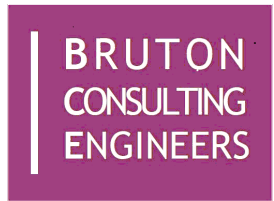


Appendix A.8.4.1

**Stage F1 Road Safety Audit
(RSA)**



Title: **STAGE F1 ROAD SAFETY AUDIT**
For;
N4 Carrick-on-Shannon to Dromod Project.

Client: **ARUP/ Leitrim County Council**

Date: **December 2021**

Report reference: **1180R02-Rev 1**

VERSION: **FINAL (February 2022)**

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1.0 Introduction

This report was prepared in response to a request from Ms. Mary Hurley, ARUP, for a Stage F1 Road Safety Audit of the proposed N4 Carrick-on-Shannon to Dromod Project.

The Road Safety Audit Team comprised;

Team Leader: **Norman Bruton**, BE CEng FIEI, Cert Comp RSA.

TII Auditor Approval no. NB 168446

Team Member: **Martin Deegan** BEng (Hons) MSc CEng MIEI, Cert Comp RSA

TII Auditor Approval no. MD 101312

The Road Safety Audit comprised an examination of the drawings and other material provided and a site visit. The site visit took place on the 18th of October 2021. The weather at the time of the site visit was dry and the road surface was also dry.

This Stage F1 Road Safety Audit has been carried out in accordance with the requirements of TII Publication Number GE-STY-01024, dated December 2017.

This Stage F1 report assesses and ranks each option at this Stage 2 of the Design Development, provided by the Design Team with regard to road safety.

This report will form part of the project's option selection process. The overall preferred option may not match the highest ranked option with regard to road safety as many other factors have to be included in the overall assessment.

A list of the documents provided to the Audit Team is provided in **Appendix A**.

TII Audit Team Approval is contained in **Appendix B**.

2.0 Background

2.1 Brief Description of the Project

The N4 is a National Primary route between Dublin to Sligo. The section under consideration is from Carrick-on-Shannon to Dromod in Co. Leitrim.

2.2 Existing Conditions

The existing N4 is a single carriageway road which travels through the town of Carrick-on-Shannon and the urban area of Cortober. There is an existing issue with congestion on this section of the N4. The eastern extent of the study area commences at the end of the existing dual carriageway section at Dromod and finished west of Carrick-on Shannon at Cloongownagh.

2.3 Key Objectives

Only the alternatives and options that meet the project objectives have made it to this stage of the assessment as provided by the Design Team. This assessment relates only to road safety.

2.4 Project Assessment

The project is currently going through the Stage 2 assessment process (As per the TII Project Management Guidelines). There are alternatives and options being considered by the Design Team.

2.5 Alternatives & Options

The list of alternatives and options provided to the Audit Team by the Design Team are as follows.

- Do-Minimum (planned and committed schemes)
- Do-Something Alternatives
 - Alternative A - Active Travel
 - Alternative B- Public Transport Improvements, including improved inter-urban bus services and improved local bus services in Cortober / Carrick-on-Shannon. Improvements to the railway station.
 - Alternative C - Demand Management Proposals (Reducing demand).
- Do-Something Options.

All option corridors, apart from one, converge at the existing Drumsna Junction. The assessment has been split for all environmental disciplines into the section east and the section west of this junction. This junction is known as Node J.

Other nodes are named A to H and are referenced in Table 1 below which is a summary list of the option corridors and designs.

A total of eight option corridors with the potential for road based solutions have been taken forward to the Stage 2 Project Appraisal Matrix.

Five option corridors are located to the west of Drumsna Junction (Node J) (Black, Cyan, Orange, Purple West and Dark Green) and three option corridors are to the east of Drumsna Junction (Node J) (Purple East, Green and Yellow).

One of the options west of Node J (Black Corridor) is a single carriageway urban street.

The other four corridors to the west of Node J are dual carriageways. For the purposes of this RSA an assessment of the dual carriageway type cross-sections was undertaken.

One of the options east of Node J (Purple East Corridor) is a dual carriageway and the other two are single carriageways.

Table 2.1 - Summary List of Option Corridors and Designs

Option Corridor	Node	Design Colour	Carriageway
West of Drumsna Junction (Node J)			
Black Corridor	N/A	Black Design	Single Carriageway Urban Street
Cyan Option Corridor	A-J	Pink Design	Dual Carriageway
Orange Option Corridor	B-J	Orange Design	Dual Carriageway
Purple West Option Corridor	B-J	Purple Design	Dual Carriageway
Dark Green Option Corridor	B-J	Grey Design	Dual Carriageway
East of Drumsna Junction (Node J)			
Purple East Option Corridor	J-H	Purple Design	Dual Carriageway
Green Option Corridor	J-H	Green Design	Single Carriageway
Yellow Option Corridor	J-H	Yellow Design	Single Carriageway

A Stage F road safety audit is as described in the extract below from TII Publication, GE-STY-01024, Road Safety Audit.

Stage F audits shall be completed where a choice of routes or other options is available, Stage F audits shall be carried out in two parts. Part 1 shall be a comparative assessment of the options from a road safety point of view. Once the option has been chosen, Part 2 of the audit shall be carried out on the chosen option, in the standard problem and recommendation format.

Figure 2.1 - Extract from TII Publication, GE-STY-01024, Road Safety Audit

In this report some high-level road safety assessment is provided on the Do-Something Alternatives, followed by an assessment of each Do-Something option, followed by a ranking of the Do-Something options only. Ranking of the alternatives is not provided as they are not like for like options that can be ranked in terms of road safety.

The study area boundary (red line), option corridors, and designs are shown below in Figure 2.2.

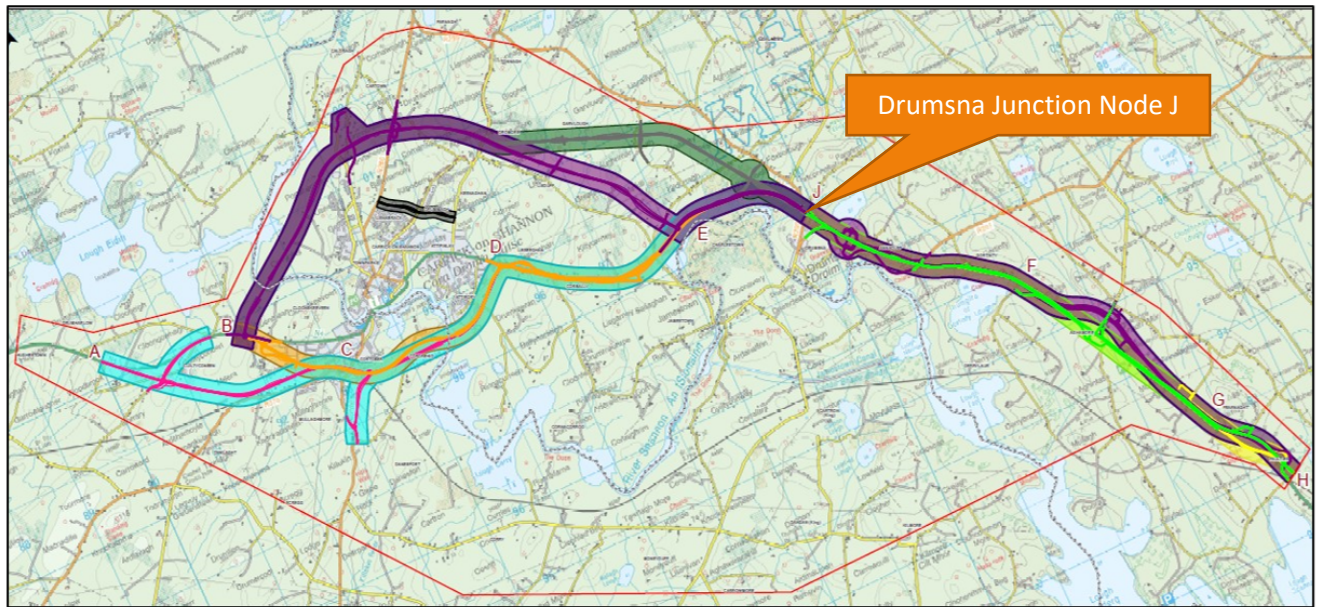


Figure 2.2 - Study area boundary, option corridors and designs

2.6 Collision History

The Road Safety Authority's website (www.rsa.ie) shows that there were two fatal, and three serious injuries recorded in the period 2006 to 2016 along the N4 route under consideration. There were also two fatal collisions and two serious injury collisions on the R280 in that period.

Extracts from the mapping feature on the RSA website are shown below which indicate the severity and location of each recorded collision.

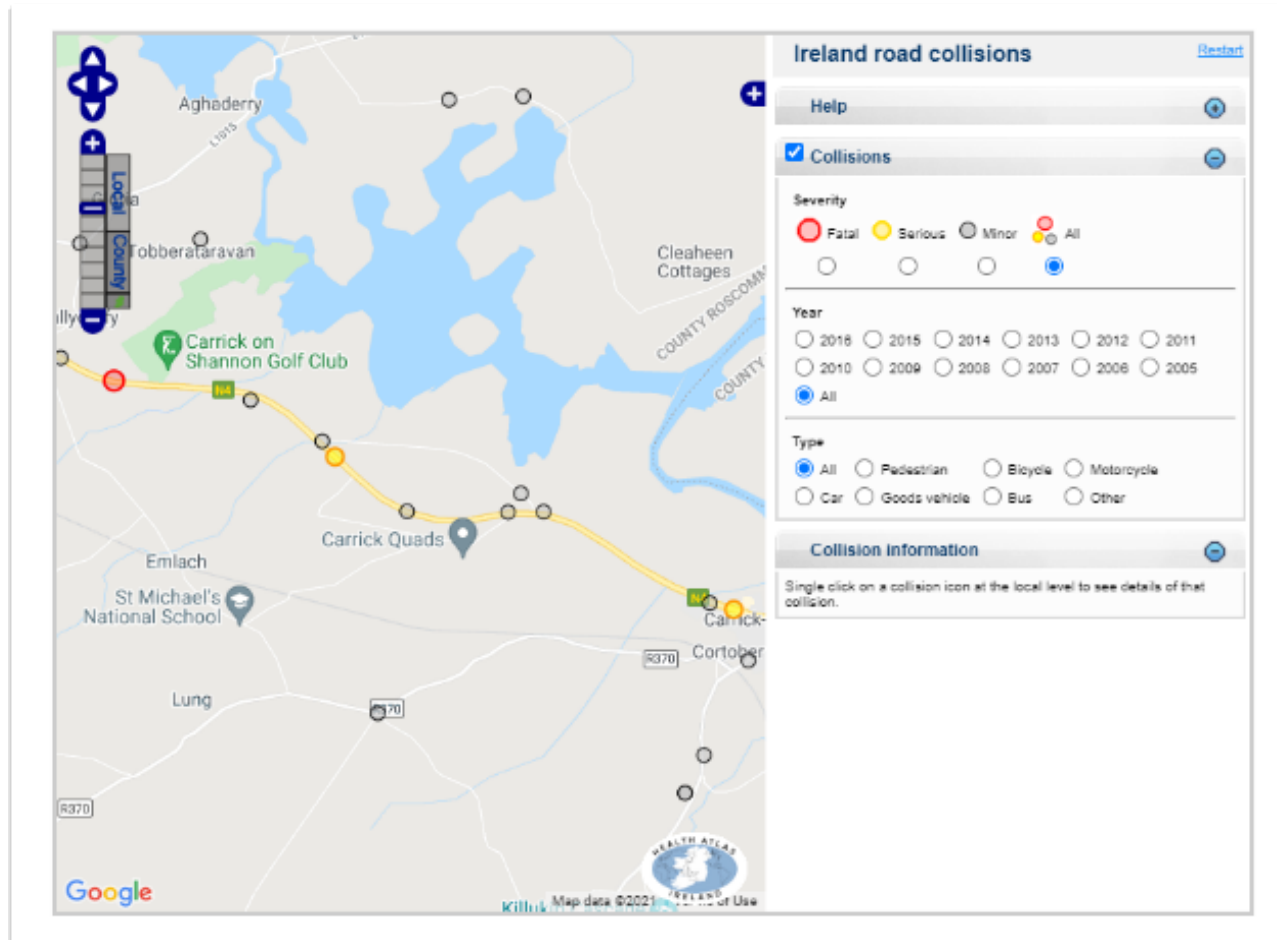


Figure 2.3 - Extract No. 1 from RSA's collision data (www.rsa.ie)

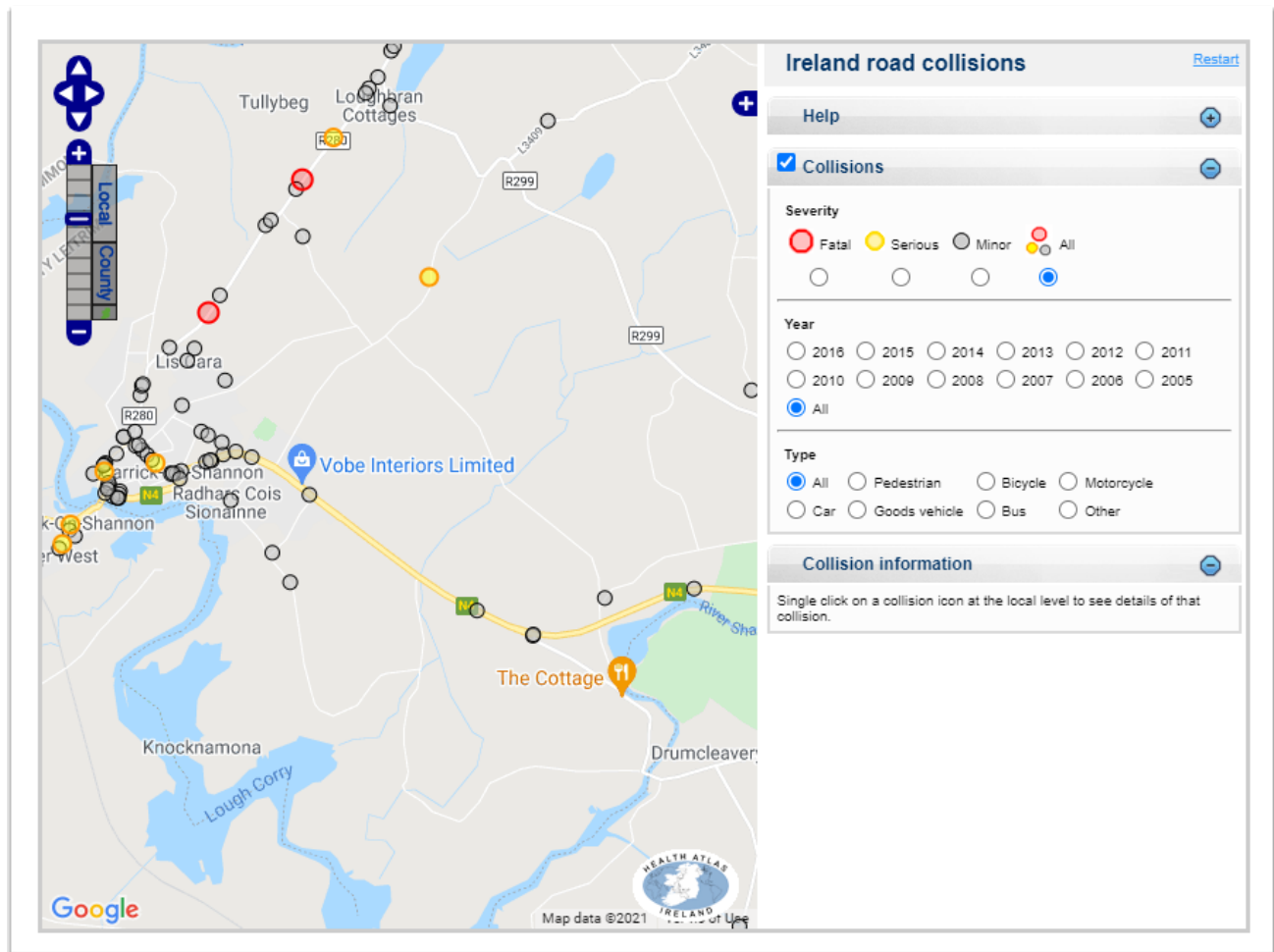


Figure 2.4 - Extract No. 2 from RSA's collision data (www.rsa.ie)

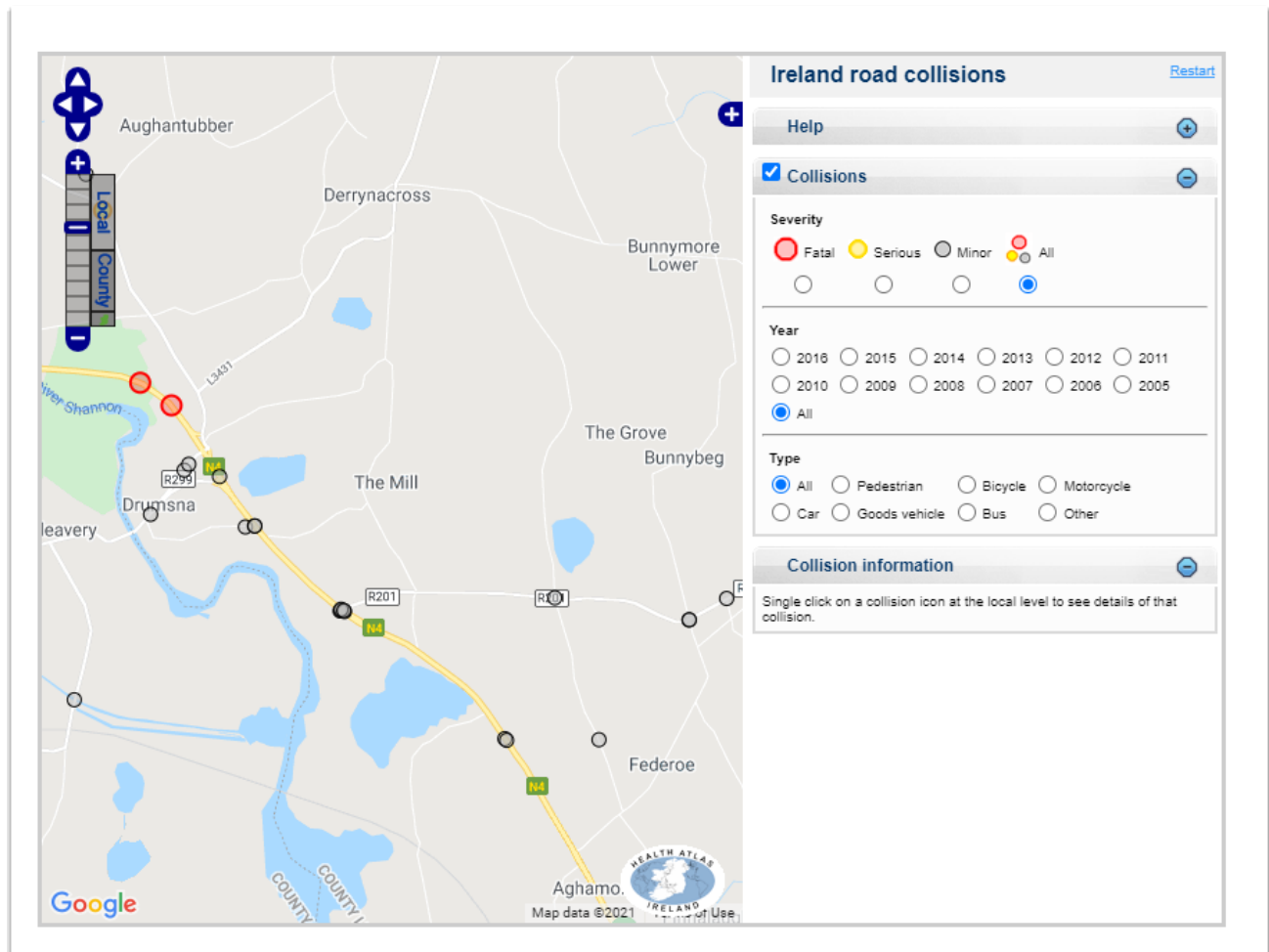


Figure 2.5 - Extract No. 3 from RSA's collision data (www.rsa.ie)

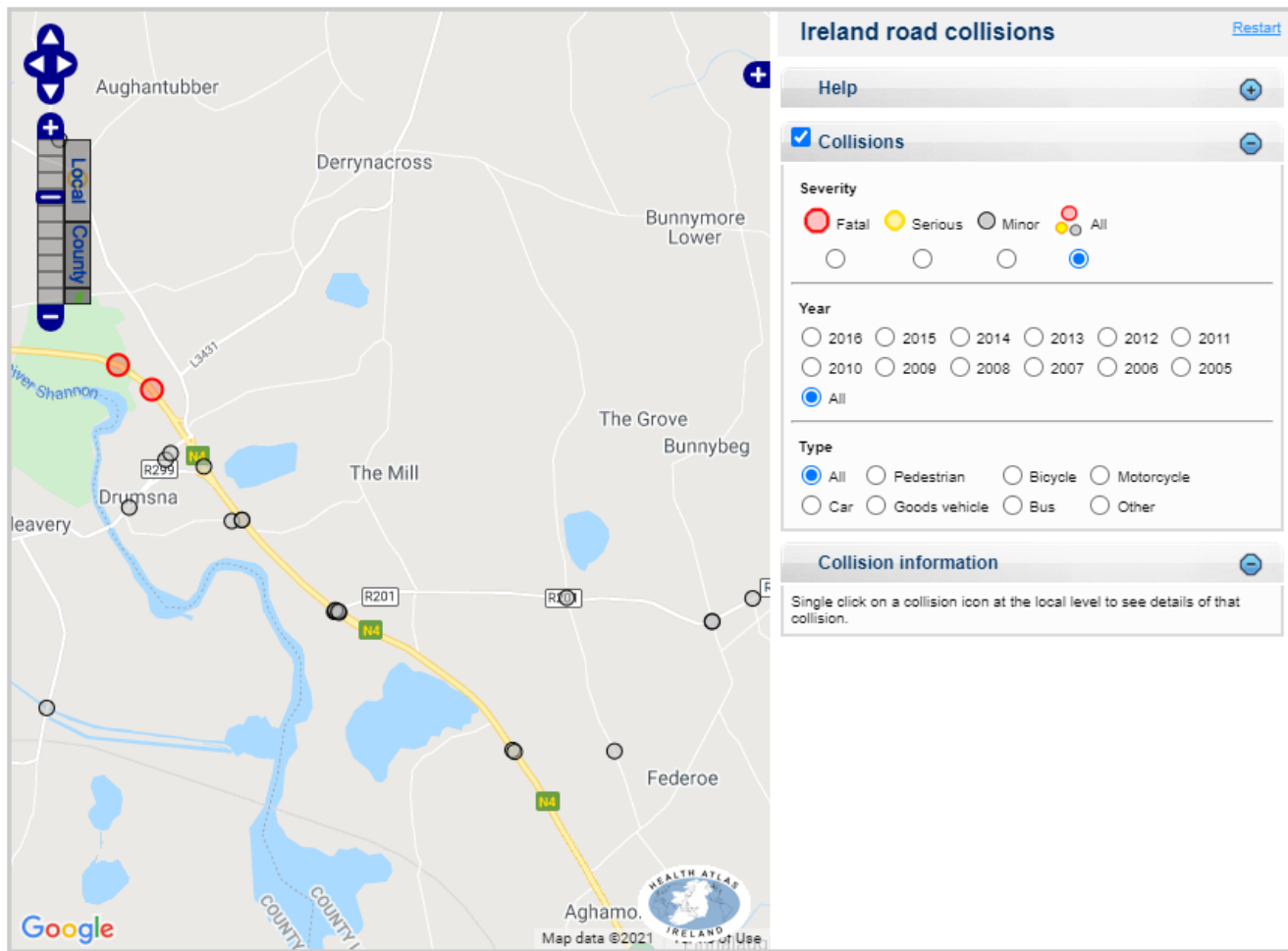


Figure 2.6 - Extract No. 4 from RSA's collision data (www.rsa.ie)

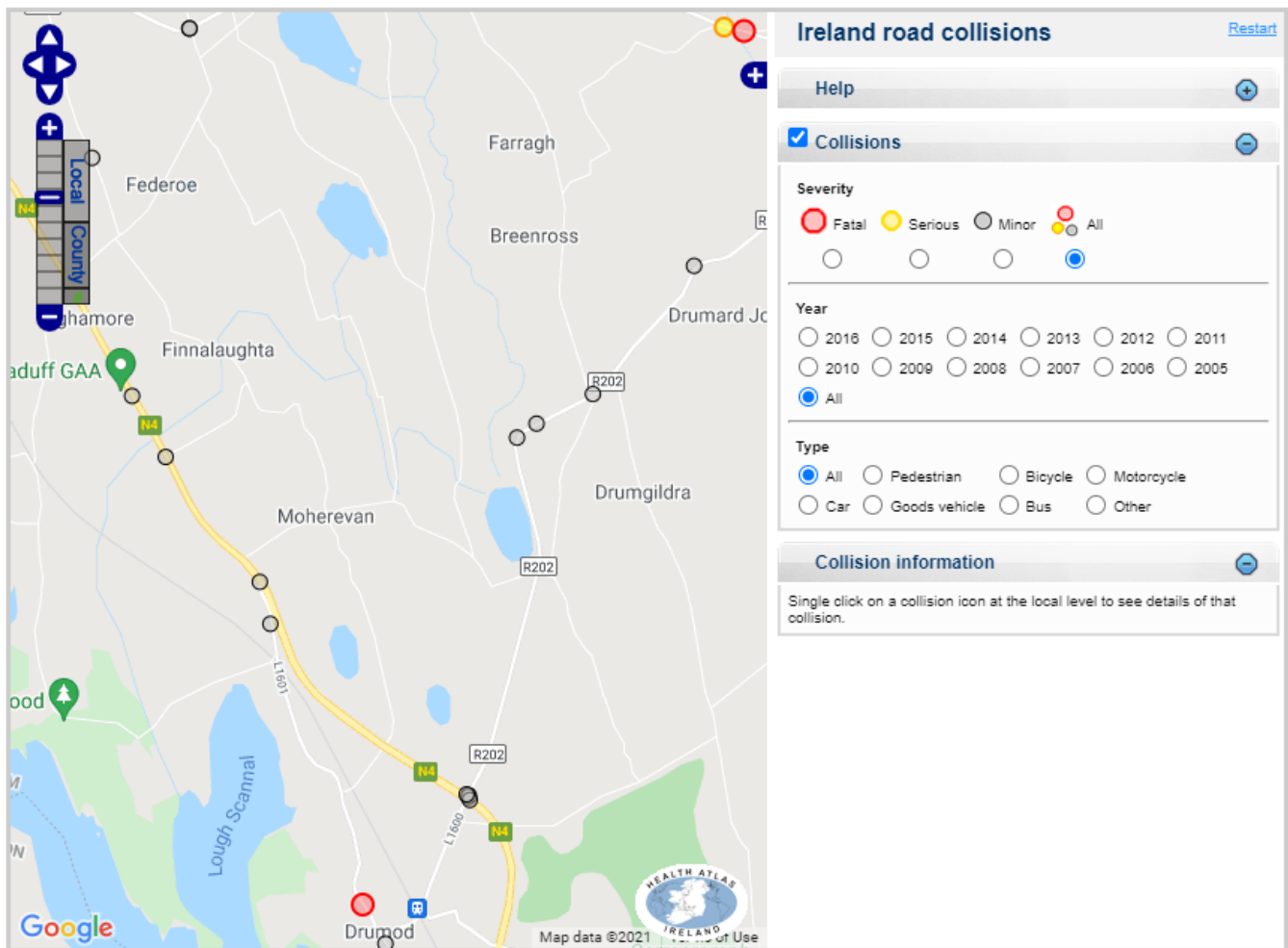


Figure 2.7 - Extract No. 5 from RSA's collision data (www.rsa.ie)

3.0 Road Safety Assessment of Alternatives

3.1 List of Alternatives

The alternatives are as follows:

- Alternative A - Active Travel
- Alternative B - Public Transport Improvements, including improved inter-urban bus services and improved local bus services in Cortober / Carrick-on-Shannon. Improvements to the railway station.
- Alternative C - Demand Management Proposals (Reducing demand).

3.2 General Problems for All Alternatives.

3.2.1 Problem

LOCATION

Throughout the study area.

PROBLEM

None of the alternatives address the sub-standard road alignment along the existing N4 route through the study area. The route has a collision history, and the likelihood of collisions will increase if significant improvements are not carried out.

3.3 Alternative A: Active Travel

3.3.1 Problem

LOCATION

Through the existing N4.

PROBLEM

The Active Travel Alternative will improve safety for vulnerable road users in the urban areas of Carrick-on-Shannon and Cortober. It is also proposed to provide active travel facilities throughout the entire route. It is assumed that this would be via a shared use footpath /cycle track along the existing N4. Such a route would improve the facilities for vulnerable road users, but segregation from mainline traffic would not be guaranteed along the entirety of the route. Retrofitting facilities would inevitably lead to a greater number of departures from standard and would possibly compromise the quality of the facilities provided.

3.4 Alternative B: Public Transport Improvements

3.4.1 Problem

LOCATION

Throughout the study area.

PROBLEM

Bus enhancements would improve safety for bus users at bus stops when provided to current standards. This Alternative would seek to increase bus usage which is to be encouraged. However, it does not improve safety significantly for any other road user group, either within the urban areas or along the rural sections of the N4 as the mode shift to bus is approximately 1%.

3.5 Alternative C: Reducing Demand

3.5.1 Problem

LOCATION

Carrick-on-Shannon.

PROBLEM

This is a localised alternative in Carrick-on Shannon and does not address the strategic nature of the N4 route. The reduction in car trips is to be encouraged from both a sustainability and road safety viewpoint. All road users within Carrick-on Shannon would benefit in terms of road safety however this alternative would not address issues outside this area.

3.6 Do-Minimum Option - Maintenance

3.6.1 Problem

LOCATION

Throughout the study area.

PROBLEM

The existing N4 has a substandard alignment and has unforgiving roadsides. The Do-Minimum option would seek to maintain the current layout with ongoing minor low cost works without addressing the major shortcomings which would contribute to future collision rates.

4.0 Items Arising from The Audit for the N4 Options

4.1 General Problems for All Options

4.1.1 Problem

LOCATION

Throughout the alignment options.

PROBLEM

The proposed cross-section is either a single carriageway or a dual carriageway. Although a wide corridor is proposed it is unclear if facilities for pedestrians and cyclists have been taken into account. The Standard Construction Detail CC-SCD-00001 notes that provision for pedestrians and cyclists should be made in the verge 'as necessary'. There is a risk that the provision for such vulnerable road users will take place secondary to general traffic leading to pinch points or gaps in the provision as the project design develops.

HAZARD

Unsegregated vulnerable road users are more likely to be struck by passing vehicular traffic.

4.1.2 Problem

LOCATION

All options west of Drumsna (Node J) crossing the River Shannon.

PROBLEM

The River Shannon is a wide river and there is a risk that there will be crosswinds which could affect high sided vehicles and cyclists.

HAZARD

Crosswinds at River Shannon crossings.

4.1.3 Problem

LOCATION

All options west of Drumsna (Node J), cut and fill slopes.

PROBLEM

All options west of the Drumsna Junction involve significant areas of cut and fill. There is a risk that due to economic and land acquisition constraints that steep slopes and narrow verges will be provided leading to unforgiving roadsides resulting in vehicle restraint systems being required. Vehicle restraint systems are themselves hazards for the occupants of errant vehicles.

HAZARD

Significant earthworks leading to unforgiving roadsides.

4.2 Options West of Drumsna (Node J)

4.2.1 Black Option Corridor – Single Carriageway Urban Street

The Black Design comprises an urban street improvement within Carrick-on-Shannon. This option provides linkage by interconnecting the R280 (Leitrim Road) to the Summerhill Road and on to the Castlecara Road.

This option is unlike the 4 other options west of Drumsna in that it does not start at Cloongownagh and terminate at Node J. It cannot, therefore, be brought forward to the ranking part of this assessment as it cannot be ranked on a like for like basis.

4.2.1.1

LOCATION

Vertical Alignment.

PROBLEM

There is a steep vertical alignment on the Black Option (5% gradients) as a function of the existing topography. This route would be used by vulnerable road users and crossing of the route would inevitably occur at desire lines as route becomes more desirable and urban as the population of the town increases. The steep gradients can lead to a lack of stopping sight distance for drivers to low objects such as children crossing.

HAZARD

Lack of stopping sight distance can lead to collisions with hazards on the carriageway.

4.2.1.2

LOCATION

The proposed route.

PROBLEM

The connecting road may be classified (DMURS) somewhere between an arterial route connecting two major links to the existing N4 and connecting with an urban Link/Local road. The proposed geometric alignment and cross-section may lead to an arterial road nature whilst the location on Summerhill Road in a residential area may lead to a local road nature.

There is a danger that the road will not fall in either category and may not give the sense of place that it should. This could lead to high speeds in the residential environment, which in turn could lead to high collision severity.

HAZARD

Inappropriate design features for an urban road could lead to high speeds in the residential environment, which in turn could lead to high collision severity.

4.2.2 Cyan Option Corridor (Pink Design)

The Cyan Option Corridor consists of the Pink Design (The Cyan Option Corridor also has the Cyan Design which is the single carriageway option) which comprises an off-line dual carriageway to the south of the existing N4, which commences at Node A at Cloongownagh and immediately deviates from the existing N4. It continues eastwards hugging the north of the railway line, crosses the R368 to the east of the railway station and crosses the River Shannon at Cordrehid. It rejoins the existing N4 with a roundabout junction at Node D at Lisseeghan. An on-line upgrade of the existing single carriageway to a dual carriageway is proposed between Node D at Lisseeghan and Node J at Drumsna Junction.

This option has three roundabout junctions and one River Shannon crossing. There is one underbridge and two overbridges.

The overall length of this option is 11.1km.

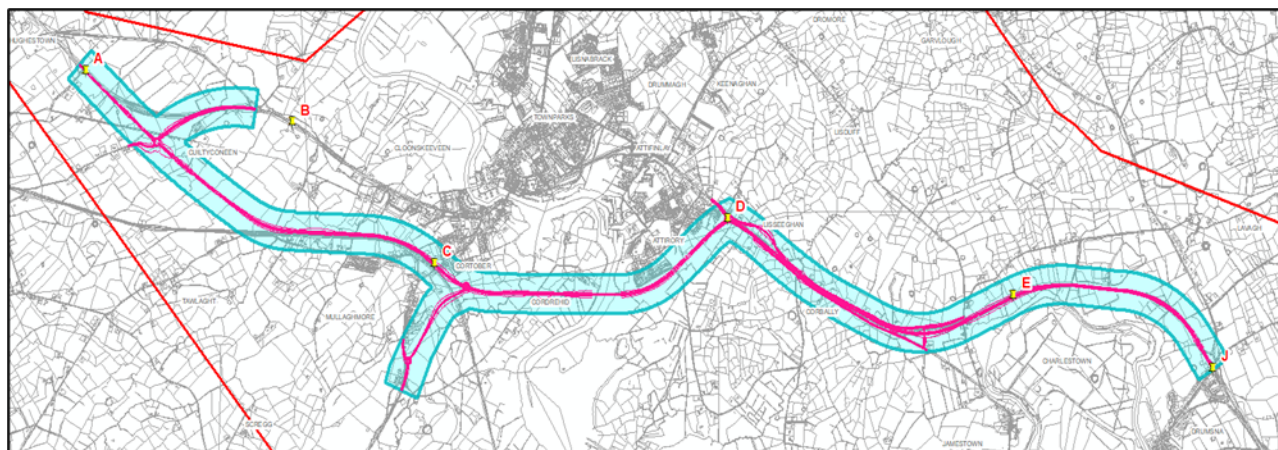


Figure 4.1 - Cyan Option Corridor (Pink Design)

4.2.2.1

LOCATION

Junction West Roundabout.

PROBLEM

Junction West roundabout is located in an area of large cutting and is on the downside of a gradient for westbound traffic. The junction may not be expected by drivers who believe they are in a rural area and who cannot see the roundabout on approach.

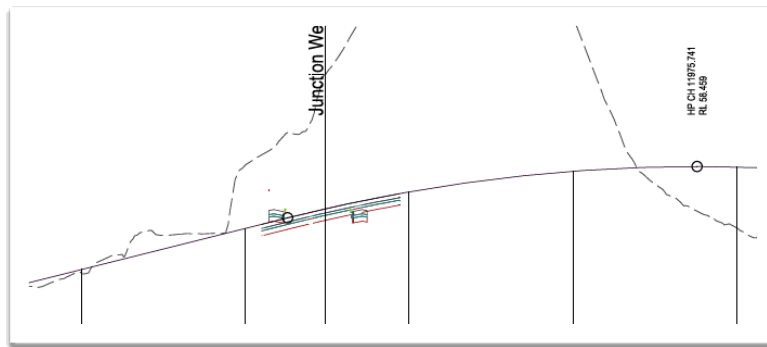


Figure 4.2 – Vertical alignment of mainline at Junction West Roundabout

HAZARD

The presence of a rural roundabout on a downslope may lead to overshoot by drivers who do not anticipate its presence.

4.2.2.2

LOCATION

Drishoge, parallel to the railway line (Ch 13,300 to Ch 14,400)

PROBLEM

Placing the mainline parallel to the railway line could lead to dazzle for drivers from train lights, and for train drivers from headlights of traffic. This could lead to loss of control for drivers, and for train drivers to be unable to see hazards on the rail line ahead.

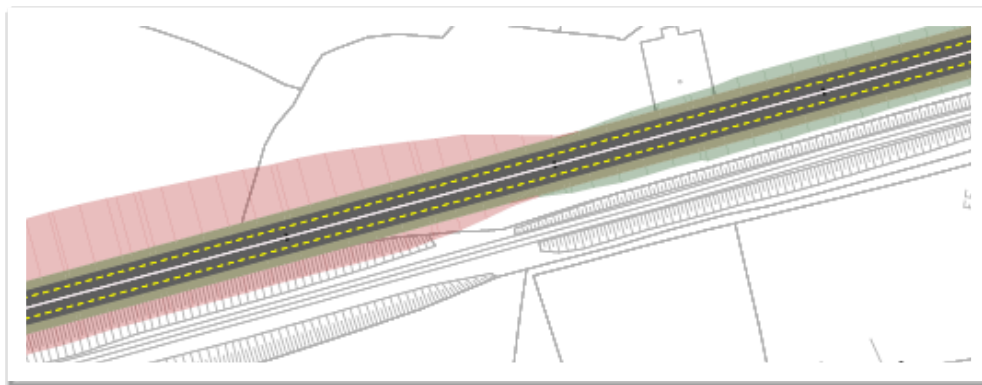


Figure 4.3 - Drishoge, parallel to the railway line

HAZARD

Dazzle from parallel road and train line.

4.2.2.3

LOCATION

Cortober Roundabout, Ch 14,700.

STAGE F1 RSA – N4 CARRICK-ON-SHANNON TO DROMOD ARUP

PROBLEM

The realigned R368 arm of the Cortober roundabout is at an acute angle to the east - west realigned N4 mainline. There appears to be a constraint with a perpendicular crossing of the railway line. The acute angle may lead to side-swipe collisions on the circulating carriageway of the roundabout if eastbound N4 mainline drivers misjudge gaps to the R368 traffic entering the roundabout.

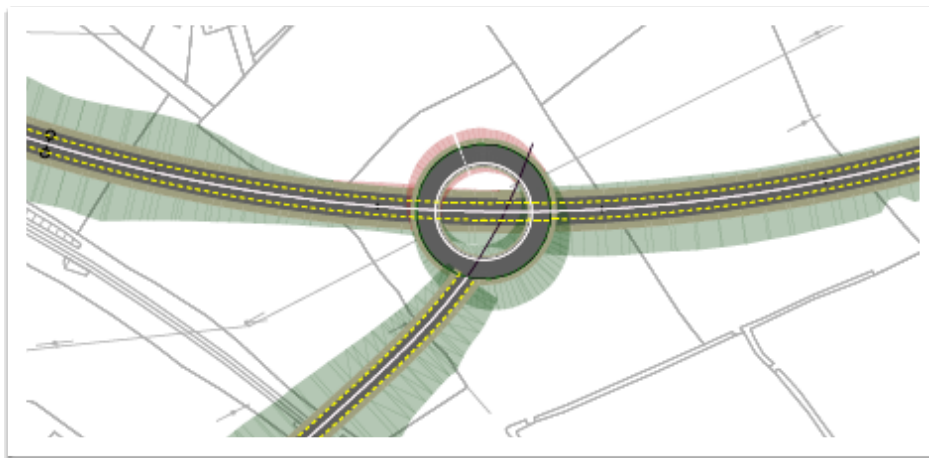


Figure 4.4 - Cortober Roundabout

HAZARD

Roundabout geometry could lead to side-swipe collisions.

4.2.2.4

LOCATION

Collector roads either side of N4 mainline Ch 17,300 to Ch 18,900.

PROBLEM

The proposed collector roads on both sides of the N4 mainline could lead to dazzle for drivers.

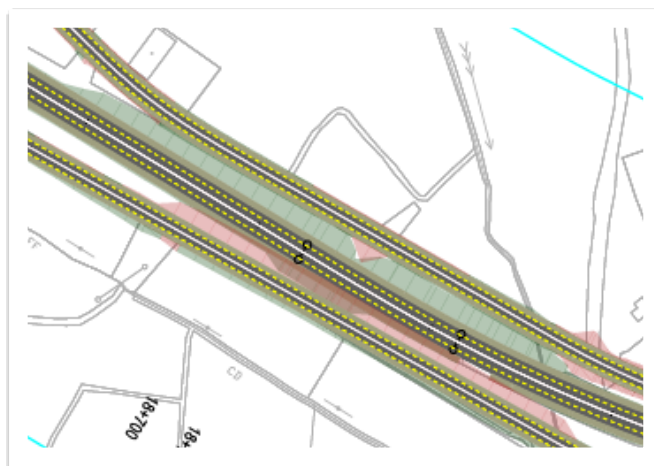


Figure 4.5 - Collector roads either side of N4 mainline Ch 17,300 to Ch 18,900

HAZARD

Dazzle from headlights of vehicles travelling in the opposite direction on the collector roads could lead to loss of control.

4.2.2.5

LOCATION

Ch 20,700 to Ch 21,300, Vertical Alignment.

PROBLEM

The vertical alignment between Ch 20,700 and Ch 21,300 is very flat. When construction tolerances of the surfacing course are taken into account this could lead to flat spots resulting in surface water ponding.

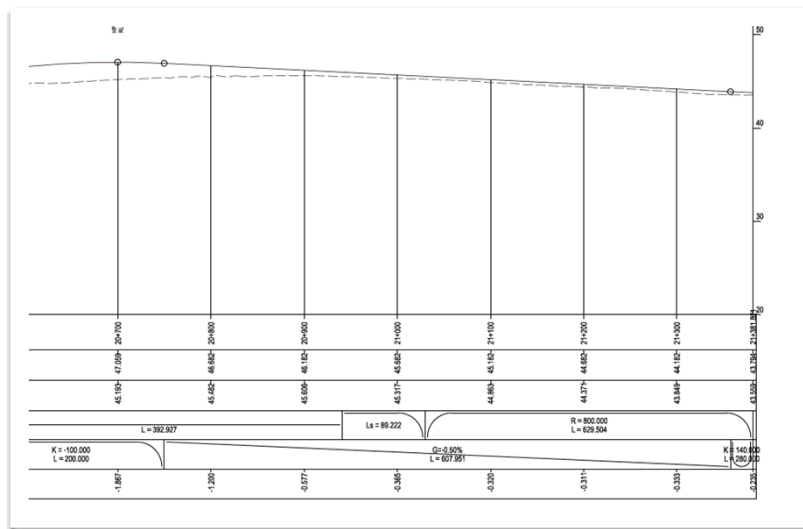


Figure 4.6 - Vertical Alignment, Ch 20,700 to Ch 21,300

HAZARD

Surface water ponding in flat areas could lead to loss of traction and loss of control.

4.2.3 Orange Option Corridor

The Orange Design is a dual carriageway option which commences and deviates from the existing N4 at Node B 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 Node D at Lisseeghan. An on-line upgrade of the existing single carriageway to a dual carriageway between Node D at Lisseeghan and Node J at Drumsna Junction is proposed.



Figure 4.7 - Orange Option Corridor

This option has two roundabout junctions and one River Shannon crossing. There is one underbridge and three overbridges.

The overall length of this option is 9.3 km.

4.2.3.1

LOCATION

Parallel to the railway line (Ch 14,000 to Ch 14,500)

PROBLEM

Placing the mainline parallel to the railway line could lead to dazzle for drivers from train lights, and for train drivers from headlights of traffic. This could lead to loss of control for drivers, and for train drivers to be unable to see hazards on the rail line.



Figure 4.8 - Parallel to the railway line

STAGE F1 RSA – N4 CARRICK-ON-SHANNON TO DROMOD ARUP

HAZARD

Dazzle from parallel road and train line.

4.2.3.2

LOCATION

Collector roads either side of N4 mainline Ch 17,500 to Ch 18,900

PROBLEM

The proposed collector roads on both sides of the N4 mainline could lead to dazzle for drivers.

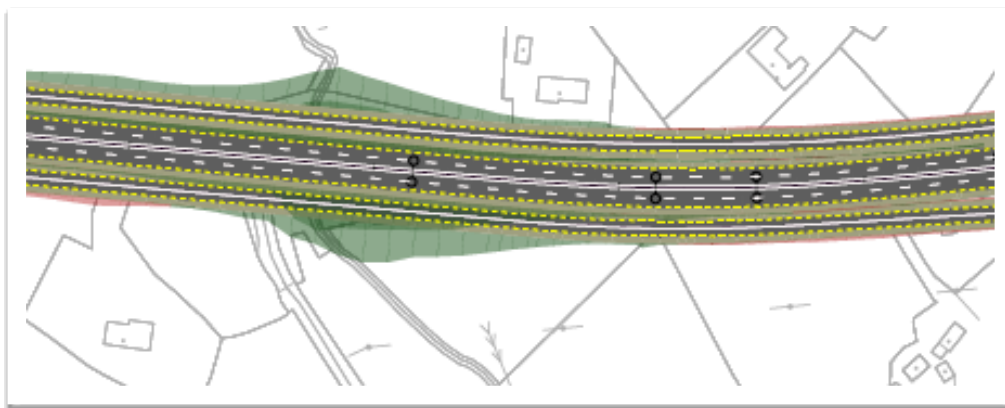


Figure 4.9 - Collector roads either side of N4 mainline Ch 17,500 to Ch 18,900

HAZARD

Dazzle from headlights of vehicles travelling in the opposite direction on the collector roads could lead to loss of control.

4.2.3.3

LOCATION

Ch 20,700 to Ch 21,300, Vertical Alignment.

PROBLEM

The vertical alignment between Ch 20,700 and Ch 21,300 is very flat. When construction tolerances of the surfacing course are taken into account this could lead to flat spots resulting in surface water ponding.

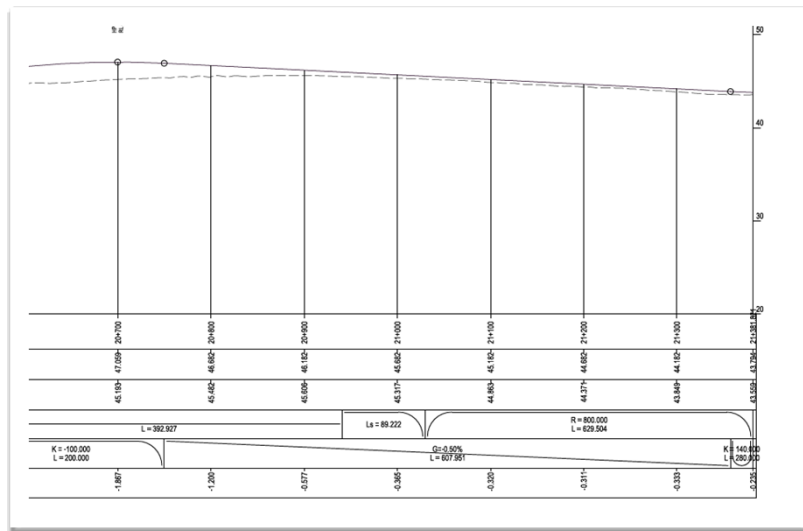


Figure 4.10 - Vertical Alignment, Ch 20,700 to Ch 21,300

HAZARD

Surface water ponding in flat areas could lead to loss of traction and loss of control.

4.2.4 Purple West Option Corridor

The Purple West Design comprises an off-line dual carriageway to the north of the existing N4 which commences and deviates from the N4 at Node B at Meera. It continues north-eastwards, with a grade separated junction with the R280 at Cartown. It continues south-eastwards and rejoins the existing N4 at Node E at Tully. An on-line upgrade of the existing N4 single carriageway to a dual carriageway cross-section is proposed between Node E at Tully and Node J at Drumsna Junction.

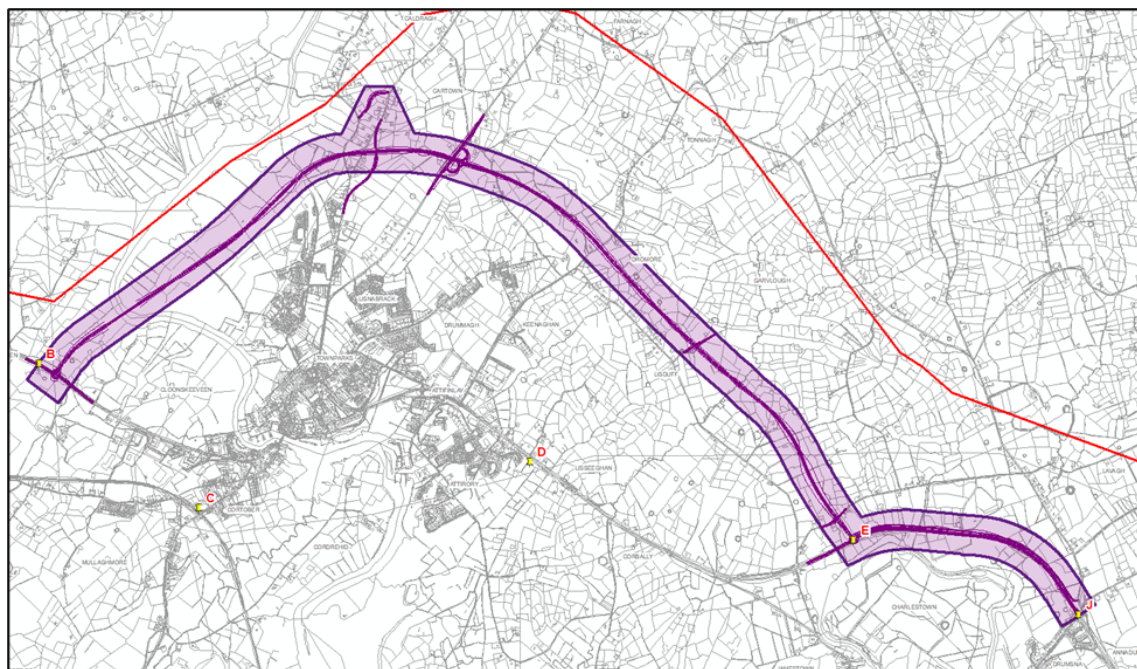


Figure 4.11 - Purple West Option Corridor

This option has two roundabout junctions and one River Shannon crossing. There is one underbridge, three overbridges and one compact grade separated junction.

The overall length of this option is 10.0 km.

4.2.4.1

LOCATION

Junctions along the route.

PROBLEM

There is a mixture of roundabout and grade separated junctions along the route. The proposed R280 junction is a grade separated junction as is the Drumsna junction, but Node B and Node E are proposed roundabouts. Mainline drivers on the N4 travelling onwards to Sligo or Dublin may not expect to have to negotiate at-grade junctions and may not be alert to these after free flowing through grade separated junctions.

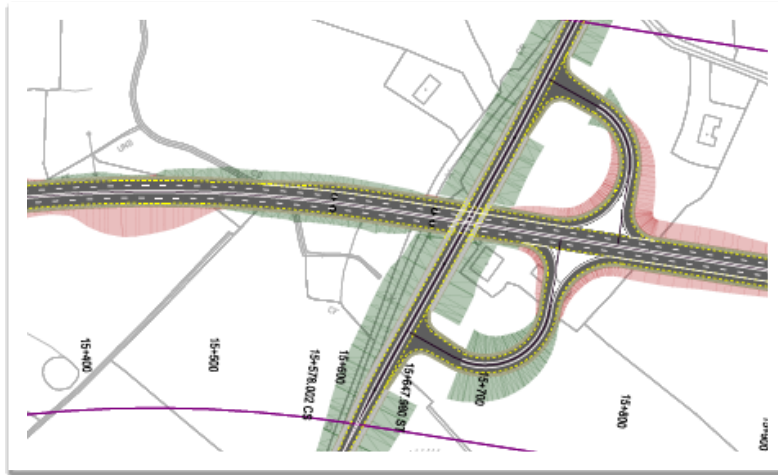


Figure 4.12 - R280 grade separated junction

HAZARD

Inconsistent junction types along the route may lead to mainline N4 drivers being less aware of upcoming at-grade junctions at which they must give way.

4.2.5 Dark Green Option Corridor (Grey Design)

The Dark Green Option Corridor contains the Grey Design (Dark Green Design was the single carriageway option) which comprises an off-line dual carriageway which commences and deviates from the existing N4 at Meera at Node B. It continues north-eastwards, crossing the River Shannon at Corryolus, and meets the R280 at Cartown. It then progresses south-eastwards and rejoins the existing N4 at the Drumsna Junction at Node J.

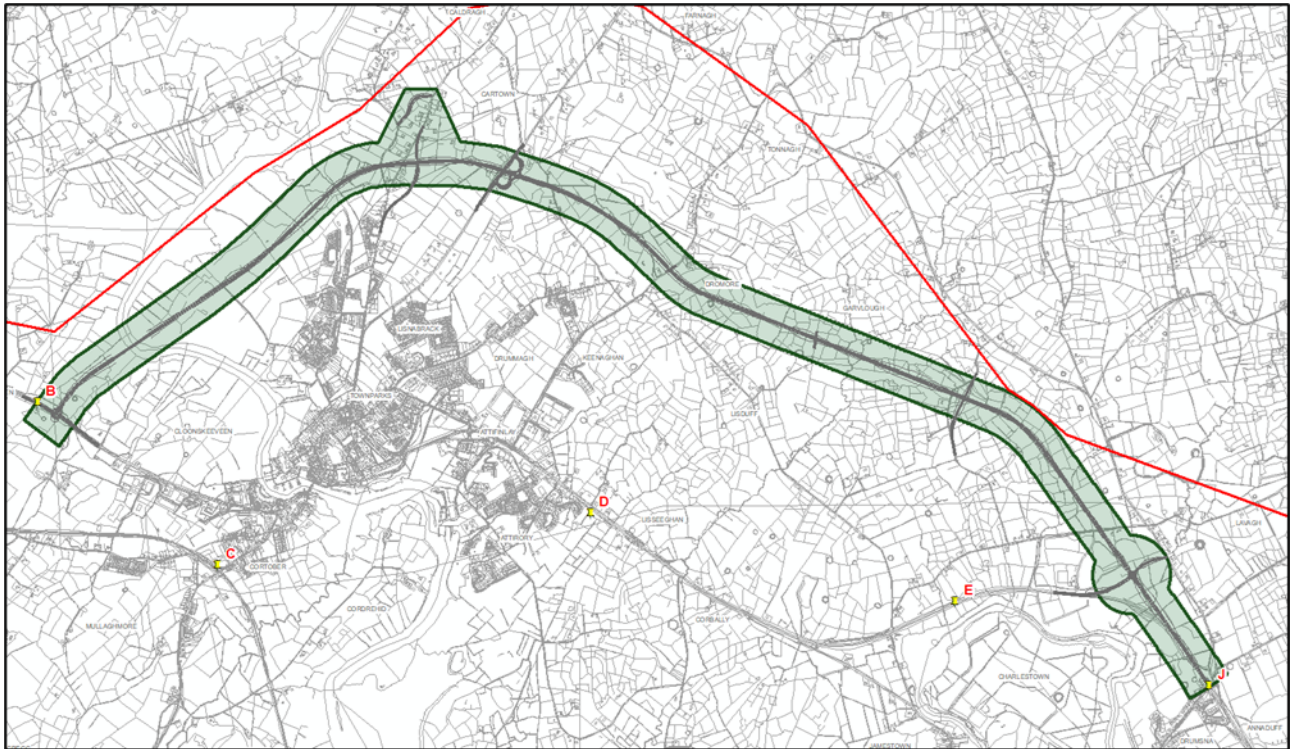


Figure 4.13 - Dark Green Option Corridor (Grey Design)

This option has two roundabout junctions and one River Shannon crossing. There are two underbridges, two overbridges, and one compact grade separated junction.

The overall length of this option is 9.8Km.

4.2.5.1

LOCATION

Ch 17,800 to Ch 19,400, Vertical Alignment.

PROBLEM

The proposed vertical alignment between Ch 17,800 and Ch 19,400 is very flat. When construction tolerances of the surfacing course are taken into account this could lead to flat spots resulting in surface water ponding.

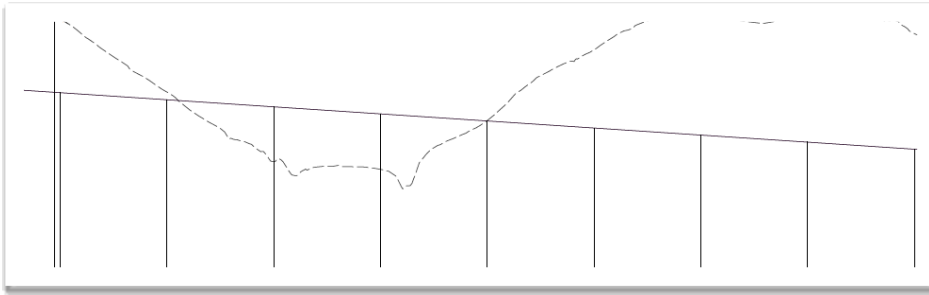


Figure 4.14 - Vertical Alignment, Ch 17,800 to Ch 19,400

HAZARD

Surface water ponding in flat areas could lead to loss of traction and loss of control.

4.2.5.2

LOCATION

Junctions along the route.

PROBLEM

There is a mixture of roundabout and grade separated junctions along the route. The proposed R280 junction is a grade separated junction as is the Drumsna junction, but Node B and Node E are proposed roundabouts. Mainline drivers on the N4 travelling onwards to Sligo or Dublin may not expect to have to negotiate at-grade junctions and may not be alert to these after free flowing through grade separated junctions.

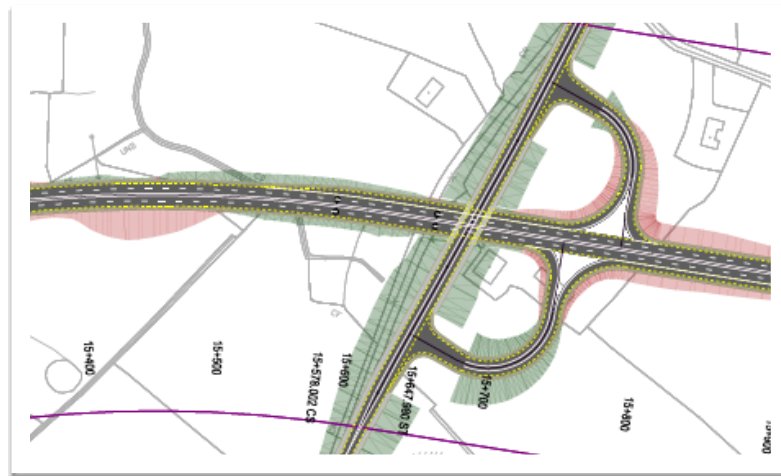


Figure 4.15 - R280 grade separated junction

HAZARD

Inconsistent junction types along the route may lead to mainline N4 drivers being less aware of upcoming at-grade junctions at which they must give way.

4.3 Options East of Drumsna, Node J

4.3.1 Purple East Option

An on-line upgrade of the existing N4 single carriageway to a dual carriageway cross-section is proposed between Node J at Drumsna Junction and Node F at Drumgildra. A short off-line deviation to the east of Aghamore is proposed with the remaining N4 upgraded between Aghamore and Node H at Faulties to a dual carriageway.

This option has 2 grade separated junctions and one overbridge.

The overall length is 7.6km.

4.3.1.1

LOCATION

Drumsna Junction.

PROBLEM

It is unclear if the existing eastern side of the Drumsna Junction is to be retained. This could result in two junctions in close proximity leading to driver confusion regarding which exit to take, sudden braking and side-swipe collisions.



Figure 4.16 - Drumsna Junction

HAZARD

Junctions in close proximity can lead to high collision rates.

4.3.1.2

LOCATION

Drumsna Junction.

PROBLEM

Without an eastern link to the R299 unnecessary heavy traffic would be brought through Drumsna Village.

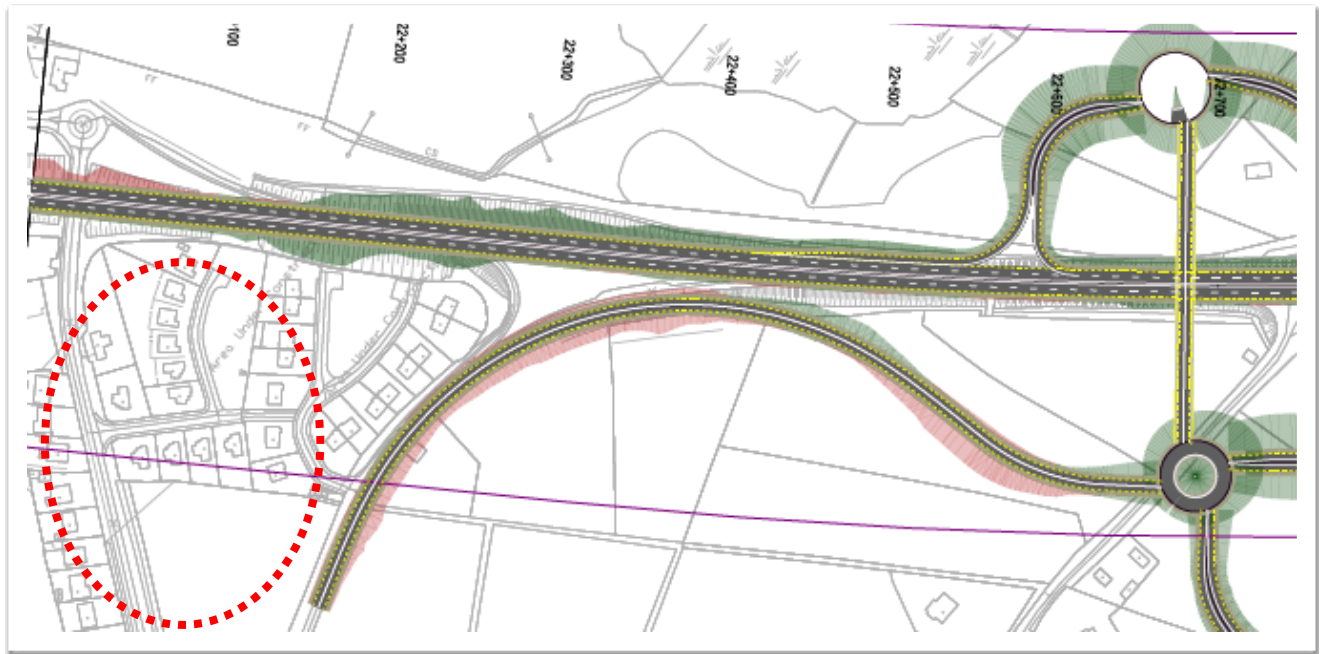


Figure 4.17 - Drumsna Junction

HAZARD

Mixing of heavy vehicles and vulnerable road users in urban areas leads to higher collision rates and more severe collisions.

4.3.1.3

LOCATION

Ch 22,000 to Ch 22,800, Vertical Alignment.

PROBLEM

The vertical alignment between Ch 22,000 and Ch 22,800 is very flat. When construction tolerances of the surfacing course are taken into account this could lead to flat spots resulting in surface water ponding.

HAZARD

Surface water ponding in flat areas could lead to loss of traction and loss of control.

4.3.1.4

LOCATION

Collector road north of N4 mainline, Ch 24,400 to Ch 26,200 & Ch 27,000 to Ch 28,700 and collector road south of mainline from Ch 27,800 to Ch 29,100.

PROBLEM

The proposed collector roads north and south of the N4 mainline could lead to dazzle for drivers.

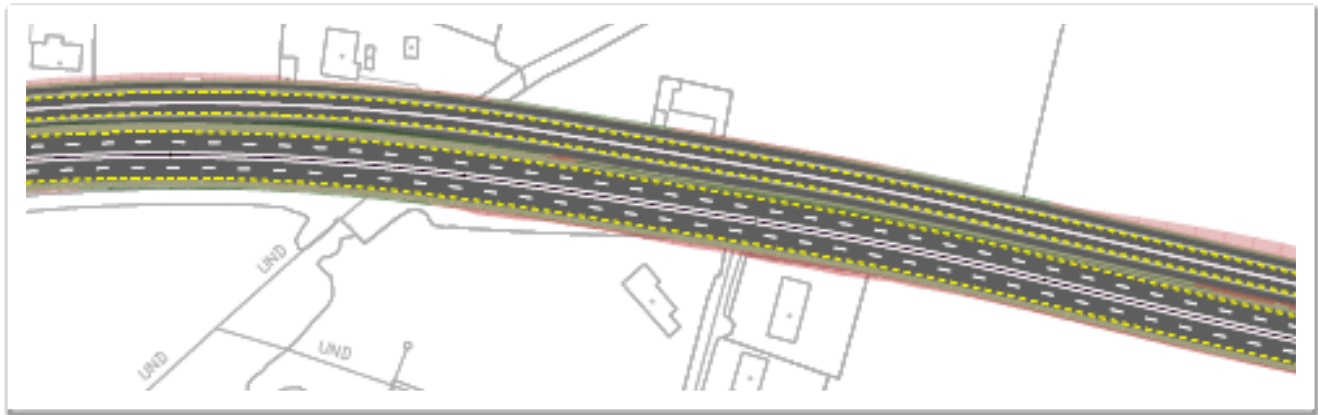


Figure 4.18 - Collector road north of N4 mainline

HAZARD

Dazzle from headlights of vehicles travelling in the opposite direction on the collector road could lead to loss of control.

4.3.1.5

LOCATION

Collector road north of N4 mainline, Ch 24,400 to Ch 26,200.

PROBLEM

The proposed collector road north of the N4 mainline could lead to excessive use of vehicle restraint systems if the Clear Zone is not provided between the N4 mainline and the collector road.

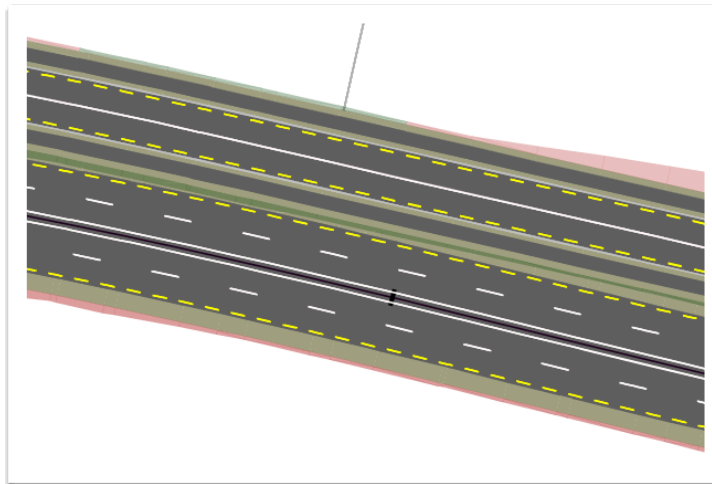


Figure 4.19 - Collector road north of N4 mainline, Ch 24,400 to Ch 26,200

HAZARD

Vehicle restraint systems are hazards for the occupants of errant vehicles.

4.3.1.6

LOCATION

Collector road north of N4 mainline, Ch 24,400 to Ch 26,500.

PROBLEM

It is proposed to provide pedestrian/cycle facilities both sides of the collector road from the L7430 tie-in to the Aghamore grade separated junction. The proposed facilities stop at both ends without continuity to other facilities.

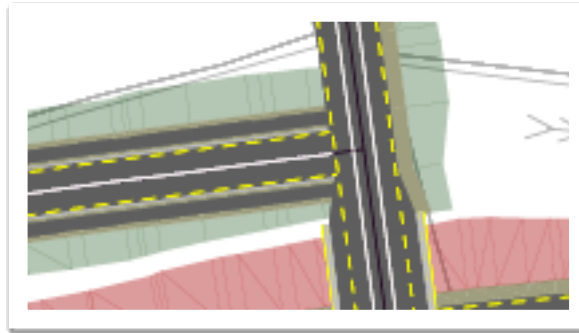


Figure 4.20 - L7430 tie-in

HAZARD

Discontinuities in facilities for vulnerable road users can lead to sharing of space with general traffic and increase the likelihood of collisions.

4.3.1.7

LOCATION

Annaduff.

PROBLEM

The realignment of the N4 at Aghamore will split the Annaduff community. The overbridge of the grade separated junction along with the sweeping horizontal alignment to connect with the existing N4 will lead to a higher speed environment adjacent to the School and Church. That environment will not be suitable for vulnerable road users.

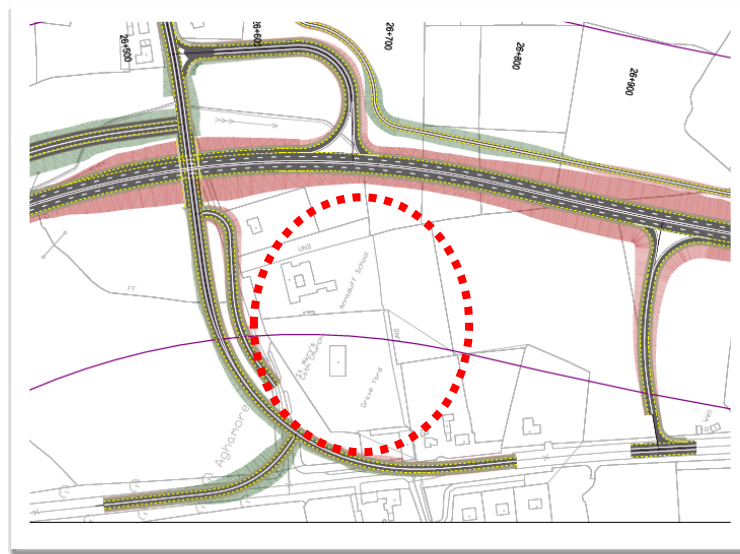


Figure 4.21 - Aghamore

HAZARD

Unsuitable road layouts in urban areas will lead to higher speed, mixing of heavy vehicles and vulnerable road users and will result in higher likelihood of collisions.

4.3.1.8

LOCATION

Aghamore junction.

PROBLEM

The mainline at the left out of the eastbound Aghamore junction has a proposed vertical alignment of approximately 5%. This will lead to difficulties for heavy vehicles to accelerate once they enter the mainline.

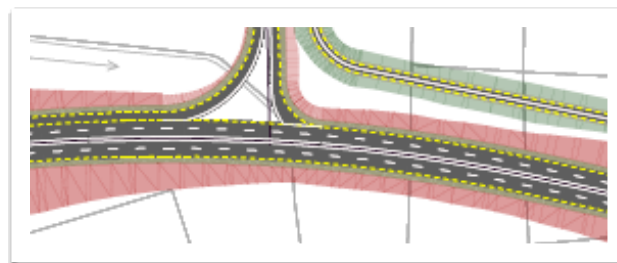


Figure 4.22 - Aghamore junction

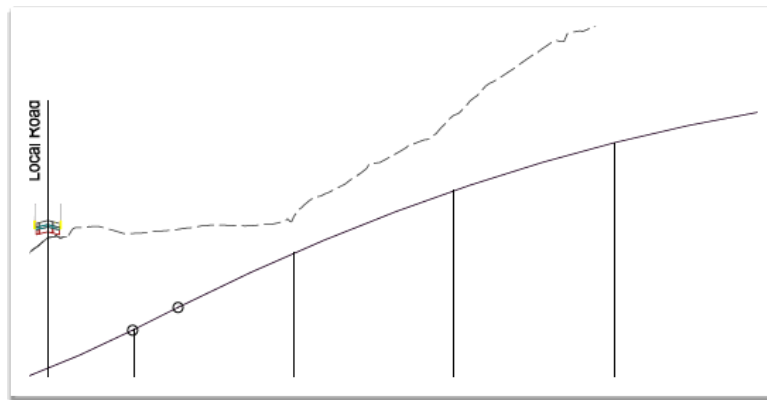


Figure 4.23 - Mainline vertical alignment at Aghamore junction

HAZARD

Slow moving heavy goods vehicles could lead to rear-end collisions.

4.3.2 Green Option Corridor

The Green Design comprises an on-line upgrade of the existing single carriageway between the Drumsna Junction at Node J and Faulties at Node H.

This option has one grade separated junction, five priority junctions (counting each staggered junction as two junctions) and one roundabout.

The overall length of this option is 7.9km.

4.3.2.1

LOCATION

Ch 22,000 to Ch 22,800, Vertical Alignment.

PROBLEM

The vertical alignment between Ch 22,000 and Ch 22,800 is very flat. When construction tolerances of the surfacing course are taken into account this could lead to flat spots resulting in surface water ponding.

HAZARD

Surface water ponding in flat areas could lead to loss of traction and loss of control.

4.3.2.2

LOCATION

Collector Road north of N4 mainline, Ch 24,400 to Ch 26,000 & Ch 26,500 to Ch 27,400 and collector road south of mainline from Ch 25,500 to Ch 26,200.

PROBLEM

The proposed collector roads north and south of the N4 mainline could lead to dazzle for drivers.

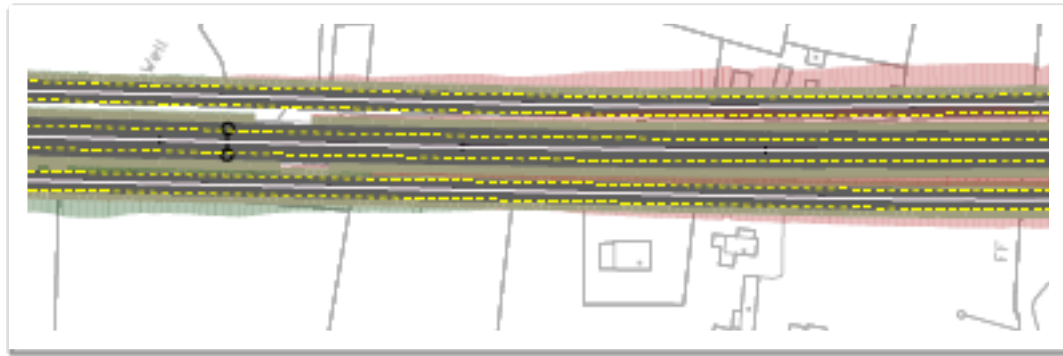


Figure 4.24 - Collector roads north and south of mainline

HAZARD

Dazzle from headlights of vehicles travelling in the opposite direction on the collector road could lead to loss of control.

4.3.2.3

LOCATION

Aghamore junction.

PROBLEM

The mainline at the eastbound Aghamore junction has a proposed vertical alignment of approximately 6% uphill. This will lead to difficulties for heavy vehicles to accelerate once they enter the mainline.

There is the same gradient downhill to the westbound exit off the N4. This steep gradient will lead to longer braking distances and possible overshoot of the junction or loss of control.

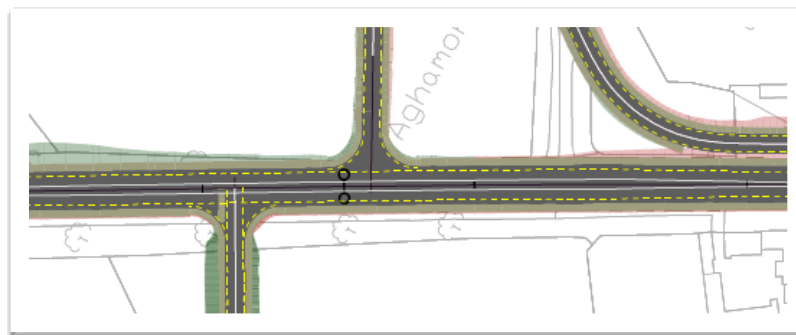


Figure 4.25 - Aghamore junction

HAZARD

Slow moving heavy goods vehicles could lead to rear-end collisions. Deceleration on a steep downhill gradient could lead to loss of control.

4.3.3 Yellow Option Corridor

The Yellow Design comprises an on-line upgrade of the existing single carriageway between the Drumsna Junction at Node J and Fernaught at Node G, with a short off-line section proposed between Node G at Fernaught and Node H at Faulties.

This option has one grade separated junction, four priority junctions (counting each staggered junction as two junctions) and one roundabout.

The overall length of this option is 7.9km.

4.3.3.1

LOCATION

Ch 22,000 to Ch 22,800, Vertical Alignment.

PROBLEM

The vertical alignment between Ch 22,000 and Ch 22,800 is very flat. When construction tolerances of the surfacing course are taken into account this could lead to flat spots resulting in surface water ponding.

HAZARD

Surface water ponding in flat areas could lead to loss of traction and loss of control.

4.3.3.2

LOCATION

Collector Road north of N4 mainline, Ch 24,200 to Ch 26,000 & Ch 26,550 to Ch 27,400 and collector roads south of mainline from Ch 25,500 to Ch 26,200 and Ch 26,700 to Ch 28,000.

PROBLEM

The proposed collector roads north and south of the N4 mainline could lead to dazzle for drivers.

HAZARD

Dazzle from headlights of vehicles travelling in the opposite direction on the collector road could lead to loss of control.

4.3.3.3

LOCATION

Aghamore junction.

PROBLEM

The mainline at the eastbound Aghamore junction has a proposed vertical alignment of approximately 6% uphill. This will lead to difficulties for heavy vehicles to accelerate once they enter the mainline.

There is the same gradient downhill to the westbound exit off the N4. This steep gradient will lead to longer braking distances and possible overshoot of the junction or loss of control.



Figure 4.26 - Aghamore junction

HAZARD

Slow moving heavy goods vehicles could lead to rear-end collisions. Deceleration on a steep downhill gradient could lead to loss of control.

5.0 Preference of Design Options (Not including Alternatives)

Following the safety concerns outlined in Section 4.0, below is a summary of the main points with respect to each option.

5.1 Options West of Drumsna (Node J)

5.1.1 Black Option Corridor

An urban road providing connectivity within Carrick-on-Shannon. There is a risk that it will not fall easily into a category of road in accordance with DMURS and may not be suitable for vulnerable road users. This option will be taken no further forward in this report as it cannot be compared with the other options.

5.1.2 Cyan Option Corridor (Pink Design)

The transition from dual carriageway to single carriageway at the western end would need to be detailed correctly to avoid collisions. The option passes through urban areas and tie-in geometry of links may be constrained.

5.1.3 Orange Option Corridor

Similar to the Cyan Option Corridor above this option is south of Carrick-on Shannon. Similar issues with dazzle from vehicles and trains occur.

5.1.4 Purple West Option Corridor

This option travels north of Carrick-on Shannon. A mixture of junction types along the route leads to inconsistency and may be unexpected by drivers leading to sudden braking and loss of control.

5.1.5 Dark Green Option Corridor (Grey Design)

This option travels north of Carrick-on Shannon. Like many other options a section of flat alignment may lead to drainage issues and loss of control in very wet or icy conditions.

5.2 Options East of Drumsna (Node J)

5.2.1 Purple East Option Corridor

This is the only dual carriageway option east of Drumsna. There are issues with mixing national primary route traffic with vulnerable road users in urban/semi urban areas of Annaduff and Drumsna. There is a lack of connectivity for facilities for vulnerable road users. Similar to the other two options there is an issue with the steep gradients at the proposed Aghamore junction.

5.2.2 Green Option Corridor

This is a single carriageway option. Similar to the other two options there is an issue with the steep gradients at the proposed Aghamore junction. Priority junctions including staggered junctions tend to have higher collision rates than grade separated junctions.

5.2.3 Yellow Option.

This is a single carriageway option. Similar to the other two options there is an issue with the steep gradients at the proposed Aghamore junction. Priority junctions including staggered junctions tend to have higher collision rates than grade separated junctions.

6.0 Ranking of Options

6.1 Categories for Ranking Each Option

The main safety considerations in comparing the options at this early stage are detailed below.

1. **Road Classification:** There are single and dual carriageway options. Dual carriageways are deemed safer than single carriageways due to the removal of travel in opposing directions without segregation.
2. **Number of junctions:** Each junction along an option is a potential location for collisions given the conflicting manoeuvres.
3. **Junction Consistency:** Options with consistent junction types lead to less confusion for drivers.
4. **Number of Over/Under bridges:** Each structure will lead to parapet railings or abutment walls with approach and departure vehicle restraint systems, which are less forgiving than wide verges and Clear Zones free of obstacles.
5. **Length of each option:** In some schemes the longer the distance between two fixed start and end points leads to the lower ranking. In this project, the length of the options vary because of the different end points for the western section. Three options end at Node B and one at Node A. The Cyan Option Corridor extends further westwards and hence the N4 will be improved to current standards for a greater length than the other options.
6. **Connectivity with urban centres:** Connectivity with Carrick-on-Shannon and Cortober via the use of suitable links.
7. **Overtaking opportunities:** Overtaking on dual carriageways is much safer than single carriageway roads.
8. **Geometry:** Some options are located close to constraints that require changes in horizontal or vertical alignment or at grade junctions to cater for links. Sharp changes in horizontal alignment and steep vertical alignments result in additional work for drivers which potentially leads to errors and collisions.
9. **General Problems:** Forgiving Roadsides (including cut/fill slopes), facilities for vulnerable road users and crossings of the River Shannon (western options). These issues have been raised as general to all options and are included in the process however equal ranking is generally provided to each option.

6.2 Ranking of Western Options (Excluding Black Option Corridor)

Each of the four options have been assessed and comparative ratings have been assigned under each of the headings outlined in Section 6.1 above. A rating of Preferred, Neutral or Least Preferred has been assigned to each option. Where options are equally ranked for the general issues, a neutral rating has been given to each.

The assessment results are given in Table 6.1 below.

Table 6.1- Ranking of Western Options

Option Heading	Cyan (Pink)	Orange	Purple West	Dark Green (Grey)
Road Classification	Preferred	Preferred	Preferred	Preferred
Number of Junctions (No. Count)	Least preferred (3)	Preferred (2)	Least Preferred (3)	Least Preferred (3)
Junction Consistency	Preferred	Preferred	Least preferred	Least Preferred
Number of Over/Under Bridges (No. Count)	Preferred (3)	Least Preferred (4)	Least Preferred (4)	Least Preferred (4)
Length of Each Option	Preferred	Neutral	Least Preferred	Least Preferred
Connectivity with urban centres	Preferred	Neutral	Neutral	Neutral
Overtaking opportunities	Neutral	Neutral	Neutral	Neutral
Geometry	Least Preferred	Least Preferred	Preferred	Preferred
Facilities for Vulnerable Road users	Neutral	Neutral	Neutral	Neutral
Forgiving Roadsides	Neutral	Neutral	Neutral	Neutral
River Shannon Crossing	Neutral	Neutral	Neutral	Neutral

To rank the options in order, a numerical value of 3 is assigned to a Preferred option, 2 to a Neutral option and 1 to a Least Preferred option. The numerical values have been shown in

Table 6.2 below.

Table 6.2 - Numerical scoring

Option Heading	Cyan (Pink)	Orange	Purple West	Dark Green (Grey)
Road Classification	3	3	3	3
Number of Junctions	1	3	1	1
Junction Consistency	3	3	1	1
Number of Over/Under Bridges	3	1	1	1
Length of Each Option	3	2	1	1
Connectivity with urban centres	3	2	2	2
Overtaking opportunities	2	2	2	2
Geometry	1	1	3	3
Facilities for Vulnerable Road users	2	2	2	2
Forgiving Roadsides	2	2	2	2
River Shannon Crossing	2	2	2	2
TOTAL SCORE	25	23	20	20

The total scores are placed in descending order to rank each option as shown in Table 6.3.

Table 6.3 - Ranking

Option Corridor	Total Score	Rank
Cyan (Pink)	25	1 st
Orange	23	2 nd
Dark Green (Grey)	20	Joint 3 rd
Purple West	20	Joint 3 rd

The Cyan Option Corridor (Pink Option) scored highest and is therefore ranked first and is the preferred option.

This assessment forms only one part of the overall assessment of the options being undertaken by the Design Team. It does not necessarily mean that the priority will be consistent with the emerging preferred option at the end of that assessment.

Each option provided a significant improvement from the existing situation and the relatively close scoring suggests that in terms of road safety there is very little difference between all the options.

6.3 Ranking of Eastern Options

Each of the three options have been assessed and comparative ratings have been assigned under each of the headings outlined in Section 6.1 above, except for the River Shannon Crossing which only relates to the western options. The urban area considered in this assessment is Annaduff. A rating of Preferred, Neutral or Least Preferred has been assigned to each option. Where options are equally ranked for the general issues, a neutral rating has been given to each.

The assessment results are given in Table 6.4 below.

Table 6.4 - Ranking of Eastern Options

Option Heading	Purple East	Green	Yellow
Road Classification	Preferred	Least Preferred	Least Preferred
Number of Junctions (Count)	Preferred (2)	Least Preferred (7)	Least Preferred (6)
Junction Consistency	Preferred	Least Preferred	Least Preferred
Number of Over/Under Bridges (Count)	Least Preferred (1)	Preferred (0)	Preferred (0)
Length of Each Option (Distance)	Preferred (7.6km)	Neutral (7.9km)	Neutral (7.9km)
Connectivity with urban centres	Least Preferred	Preferred	Preferred
Overtaking opportunities	Preferred	Least Preferred	Least Preferred
Geometry	Neutral	Neutral	Neutral
Facilities for Vulnerable Road users	Least Preferred	Neutral	Neutral
Forgiving Roadsides	Neutral	Neutral	Neutral

To rank the options in order, a numerical value of 3 is assigned to a Preferred option, 2 to a Neutral option and 1 to a Least Preferred option. The numerical values have been shown in

Table 6.5 below.

Table 6.5 - Numerical scoring

Option Heading	Purple East	Green	Yellow
Road Classification	3	1	1
Number of Junctions	3	1	1
Junction Consistency	3	1	1
Number of Over/Under Bridges	1	3	3
Length of Each Option	3	2	2
Connectivity with urban centres	1	3	3
Overtaking opportunities	3	1	1
Geometry	2	2	2
Facilities for Vulnerable Road users	1	2	2
Forgiving Roadsides	2	2	2
TOTAL SCORE	22	18	18

The total scores are placed in descending order to rank each option as shown in Table 6.6.

Table 6.6 - Ranking

Option Corridor	Total Score	Rank
Purple East	22	1st
Green	18	Joint 2nd
Yellow	18	Joint 2nd

The Purple East Option Corridor scored highest and is therefore ranked first and is the preferred option.

This assessment forms only one part of the overall assessment of the options being undertaken by the Design Team. It does not necessarily mean that the priority will be consistent with the emerging preferred option at the end of that assessment.

Each option provided a significant improvement from the existing situation, however, the dual carriageway Purple East Option Corridor performed better than the single carriageway options on a number of criteria.

7.0 Conclusion

In conclusion, the proposed alternatives and options would significantly improve road safety with the options giving the greatest benefit.

The assessment was split between the western options and the eastern options. The ranking of options lead to the Cyan Option Corridor (Pink Design) being rated highest for the western options and the Purple East Option Corridor (Purple East Design) being ranked highest of the eastern options.

This assessment will be combined with all other assessments and will contribute to the choice of an emerging preferred option by the Design Team. A Stage F, Part 2 Road Safety Audit will then be carried out on the emerging preferred option.

8.0 Audit Statement

We certify that we have examined of the documents provided. The examination has been carried out with the sole purpose of identifying any aspects of the designs which could be added, removed or modified in order to improve the safety of the scheme.

The audit has been carried out by the persons named below who have not been involved in any design work on this scheme as a member of the Design Team.

The problems that we have identified have been noted in the report together with suggestions for preferred options.

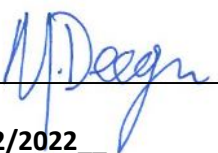
Norman Bruton

Signed: 

(Audit Team Leader)

Dated: 18/2/2022

Martin Deegan

Signed: 

(Audit Team Member)

Dated: 18/2/2022

Appendix A

Information Supplied to the Audit Team

Drawing series274219-ARUP-02-OS-DR-CH1-207101

Drawing series274219-ARUP-02-OS-DR-CH1-208101

Drawing series274219-ARUP-02-OS-DR-CH1-209101

Drawing series274219-ARUP-02-OS-DR-CH1-210101

Drawing series274219-ARUP-02-OS-DR-CH1-211101

Drawing series274219-ARUP-02-OS-DR-CH1-212101

Drawing series274219-ARUP-02-OS-DR-YE-201018

Drawing series274219-ARUP-02-OS-DR-CH1-201101

Drawing series274219-ARUP-02-OS-DR-CH1-202101

Drawing series274219-ARUP-02-OS-DR-CH1-203101

Drawing series274219-ARUP-02-OS-DR-CH1-204101

Drawing series274219-ARUP-02-OS-DR-CH1-205101

Drawing series274219-ARUP-02-OS-DR-CH1-206101

For Information

.KMZ files – Centrelines and corridors

Stage 2 Environmental Assessment of Alternatives and Options -Methodology Stage 2 , file note dated 27th August 2021, ARUP.

Appendix B

*Joe Mulleady
Aras an Chontae
Carrick on Shannon
Co. Leitrim*

Date: 05/10/2021

Our Ref: 21185231/23068/Stage F

re: N4 Carrick on Shannon to Dromod Project

APPROVAL OF ROAD SAFETY AUDIT TEAM, Stage F

Dear Joe Mulleady,

The following members of the proposed road safety audit team are approved to carry out the Stage F road safety audit of N4 Carrick on Shannon to Dromod Project.

1. Norman Bruton - Bruton Consulting Engineers Ltd - Leader
2. Martin Deegan - Traffico Ltd - Leader

A copy of all audit reports, design team response and exception reports must be uploaded through RSAAS. Successful upload of these reports and completion of the audit approval process is necessary for any further audit approval on this scheme.

Yours sincerely,

Lucy Curtis

Regional Road Safety Engineer
roadsafetyaudits@tii.ie