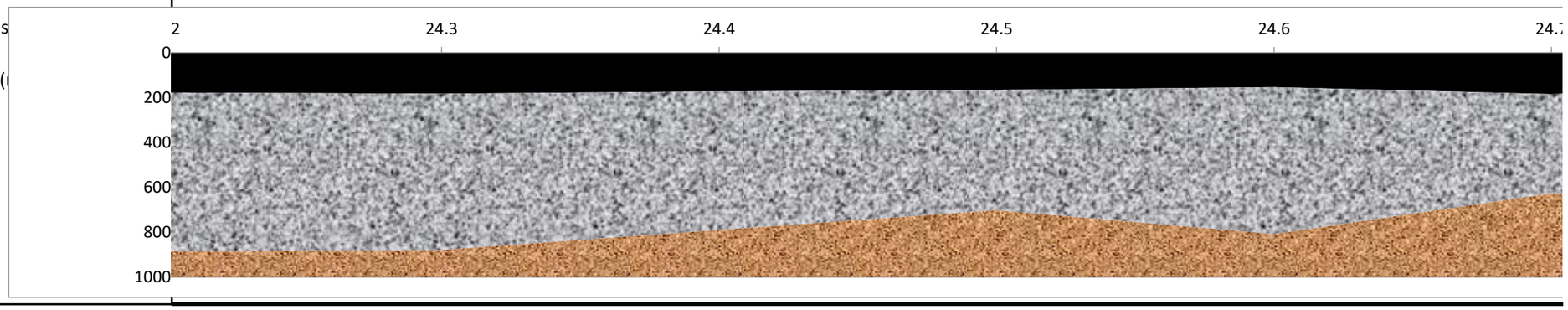
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

133.365 133.375 133.384 133.395 133.405 133.415 133.425 133.435 133.445 133.455 133.465 133.475 133.485 133.495 133.505 133.515 133.524 133.534 133.544 133.554 133.564 133.574 133.584 133.594 133.604 133.614 133.624 133.634 133.644 133.654 133.664 133.674 133.684 133.694 133.704 133.714 133.724 133.734 133.744 133.754 133.764 133.774 133.784 133.794 133.804 133.814 133.824 133.834 133.844 133.854



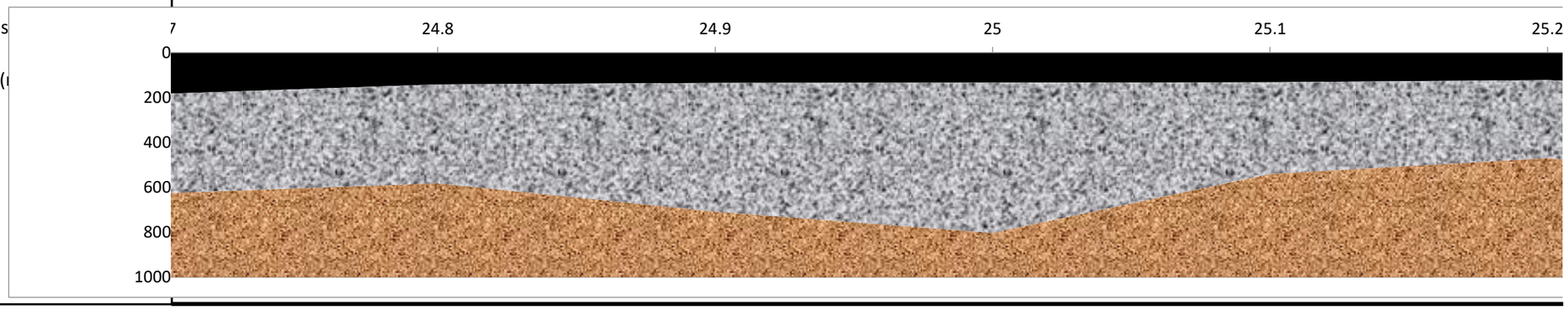
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

133.864 133.874 133.884 133.895 133.904 133.914 133.924 133.934 133.944 133.954 133.964 133.974 133.984 133.994 134.004 134.014 134.024 134.034 134.044 134.053 134.063 134.073 134.083 134.093 134.103 134.113 134.123 134.133 134.143 134.153 134.163 134.173 134.182 134.193 134.203 134.213 134.223 134.233 134.243 134.253 134.263 134.273 134.283 134.293 134.303 134.313 134.323 134.333 134.343 134.353



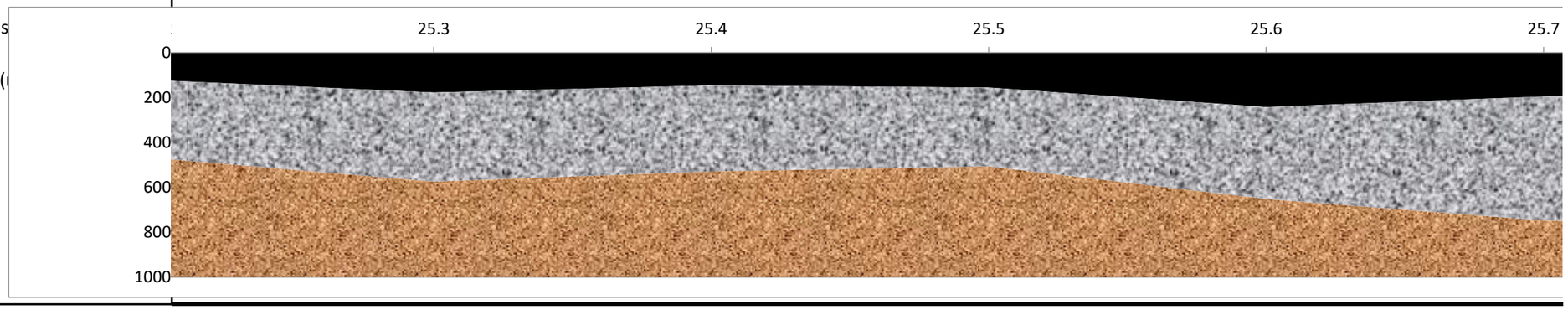
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

134.363 134.373 134.383 134.393 134.403 134.413 134.423 134.433 134.443 134.453 134.463 134.473 134.483 134.493 134.503 134.513 134.523 134.533 134.543 134.553 134.563 134.573 134.583 134.593 134.603 134.613 134.623 134.633 134.643 134.653 134.663 134.673 134.683 134.693 134.702 134.712 134.722 134.732 134.742 134.752 134.762 134.772 134.782 134.793 134.802 134.812 134.821 134.832 134.841 134.852



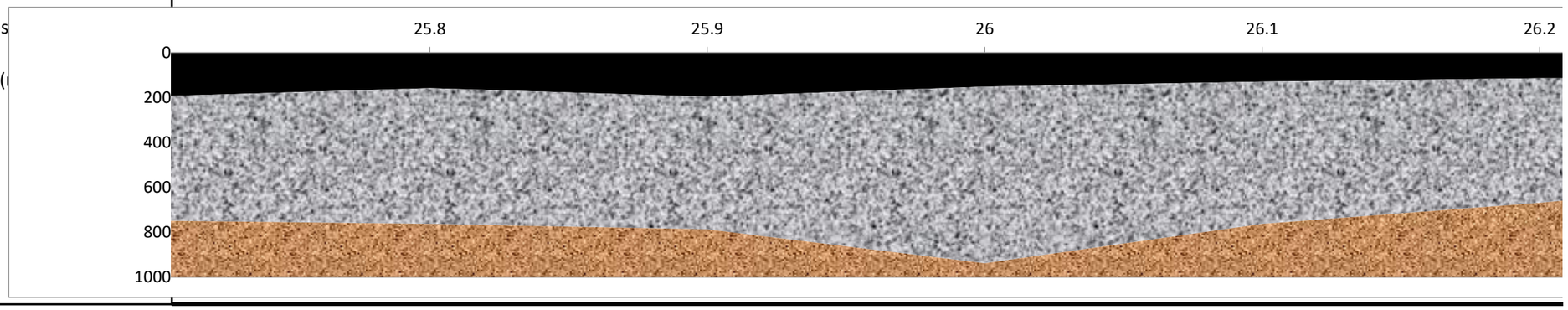
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness (mm)
	Granular Thickness (mm)
	GPR Survey 2013
	Direction
	Northbound

134.862 134.872 134.881 134.892 134.901 134.911 134.921 134.931 134.941 134.951 134.961 134.971 134.981 134.991 135.001 135.011 135.021 135.031 135.041 135.051 135.061 135.071 135.081 135.091 135.101 135.111 135.121 135.131 135.141 135.151 135.161 135.171 135.181 135.191 135.201 135.211 135.221 135.231 135.241 135.251 135.261 135.271 135.281 135.291 135.301 135.311 135.321 135.331 135.341 135.351



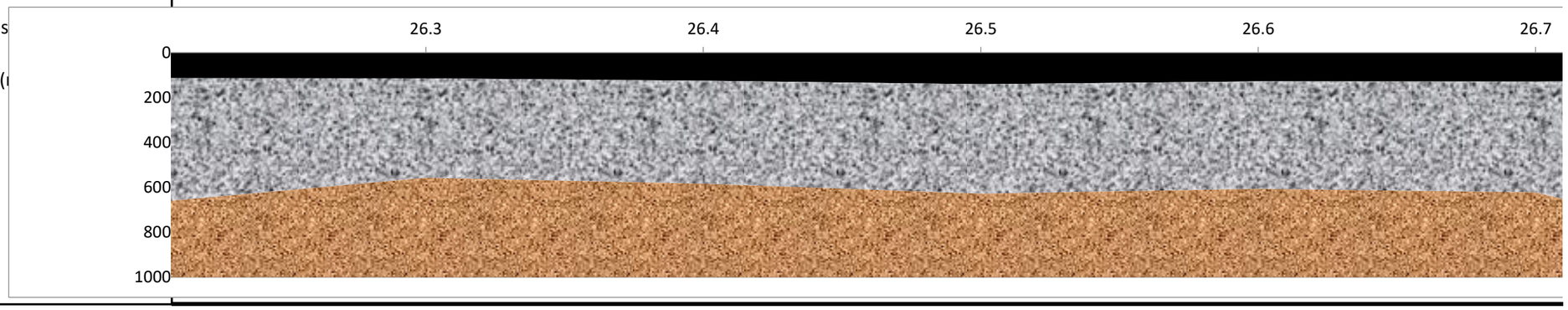
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thicknes
	Granular Thickness (r
	GPR Survey 2013
	Direction
	Northbound

135.361 135.371 135.381 135.390 135.400 135.410 135.420 135.430 135.440 135.450 135.460 135.470 135.480 135.490 135.500 135.510 135.520 135.530 135.540 135.550 135.560 135.570 135.580 135.590 135.600 135.610 135.620 135.630 135.640 135.650 135.660 135.670 135.680 135.689 135.699 135.709 135.719 135.729 135.739 135.749 135.759 135.769 135.779 135.789 135.799 135.809 135.819 135.829 135.839 135.849



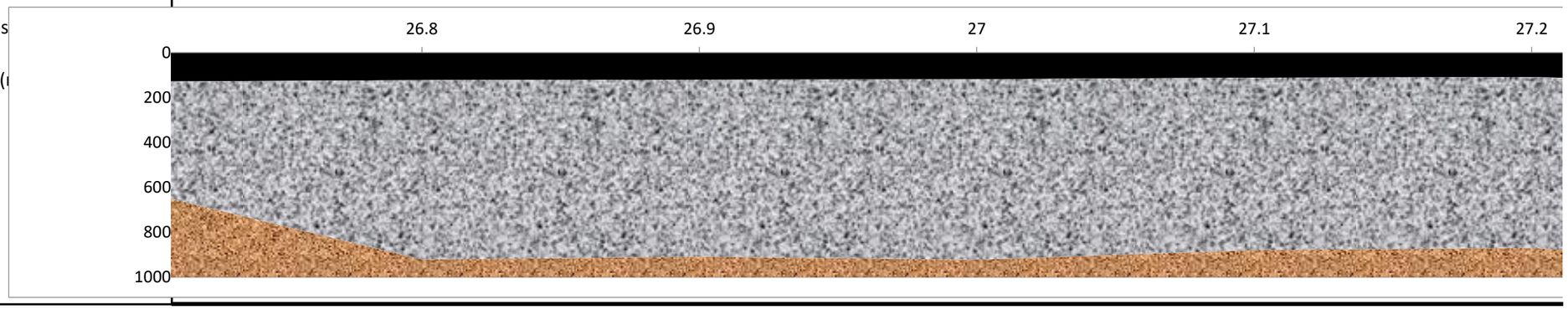
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness (mm)
	Granular Thickness (mm)
	GPR Survey 2013
	Direction
	Northbound

135.859 135.869 135.879 135.890 135.899 135.909 135.919 135.929 135.939 135.949 135.959 135.969 135.979 135.989 135.999 136.009 136.019 136.029 136.039 136.049 136.059 136.069 136.080 136.090 136.100 136.110 136.120 136.130 136.140 136.150 136.160 136.170 136.180 136.190 136.200 136.210 136.220 136.230 136.239 136.249 136.260 136.269 136.280 136.290 136.299 136.309 136.319 136.329 136.339 136.349



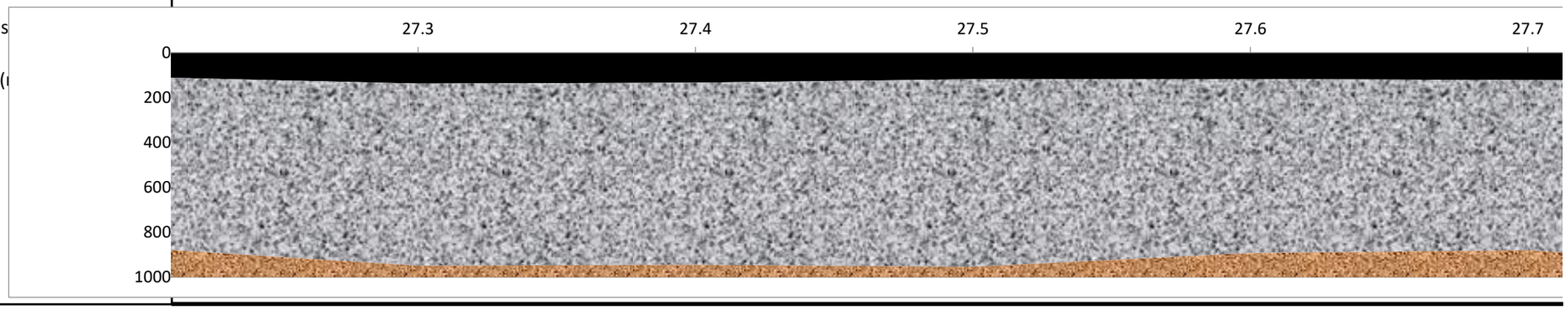
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (mm)
	GPR Survey 2013
	Direction
	Northbound

136.360 136.370 136.380 136.390 136.400 136.410 136.420 136.430 136.439 136.449 136.459 136.469 136.479 136.489 136.499 136.509 136.519 136.529 136.539 136.549 136.559 136.569 136.579 136.589 136.599 136.609 136.619 136.629 136.639 136.649 136.659 136.669 136.679 136.689 136.699 136.709 136.719 136.729 136.739 136.749 136.759 136.769 136.779 136.789 136.799 136.809 136.819 136.829 136.839 136.849



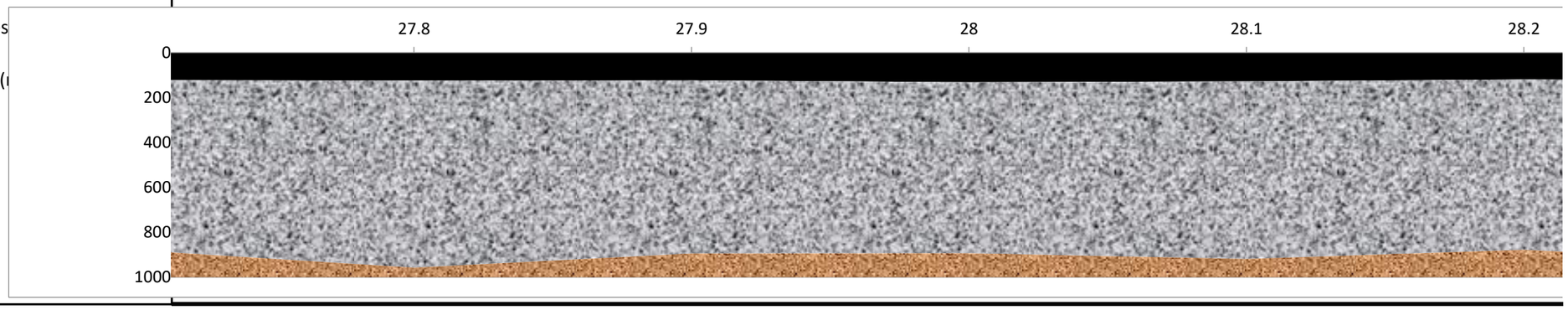
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thicknes
	Granular Thickness (r
	GPR Survey 2013
	Direction
	Northbound

136.859 136.869 136.879 136.889 136.899 136.909 136.919 136.929 136.939 136.949 136.959 136.969 136.979 136.989 136.999 137.009 137.019 137.029 137.039 137.049 137.059 137.069 137.079 137.089 137.099 137.109 137.119 137.129 137.139 137.149 137.159 137.169 137.179 137.189 137.199 137.209 137.219 137.229 137.239 137.249 137.259 137.269 137.279 137.289 137.299 137.309 137.319 137.329 137.339 137.349



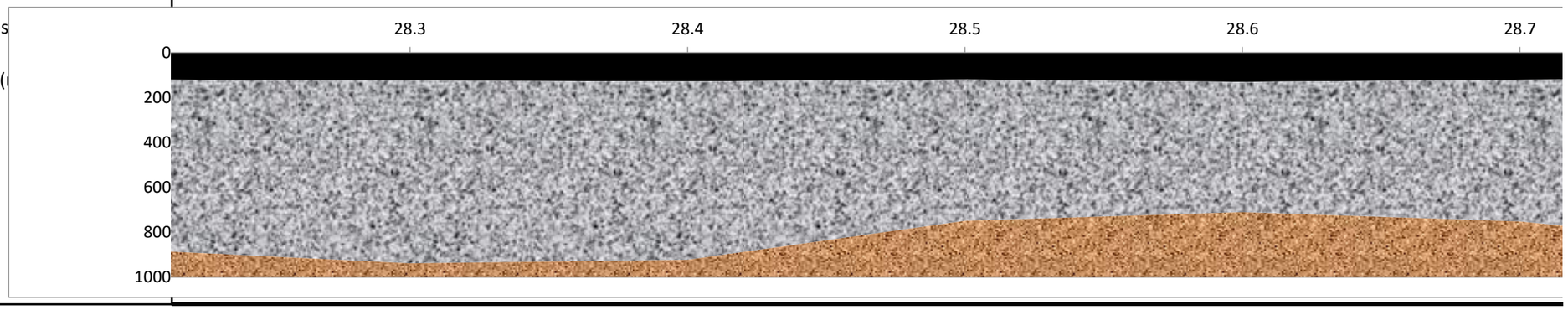
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness (mm)
	Granular Thickness (mm)
	GPR Survey 2013
	Direction
	Northbound

137.359 137.369 137.379 137.389 137.399 137.409 137.419 137.429 137.439 137.449 137.459 137.468 137.479 137.489 137.499 137.509 137.519 137.529 137.539 137.549 137.559 137.569 137.579 137.589 137.599 137.609 137.619 137.629 137.639 137.649 137.659 137.669 137.679 137.689 137.699 137.709 137.719 137.728 137.738 137.748 137.758 137.768 137.778 137.788 137.798 137.808 137.818 137.828 137.838 137.848



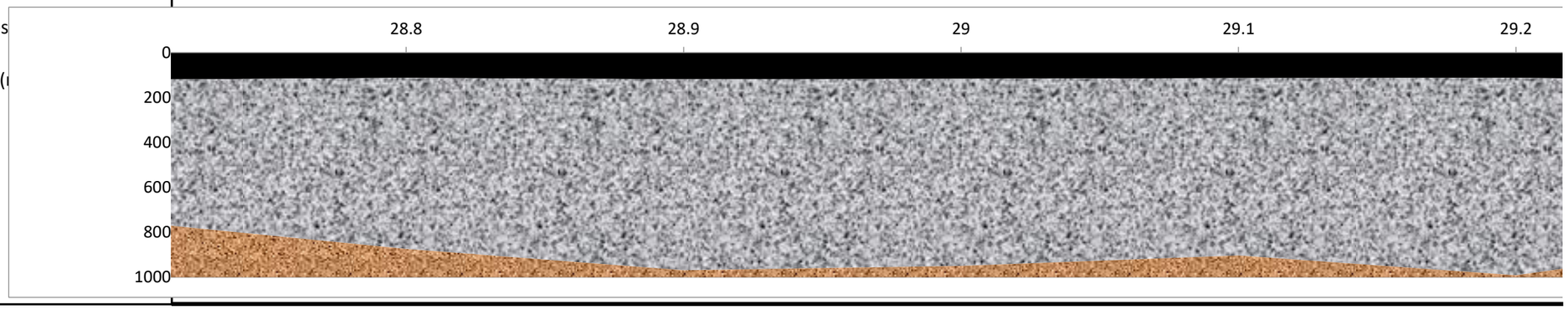
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

137.858 137.868 137.878 137.888 137.898 137.908 137.918 137.928 137.938 137.948 137.958 137.968 137.978 137.988 137.998 138.008 138.018 138.028 138.038 138.048 138.058 138.068 138.078 138.088 138.098 138.108 138.118 138.128 138.138 138.148 138.158 138.168 138.178 138.188 138.198 138.208 138.218 138.228 138.238 138.248 138.258 138.268 138.278 138.288 138.297 138.307 138.317 138.327 138.337 138.347



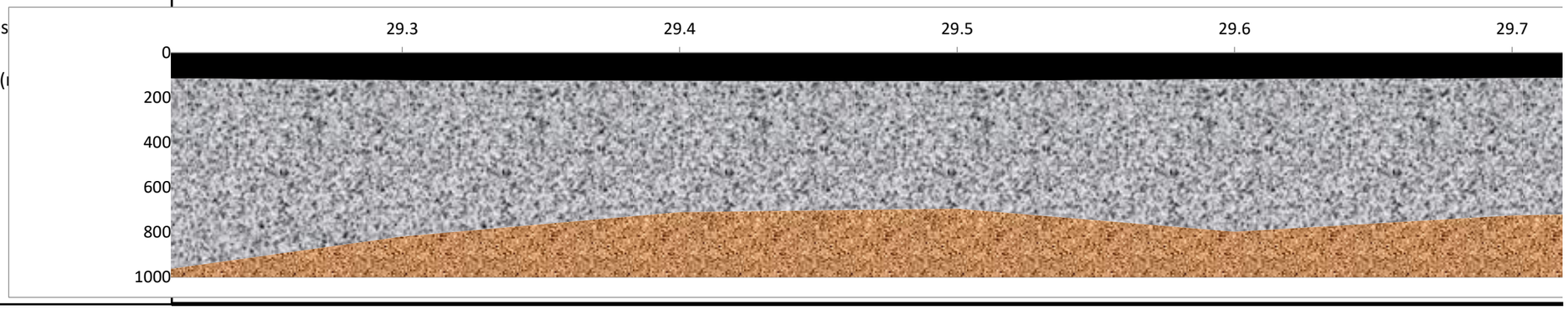
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

138.357 138.367 138.377 138.387 138.397 138.406 138.417 138.427 138.437 138.447 138.456 138.466 138.476 138.486 138.496 138.506 138.516 138.526 138.536 138.546 138.556 138.566 138.576 138.586 138.596 138.606 138.616 138.626 138.636 138.646 138.655 138.665 138.675 138.685 138.695 138.705 138.715 138.725 138.735 138.745 138.755 138.765 138.775 138.785 138.795 138.805 138.815 138.825 138.835 138.845



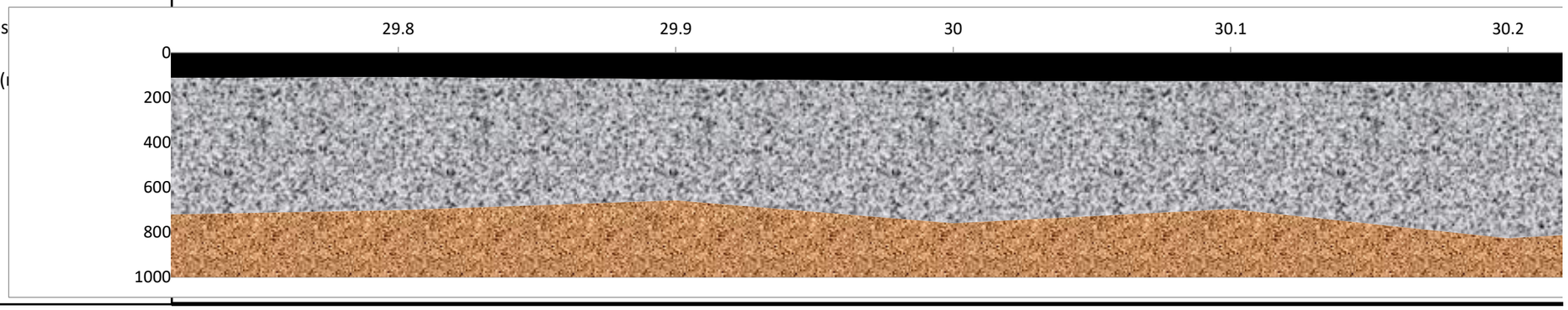
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thicknes
	Granular Thickness (r
	GPR Survey 2013
	Direction
	Northbound

138.855 138.865 138.875 138.885 138.895 138.905 138.915 138.924 138.934 138.944 138.955 138.964 138.974 138.984 138.994 139.004 139.014 139.024 139.034 139.044 139.054 139.064 139.074 139.084 139.094 139.104 139.114 139.124 139.134 139.144 139.154 139.164 139.174 139.184 139.194 139.204 139.214 139.224 139.234 139.244 139.254 139.264 139.274 139.284 139.294 139.304 139.314 139.325 139.334 139.344



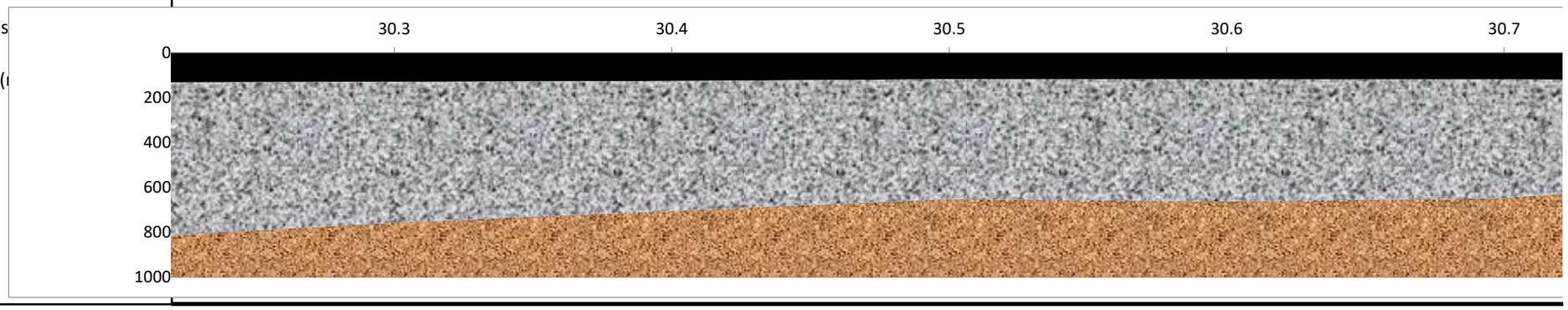
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thicknes
	Granular Thickness (r
	GPR Survey 2013
	Direction
	Northbound

139.354 139.364 139.374 139.384 139.394 139.404 139.414 139.424 139.434 139.443 139.454 139.464 139.474 139.484 139.494 139.504 139.514 139.524 139.534 139.544 139.554 139.564 139.574 139.583 139.593 139.603 139.613 139.623 139.634 139.643 139.653 139.663 139.673 139.683 139.693 139.703 139.713 139.723 139.733 139.743 139.753 139.763 139.773 139.783 139.793 139.803 139.813 139.823 139.832 139.842

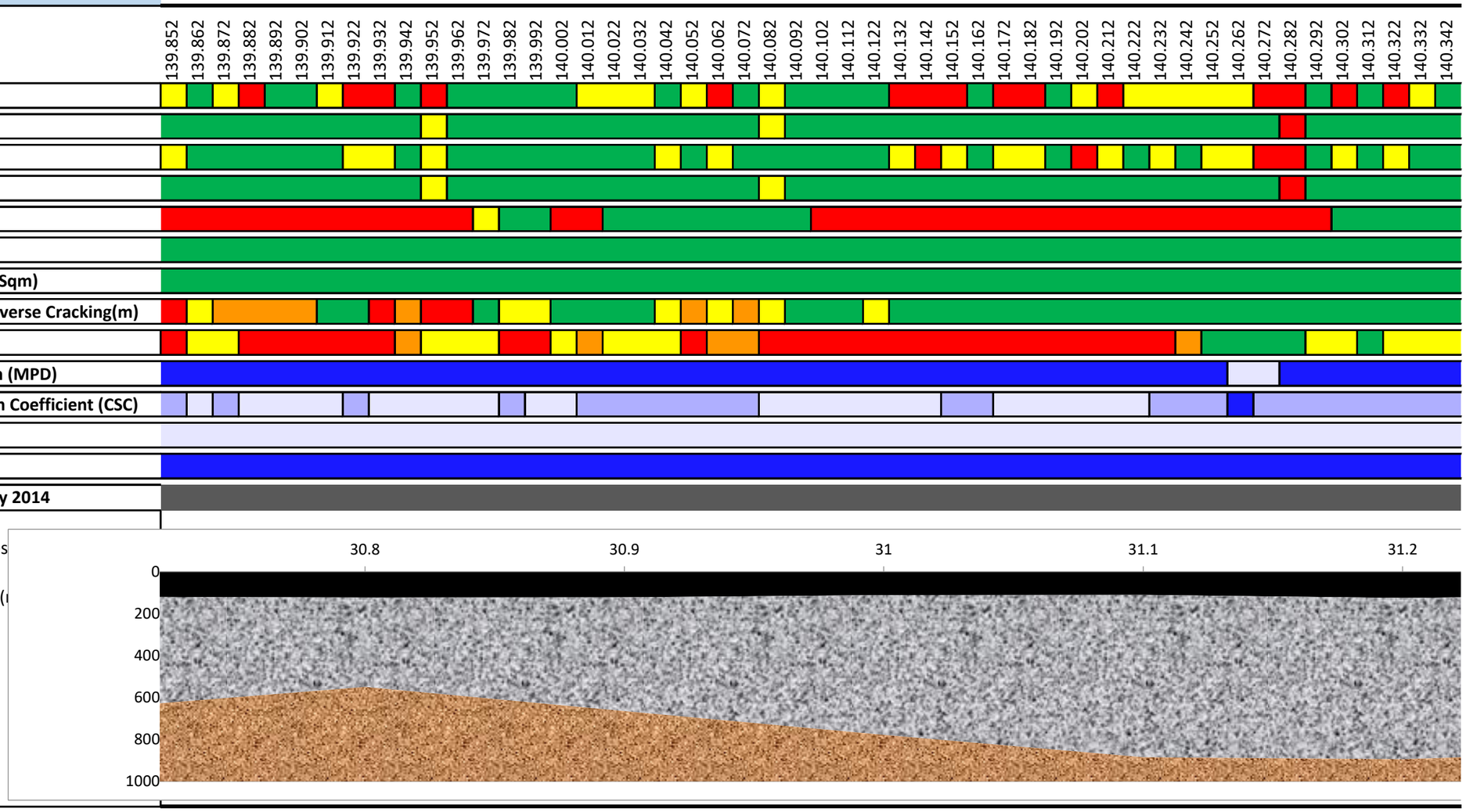


RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

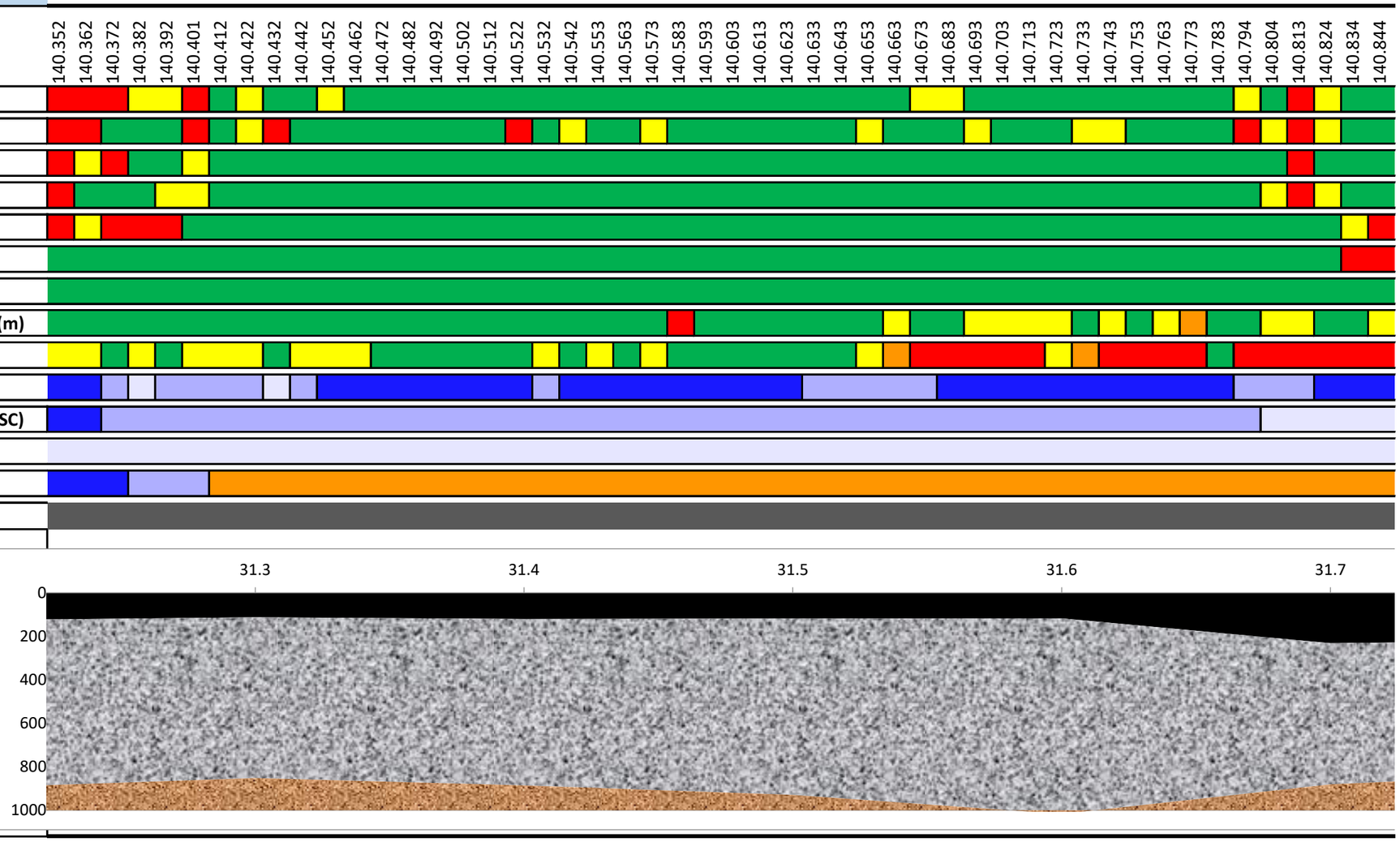


RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound



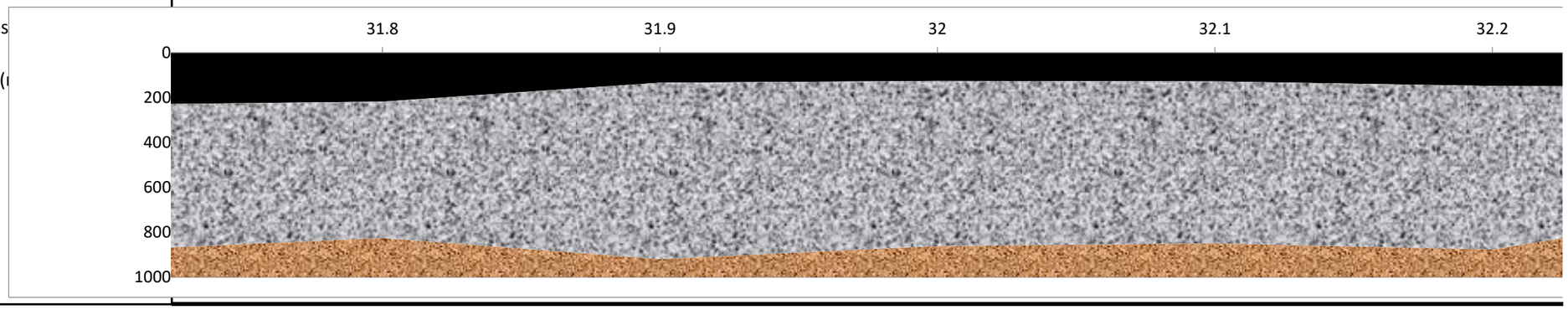
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thicknes
	Granular Thickness (I
	GPR Survey 2013
	Direction
	Northbound

140.854 140.864 140.874 140.884 140.894 140.904 140.914 140.924 140.934 140.944 140.954 140.964 140.974 140.984 140.994 141.004 141.014 141.025 141.035 141.045 141.055 141.065 141.075 141.085 141.095 141.105 141.115 141.125 141.135 141.145 141.155 141.165 141.175 141.185 141.195 141.205 141.215 141.225 141.235 141.245 141.255 141.265 141.275 141.285 141.295 141.305 141.315 141.325 141.335 141.345



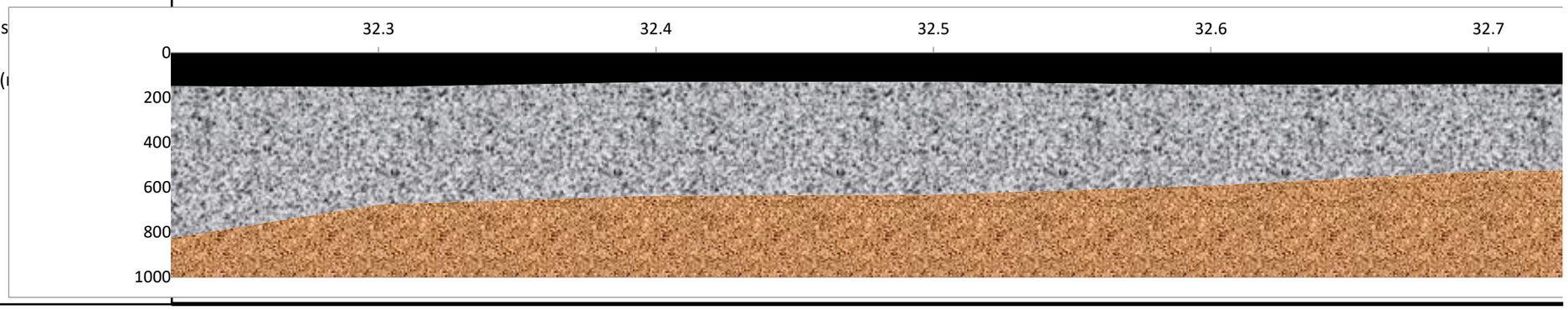
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

141.355 141.365 141.375 141.385 141.395 141.405 141.415 141.425 141.435 141.445 141.455 141.465 141.475 141.484 141.494 141.504 141.514 141.524 141.534 141.544 141.554 141.564 141.574 141.584 141.594 141.604 141.614 141.625 141.635 141.645 141.655 141.665 141.675 141.685 141.695 141.705 141.715 141.725 141.735 141.745 141.755 141.765 141.775 141.785 141.795 141.805 141.815 141.825 141.835 141.845



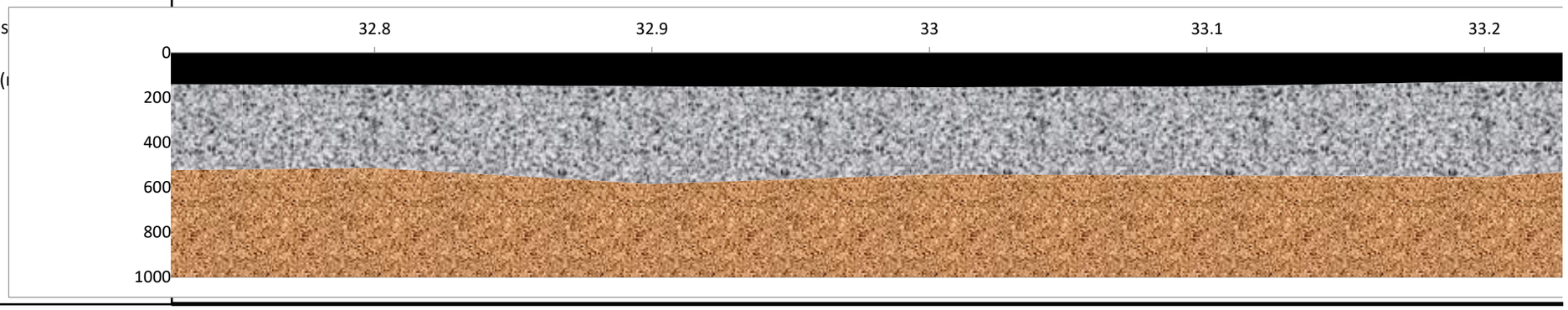
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thicknes
	Granular Thickness (r
	GPR Survey 2013
	Direction
	Northbound

141.855 141.865 141.875 141.885 141.895 141.905 141.915 141.925 141.934 141.945 141.955 141.965 141.975 141.985 141.995 142.005 142.015 142.025 142.034 142.044 142.054 142.065 142.074 142.084 142.094 142.104 142.114 142.124 142.134 142.144 142.154 142.164 142.174 142.184 142.194 142.204 142.214 142.224 142.234 142.244 142.254 142.264 142.274 142.284 142.294 142.304 142.314 142.324 142.334 142.344



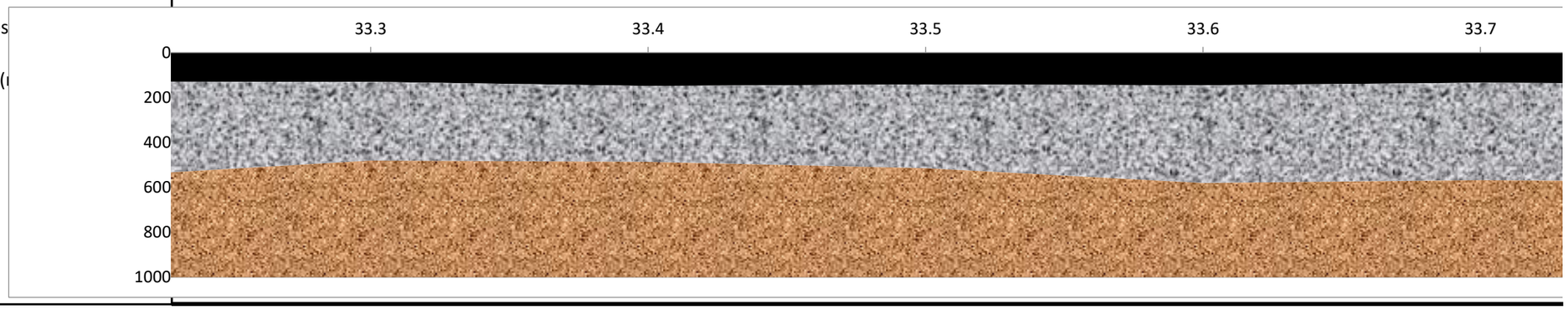
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thicknes
	Granular Thickness (r
	GPR Survey 2013
	Direction
	Northbound

142.354 142.365 142.374 142.384 142.394 142.404 142.414 142.424 142.434 142.444 142.454 142.464 142.474 142.484 142.494 142.504 142.514 142.524 142.534 142.544 142.554 142.564 142.574 142.584 142.594 142.604 142.614 142.624 142.634 142.644 142.654 142.664 142.674 142.684 142.694 142.704 142.714 142.723 142.733 142.743 142.753 142.763 142.773 142.784 142.793 142.803 142.813 142.823 142.833 142.843



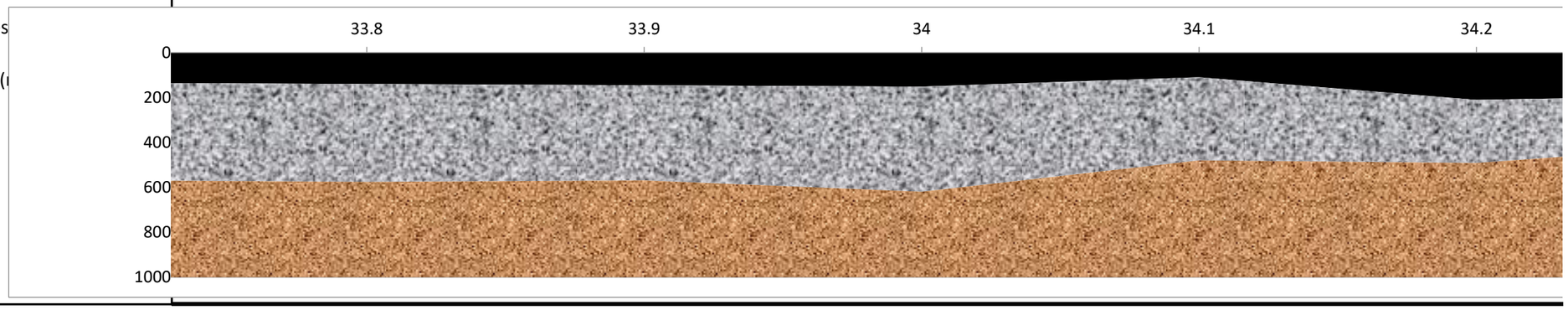
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

142.853 142.864 142.873 142.883 142.893 142.903 142.913 142.923 142.933 142.943 142.953 142.963 142.973 142.983 142.993 143.003 143.013 143.023 143.034 143.043 143.053 143.063 143.073 143.083 143.093 143.103 143.113 143.123 143.133 143.143 143.153 143.163 143.173 143.183 143.193 143.203 143.213 143.223 143.233 143.243 143.253 143.263 143.273 143.283 143.293 143.303 143.313 143.322 143.332 143.341



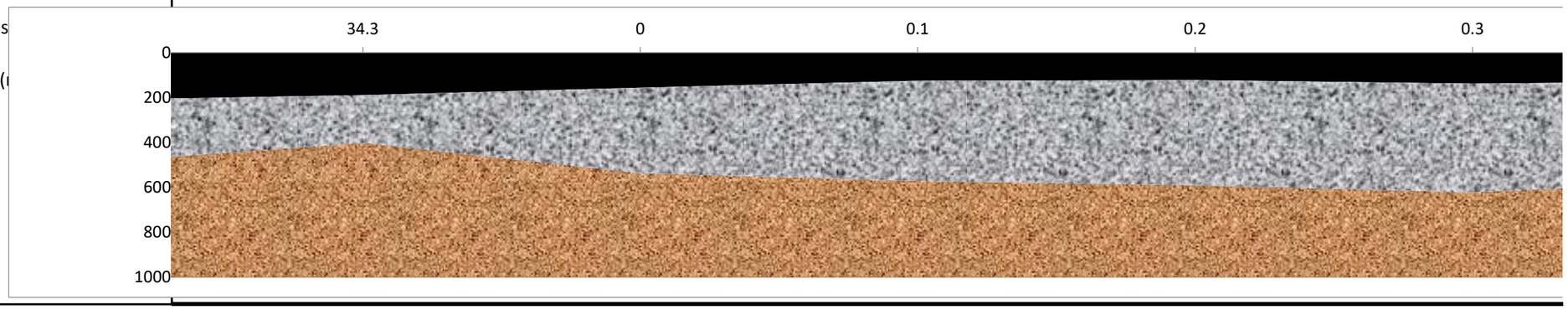
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (mm)
	GPR Survey 2013
	Direction
	Northbound

143.351 143.361 143.371 143.380 143.390 143.400 143.410 143.420 143.430 143.440 143.450 143.460 143.470 143.480 143.490 143.500 143.510 143.520 143.530 143.540 143.549 143.559 143.569 143.579 143.590 143.599 143.608 143.618 143.628 143.637 143.646 143.652 143.665 143.673 143.683 143.692 143.701 143.712 143.722 143.732 143.741 143.751 143.761 143.771 143.782 143.791 143.801 143.811 143.821 143.831



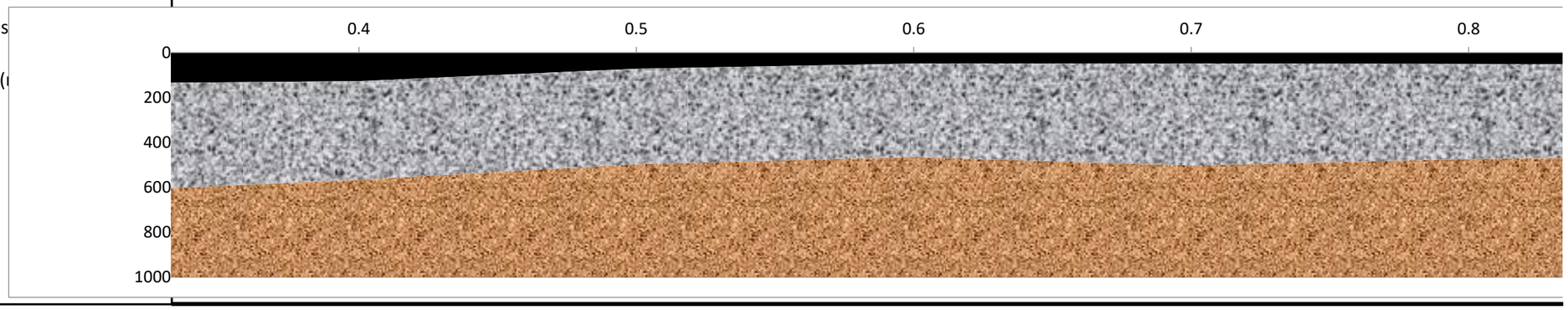
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness (mm)
	Granular Thickness (mm)
	GPR Survey 2013
	Direction
	Northbound

143.841 143.851 143.861 143.871 143.881 143.891 143.901 143.911 143.921 143.931 143.941 143.951 143.961 143.971 143.981 143.991 144.001 144.011 144.021 144.031 144.041 144.051 144.061 144.071 144.082 144.091 144.100 144.111 144.120 144.130 144.140 144.150 144.160 144.171 144.180 144.190 144.201 144.211 144.221 144.231 144.241 144.251 144.261 144.271 144.281 144.291 144.301 144.310 144.320 144.330



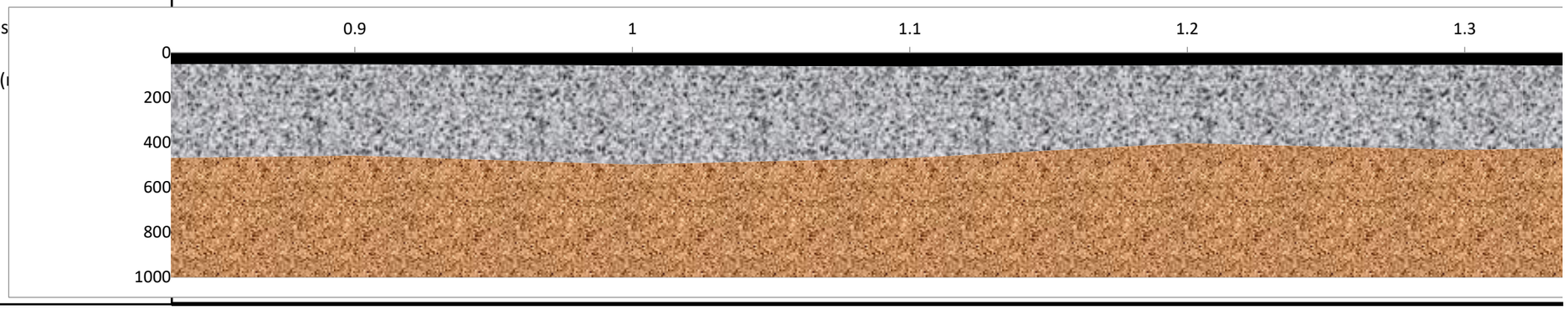
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thicknes
	Granular Thickness (r
	GPR Survey 2013
	Direction
	Northbound

144.340 144.350 144.360 144.370 144.380 144.390 144.400 144.410 144.420 144.430 144.440 144.450 144.460 144.470 144.480 144.490 144.499 144.510 144.520 144.530 144.540 144.550 144.561 144.571 144.581 144.591 144.601 144.612 144.622 144.632 144.643 144.653 144.663 144.673 144.684 144.693 144.704 144.714 144.724 144.734 144.744 144.755 144.765 144.774 144.782 144.792 144.800 144.809 144.819 144.829



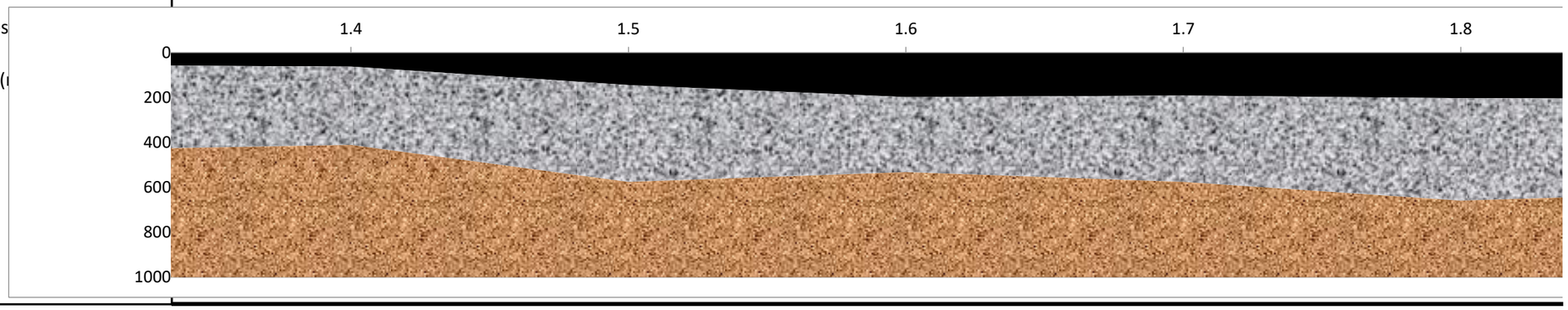
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thicknes
	Granular Thickness (r
	GPR Survey 2013
	Direction
	Northbound

144.839 144.849 144.859 144.869 144.879 144.889 144.899 144.910 144.920 144.931 144.941 144.950 144.960 144.970 144.979 144.989 144.999 145.009 145.019 145.029 145.039 145.049 145.059 145.069 145.079 145.089 145.099 145.109 145.119 145.129 145.139 145.148 145.158 145.169 145.178 145.188 145.198 145.208 145.218 145.229 145.239 145.249 145.259 145.269 145.279 145.289 145.299 145.309 145.319 145.329



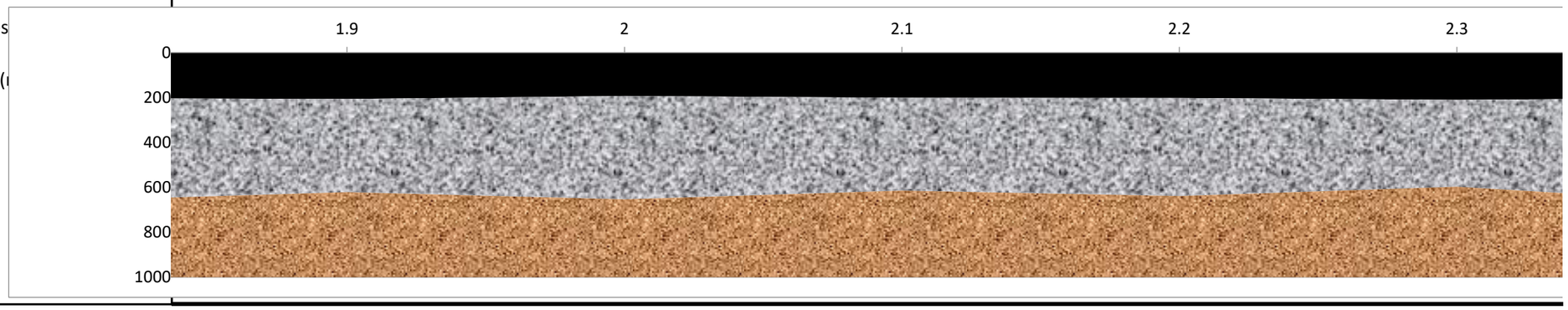
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thicknes
	Granular Thickness (r
	GPR Survey 2013
	Direction
	Northbound

145.338 145.348 145.358 145.368 145.378 145.388 145.398 145.408 145.418 145.428 145.438 145.448 145.458 145.467 145.476 145.490 145.500 145.510 145.520 145.529 145.539 145.549 145.559 145.569 145.579 145.589 145.599 145.609 145.620 145.629 145.639 145.649 145.659 145.669 145.679 145.690 145.699 145.709 145.719 145.729 145.739 145.750 145.759 145.769 145.779 145.789 145.799 145.809 145.819 145.829



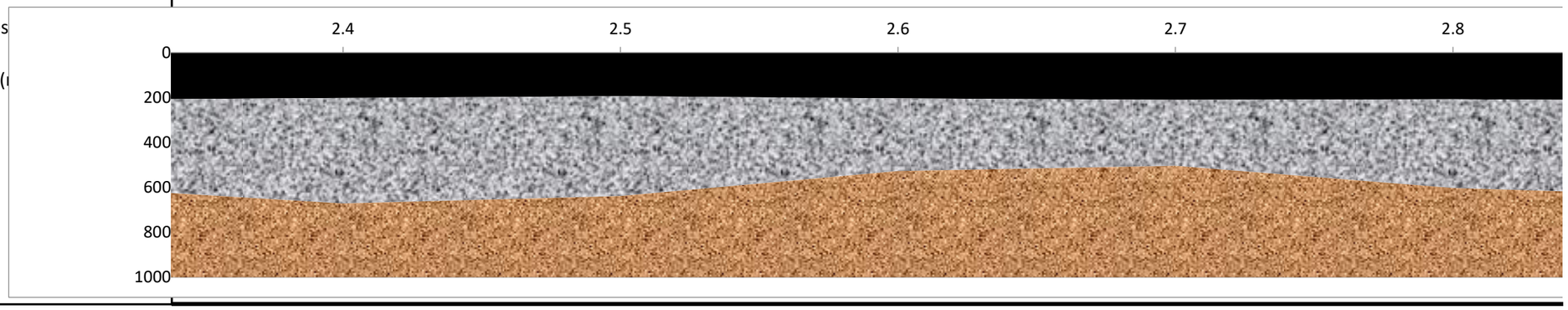
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (mm)
	GPR Survey 2013
	Direction
	Northbound

145.839 145.849 145.859 145.870 145.879 145.889 145.900 145.909 145.919 145.929 145.939 145.949 145.959 145.969 145.979 145.990 145.999 146.009 146.019 146.029 146.039 146.049 146.059 146.069 146.079 146.089 146.099 146.109 146.119 146.129 146.139 146.149 146.159 146.169 146.179 146.189 146.199 146.209 146.219 146.229 146.239 146.249 146.259 146.269 146.279 146.289 146.299 146.309 146.319 146.329



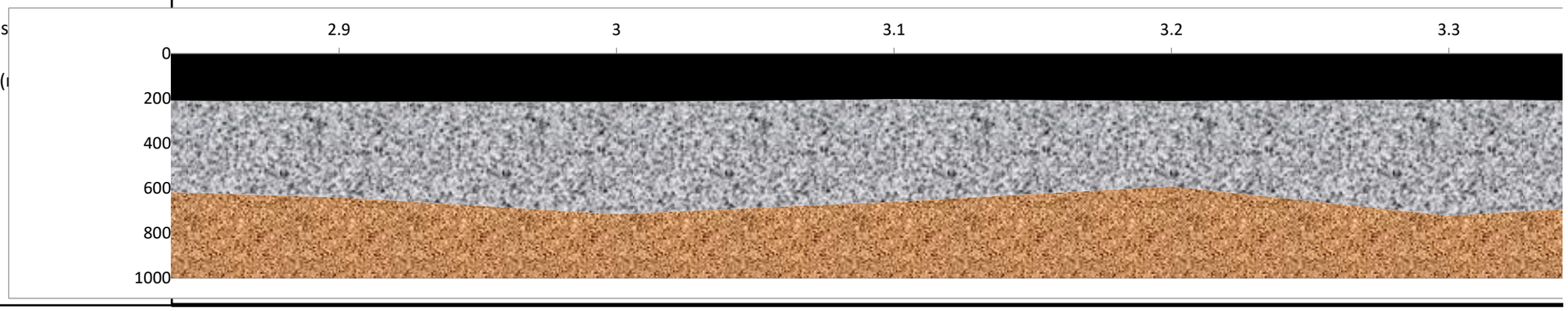
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thicknes
	Granular Thickness (r
	GPR Survey 2013
	Direction
	Northbound

146.339 146.349 146.359 146.369 146.379 146.389 146.399 146.409 146.419 146.429 146.439 146.449 146.459 146.469 146.479 146.489 146.499 146.509 146.519 146.529 146.539 146.549 146.559 146.569 146.579 146.589 146.599 146.608 146.618 146.628 146.638 146.649 146.659 146.669 146.679 146.688 146.698 146.708 146.718 146.728 146.738 146.748 146.758 146.768 146.778 146.788 146.798 146.808 146.818 146.828



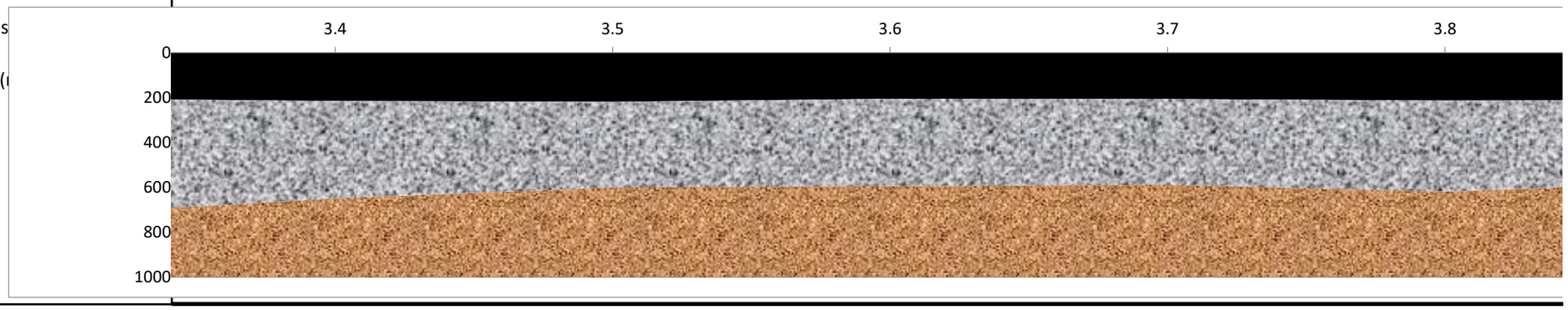
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thicknes
	Granular Thickness (r
	GPR Survey 2013
	Direction
	Northbound

146.838 146.848 146.858 146.868 146.878 146.888 146.898 146.908 146.917 146.927 146.937 146.947 146.957 146.967 146.977 146.987 146.997 147.007 147.017 147.027 147.037 147.047 147.056 147.067 147.076 147.086 147.096 147.106 147.116 147.126 147.136 147.146 147.156 147.166 147.176 147.186 147.196 147.206 147.216 147.226 147.236 147.245 147.255 147.265 147.275 147.285 147.295 147.305 147.315 147.325



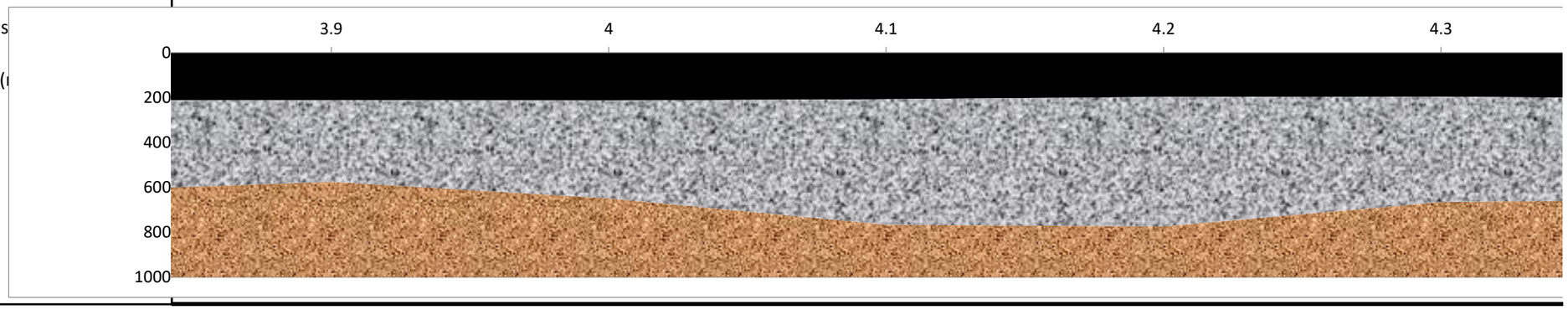
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

147.335 147.345 147.355 147.365 147.375 147.385 147.395 147.404 147.414 147.424 147.434 147.443 147.454 147.463 147.474 147.484 147.494 147.504 147.514 147.524 147.534 147.543 147.554 147.564 147.573 147.583 147.593 147.603 147.613 147.623 147.633 147.643 147.653 147.663 147.673 147.683 147.693 147.703 147.713 147.723 147.733 147.743 147.753 147.763 147.773 147.783 147.793 147.803 147.813 147.823



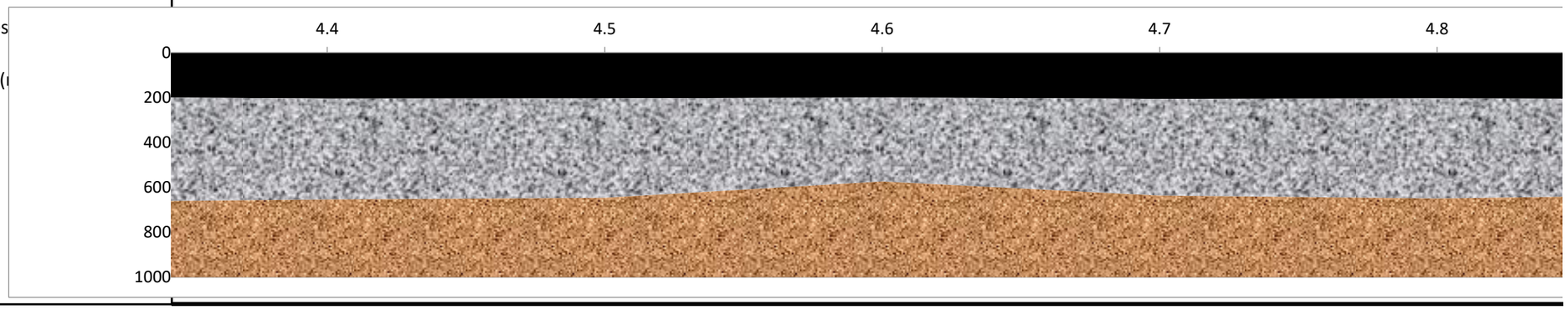
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

147.833 147.843 147.853 147.863 147.873 147.883 147.893 147.903 147.913 147.923 147.933 147.943 147.953 147.963 147.973 147.983 147.993 148.003 148.013 148.023 148.033 148.043 148.053 148.063 148.073 148.083 148.093 148.103 148.113 148.123 148.133 148.143 148.153 148.163 148.173 148.184 148.193 148.203 148.213 148.223 148.233 148.243 148.253 148.263 148.273 148.284 148.293 148.304 148.313 148.324



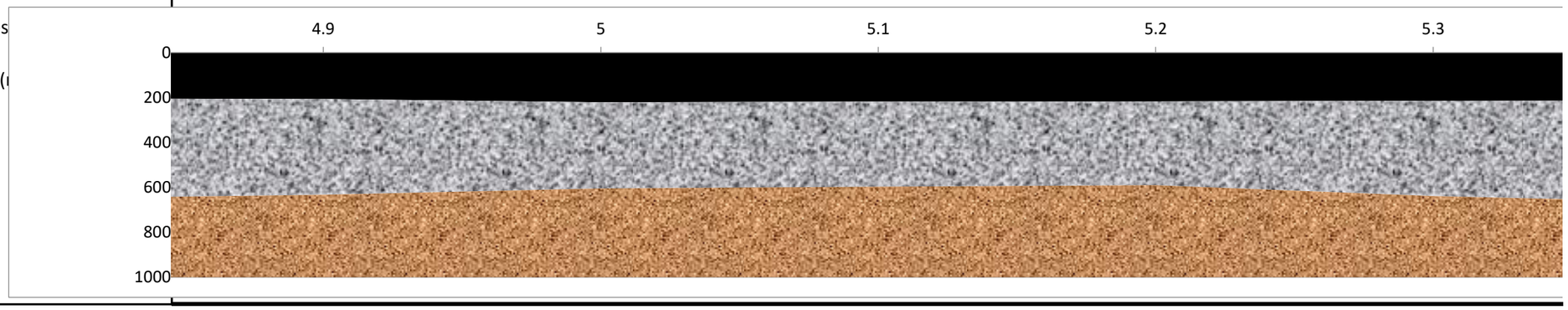
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (m)
	GPR Survey 2013
	Direction
	Northbound

148.333 148.343 148.354 148.363 148.373 148.383 148.393 148.403 148.413 148.424 148.433 148.444 148.453 148.463 148.474 148.484 148.494 148.504 148.514 148.524 148.534 148.544 148.554 148.564 148.574 148.584 148.594 148.604 148.614 148.624 148.634 148.644 148.654 148.664 148.674 148.684 148.694 148.704 148.714 148.724 148.734 148.744 148.754 148.764 148.774 148.784 148.794 148.804 148.814 148.824



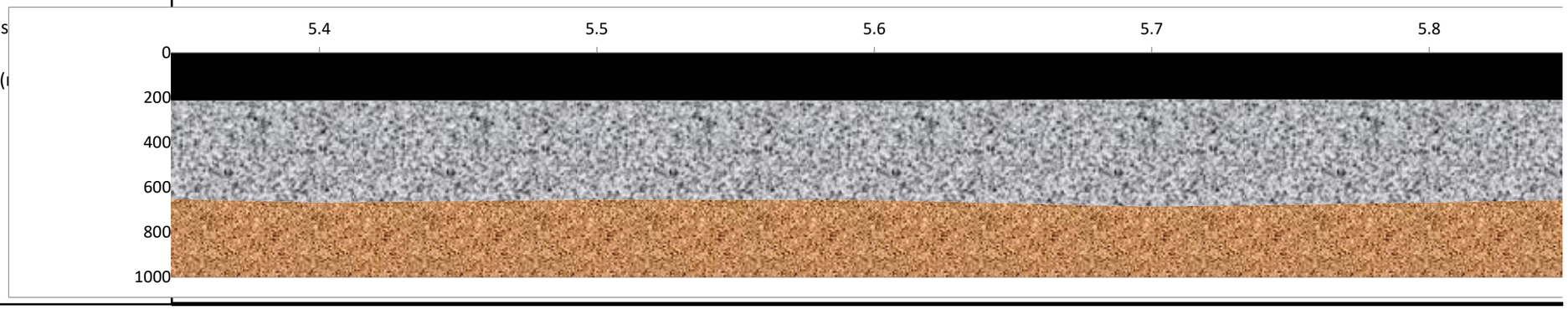
RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

Survey/Parameter	Dtims-Chainage
Longitudinal Profile	Left IRI (LIRI)
	Right IRI (RIRI)
	Left 3m (LLPV3)
	Right 3m (RLPV3)
Transverse Profile	Left Rut (LRUT)
	Right Rut (RRUT)
Cracking LCMS Survey	Alligator Cracking (Sqm)
	Longitudinal+Transverse Cracking(m)
Surface Characteristics	Ravelling (Sqm)
	Mean Profile Depth (MPD)
	Characteristic Scrim Coefficient (CSC)
Geometrics	Gradient %
	Crossfall %
Pavement Structure	Surface Type Survey 2014
	Bituminous Thickness
	Granular Thickness (mm)
	GPR Survey 2013
	Direction
	Northbound

148.834 148.844 148.854 148.864 148.874 148.884 148.894 148.904 148.914 148.924 148.934 148.944 148.954 148.964 148.974 148.984 148.994 149.004 149.014 149.024 149.034 149.044 149.054 149.064 149.074 149.084 149.094 149.104 149.114 149.124 149.134 149.144 149.154 149.164 149.174 149.184 149.194 149.204 149.214 149.224 149.234 149.244 149.254 149.264 149.274 149.284 149.293 149.304 149.313 149.324



RSP Survey - 29/07/19
SCRIM Survey - 29/08/19
LCMS Survey - 2017

N4 Carrick on Shannon - Dromod.
Surveyed Northbound 2019.

Subnet-1

(589355, 800865)

Survey/Parameter	Dtims-Chainage	149.333	149.343	149.353	149.363	149.373	149.383	149.393	149.403	149.413	149.423	149.433	149.443	149.453	149.463	149.473	149.483	149.493	149.503	149.513	149.523	149.533	149.543	149.553	149.563	149.573	149.583	149.593	149.603	149.613	149.623	149.633	149.643	149.653	149.663	149.673	149.683	149.693	149.702	149.712	149.722	149.732	149.742	149.752	149.762	149.772	149.782	149.792
Longitudinal Profile	Left IRI (LIRI)																																																
	Right IRI (RIRI)																																																
	Left 3m (LLPV3)																																																
	Right 3m (RLPV3)																																																
Transverse Profile	Left Rut (LRUT)																																																
	Right Rut (RRUT)																																																
Cracking LCMS Survey	Alligator Cracking (Sqm)																																															
	Longitudinal+Transverse Cracking(m)																																															
Surface Characteristics	Ravelling (Sqm)																																															
	Mean Profile Depth (MPD)																																															
	Characteristic Scrim Coefficient (CSC)																																															
Geometrics	Gradient %																																															
	Crossfall %																																															
Pavement Structure	Surface Type Survey 2014																																															
	Bituminous Thicknes																																															
	Granular Thickness (m																																															
	GPR Survey 2013																																															
	Direction																																															
	Northbound