ATKINS

Harry Reynolds Road Pedestrian and Cycle Route

Feasibility Study and Options Assessment Report

Fingal County Council

October 2018

Notice

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This document has 79 pages including the cover.

Revision history

Rev	Date	Description	Originator	Checker	Approver
01	03/10/18	Issued to FCC	BH	SW	MF

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Introduction

1. Introduction

1.1. Background

Fingal County Council proposes to develop a new pedestrian and cycle facility along the Harry Reynolds Road, Balbriggan, Co Dublin. The proposed scheme will aim to deliver a minimum Level of Service A in accordance with the National Cycle Manual and will allow for future possible links to a coastal greenway and other cycling routes in Balbriggan.

To achieve this objective, Atkins have been engaged by Fingal County Council for all stages relevant to the delivery of the project including to identify and assess concept route options at this stage.

1.2. Aims and Objectives

The main aims and objectives of this Feasibility Study Options Report are listed below:

- To consider the context of the scheme in terms of Local and Regional Planning Policy.
- To identify significant engineering and environmental constraints.
- To set out the route options considered and to summarise their feasibility and relative ranking in terms of various relevant criteria.
- To appraise the route options and make a recommendation in relation to a preferred concept route option.

1.3. Methodology

The following items have been undertaken in order to complete this Feasibility Study and Options Assessment Report:

- A desktop study was carried out including a review of regional and local planning policy information, a review of engineering constraints and a review of environmental constraints.
- Topographical data, utility information and traffic information were collected.
- Site inspections were carried out to ensure information was up to date and correct.
- All known significant constraints were collated and mapped.
- Route options were developed having due regard to the identified constraints.
- Route options were appraised in a comparative manner, resulting in the recommendation of a preferred route.

1.4. Study Area

The study area upon which this Feasibility Study and Options Assessment is based is divided into two distinct sections. The extents of both study areas are shown in Figure 1-1 below.

Section One encompasses the extents of Harry Reynolds Road from its beginning at the Drogheda Street junction to the north of Balbriggan town centre extending westward linking with Chieftain's Drive and Moylaragh Road. The remainder of Harry Reynolds Road extends in a generally southward direction where it terminates at the Dublin Street roundabout junction. This section then extends further east along Hamilton Road towards Castleland.

Section Two encompasses the extents of the parklands surrounding the Bracken River. Located to the east of Dublin Street.

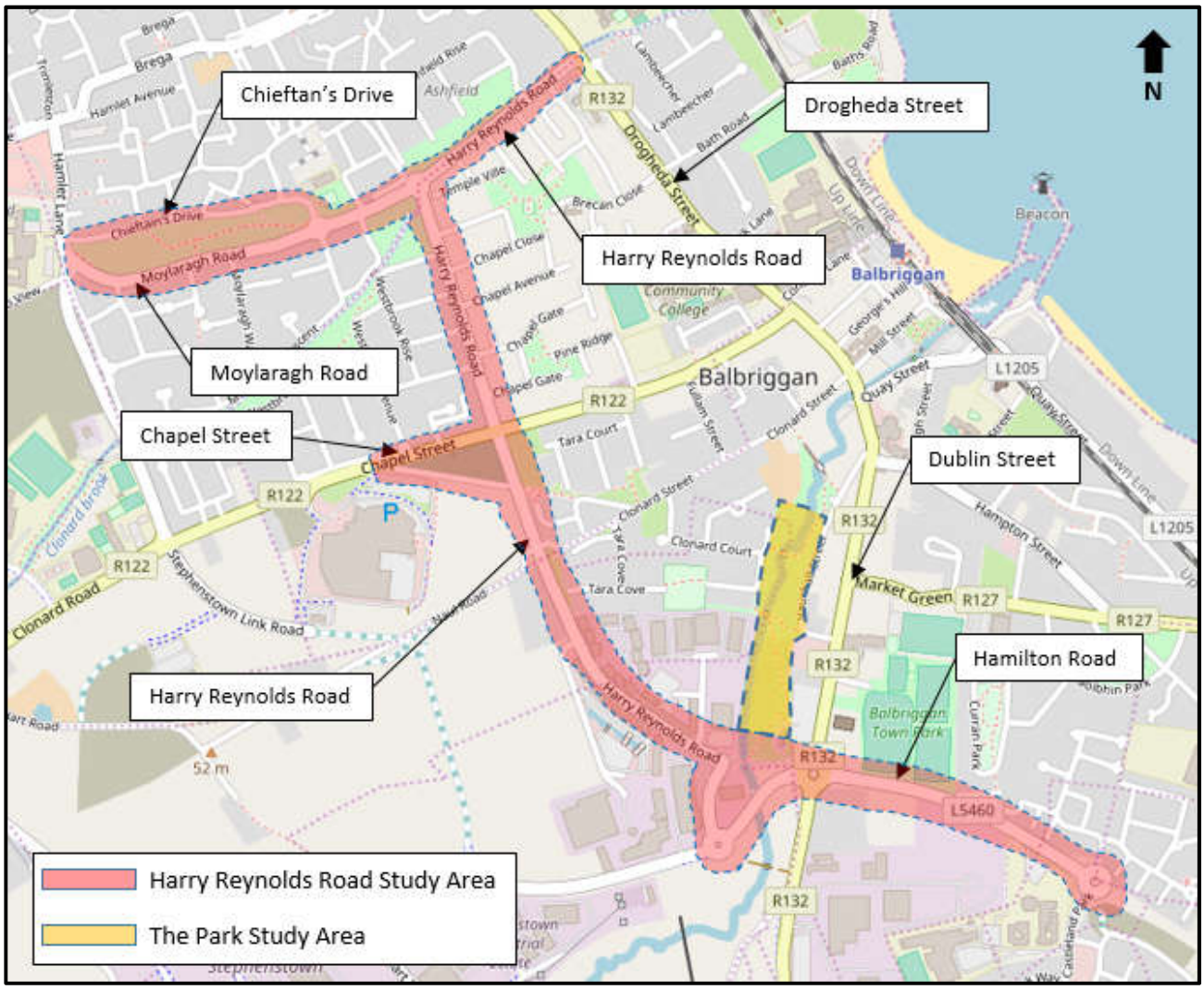


Figure 1-1 Study area

2. Scheme Context

2.1. Planning Policy

A number of Regional and Local planning policies have been considered as part of this study and are discussed below.

2.1.1. Greater Dublin Area Cycle Network Plan

The Greater Dublin Area Cycle Network Plan was published by the NTA in 2013 and sets out the proposed cycle network in the Greater Dublin Area. The GDA categorises the proposed route along Harry Reynolds Road as BA2, a Primary/Secondary route. Figure 2-1 below is an extract from the GDA showing the categorisation of proposed routes in the Balbriggan area.

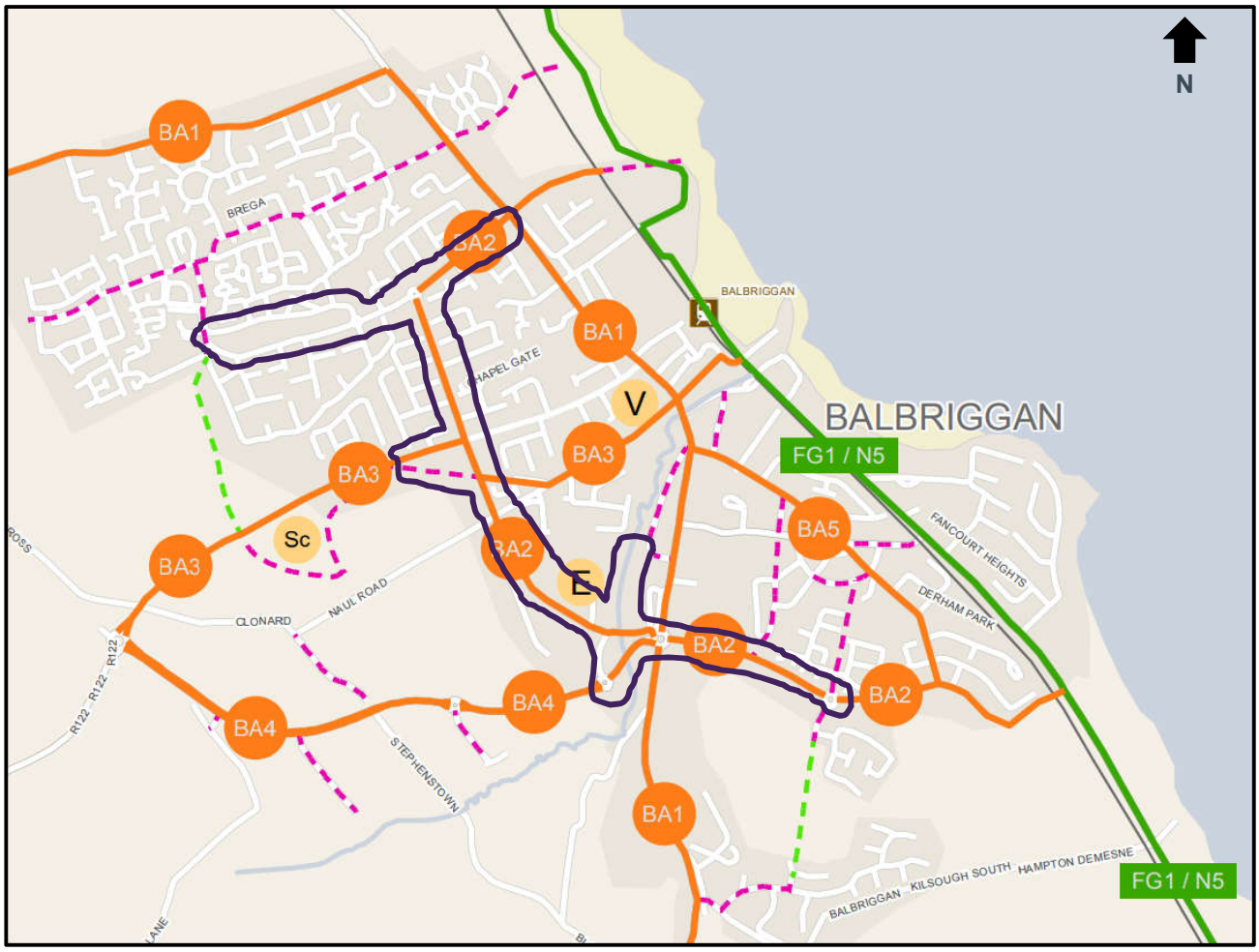


Figure 2-1 GDA route categorization in the Balbriggan area

There is also a feeder link within the park surrounding the Bracken River. An additional feeder link is also noted adjacent to the cemetery on Chapel Street. Both feeder links connect to the BA2 Primary/Secondary Route and are within the Study Area.

2.1.2. County Policy

The Fingal County Development Plan 2018-2023 sets out to promote and facilitate movement within and to the County through the integration of land use with a sustainable transport system, with priority given to public transport, walking and cycling. There are several relevant chapters in the Development Plan which relate to Cycling and Walking. The main objectives relevant to this scheme are summarised below:

- Objective 11: Ensure a safe and convenient road, pedestrian and cycle system promoting permeability, accessibility and connectivity between existing and new developments within the town. (Chapter 4).
- Objective MT17: Improve pedestrian and cycle connectivity to schools and third level colleges and identify and minimise barriers to children walking and cycling to primary and secondary schools. Parks, Open Space Recreation theme. (Chapter 7).
- Objective G126: Maximise the use and potential of existing parks, open space and recreational provision, both passive and active, by integrating existing facilities where appropriate. (Chapter 8).
- Objective G127: Provide a range of accessible new parks, open space and recreational facilities accommodating a wide variety of uses (both passive and active), use intensities and interests. (Chapter 8).
- Objective G128: Provide attractive and safe routes linking key green space sites, parks and open spaces and other foci such as cultural sites and heritage assets as an integral part of a new green infrastructure provision, where appropriate and feasible. (Chapter 8).

Figure 2-2 below displays the planning objectives for the area surrounding the proposed pedestrian and cyclist facility.

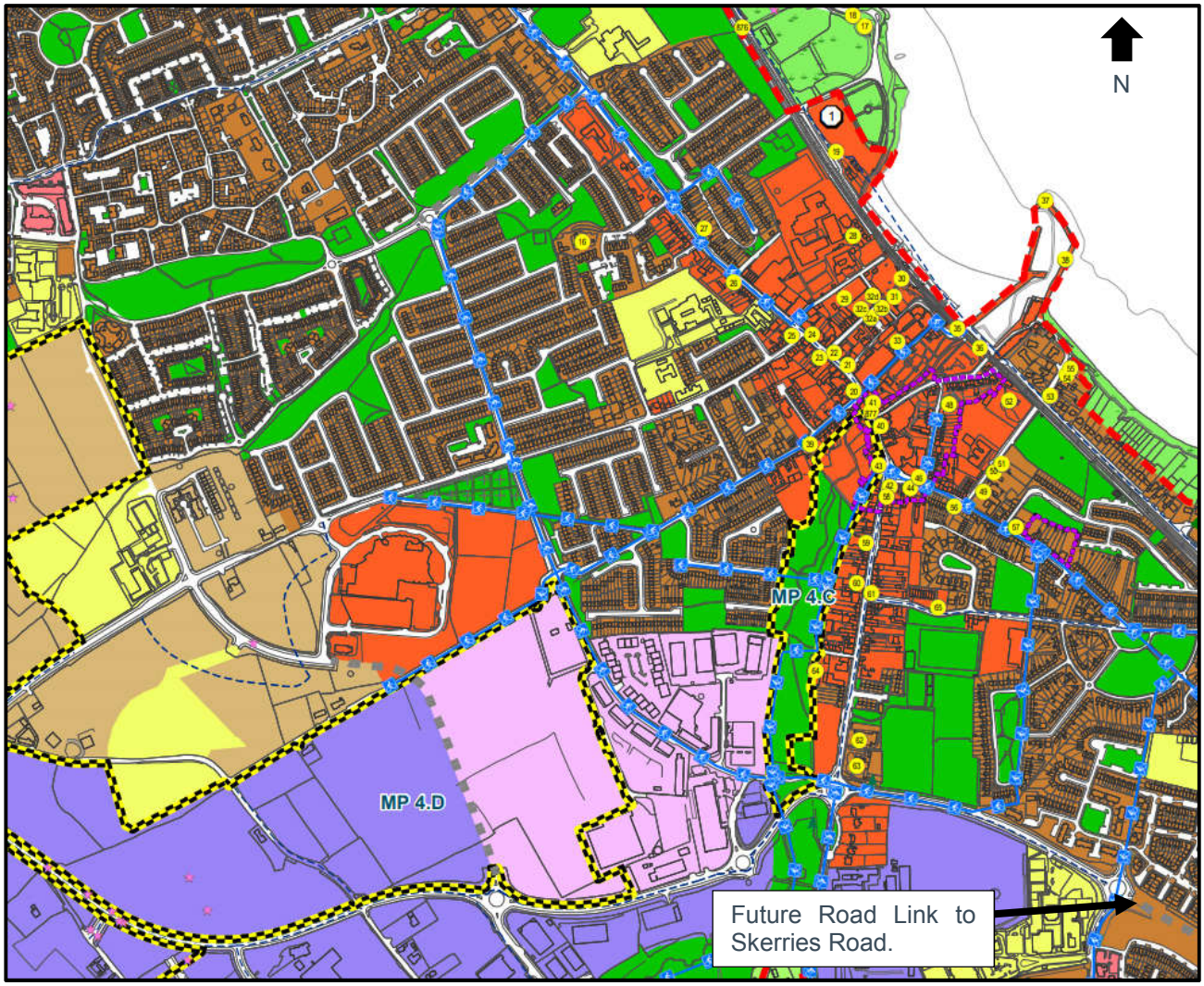


Figure 2-2 Fingal Development Plan 2017-2023 planning objectives

There are two masterplan areas in the vicinity of the proposed pedestrian and cycle facility, both of which lie in the southern section of the scheme.

- MP 4.C – Millpond Masterplan
  Facilitate the development of Mill Pond to provide for passive and active recreational facilities and amenities including a feasibility study to develop the lake for the purposes of wildlife promotion.
- MP 4.D – Stephenstown Masterplan

Provide for architecturally designed buildings with high quality finishes fronting onto the Naul Road. The development of lands in this area will be guided by the principles contained in the 'Stephenstown Urban Design and Landscape Masterplan (2009).

The development plan also highlights the proposed cycle and pedestrian routes. These routes can be viewed in **Figure 2-2** which are denoted by the symbol shown below. With the exception of Moylaragh Road, all of the route has a cycle/pedestrian route objective.

There is also a provision for a new road link to the Skerries road at the eastern end of Hamilton road. This link will allow traffic from the Skerries area with a route that avoids the town centre and should reduce and redistribute traffic from Dublin Street to Hamilton Road. .

3. Background

3.1. Land Use, Planning and Land Ownership

Land use varies throughout the extents of the scheme. Figure 3-1 below depicts the typical land uses surrounding the proposed facility.

There are a large number of residential developments in the vicinity of the proposed facility. In the northern extremities the proposed route is surrounded by residential developments. As the scheme proceeds in a south-east direction the residential developments continue along the eastern side of Harry Reynolds Road, whilst on the west side there is a cemetery and undeveloped zoned lands. Finally, in the southern section of the scheme the major residential developments are located to the north along Hamilton Road.

A number of designated business and retail areas are located along and close to the route. Balbriggan town centre is located to the east of the scheme. Stephenstown Industrial Estate encompasses the southern section of Harry Reynolds Road. Millfield Shopping Centre, the major retail attraction in the area, is located to the east of the proposed route, along Chapel Street.

A number of education centres are noted in the vicinity of the scheme, a large number of which will be accessible from the proposed route. Figure 3-1 below shows the location of these education centres.

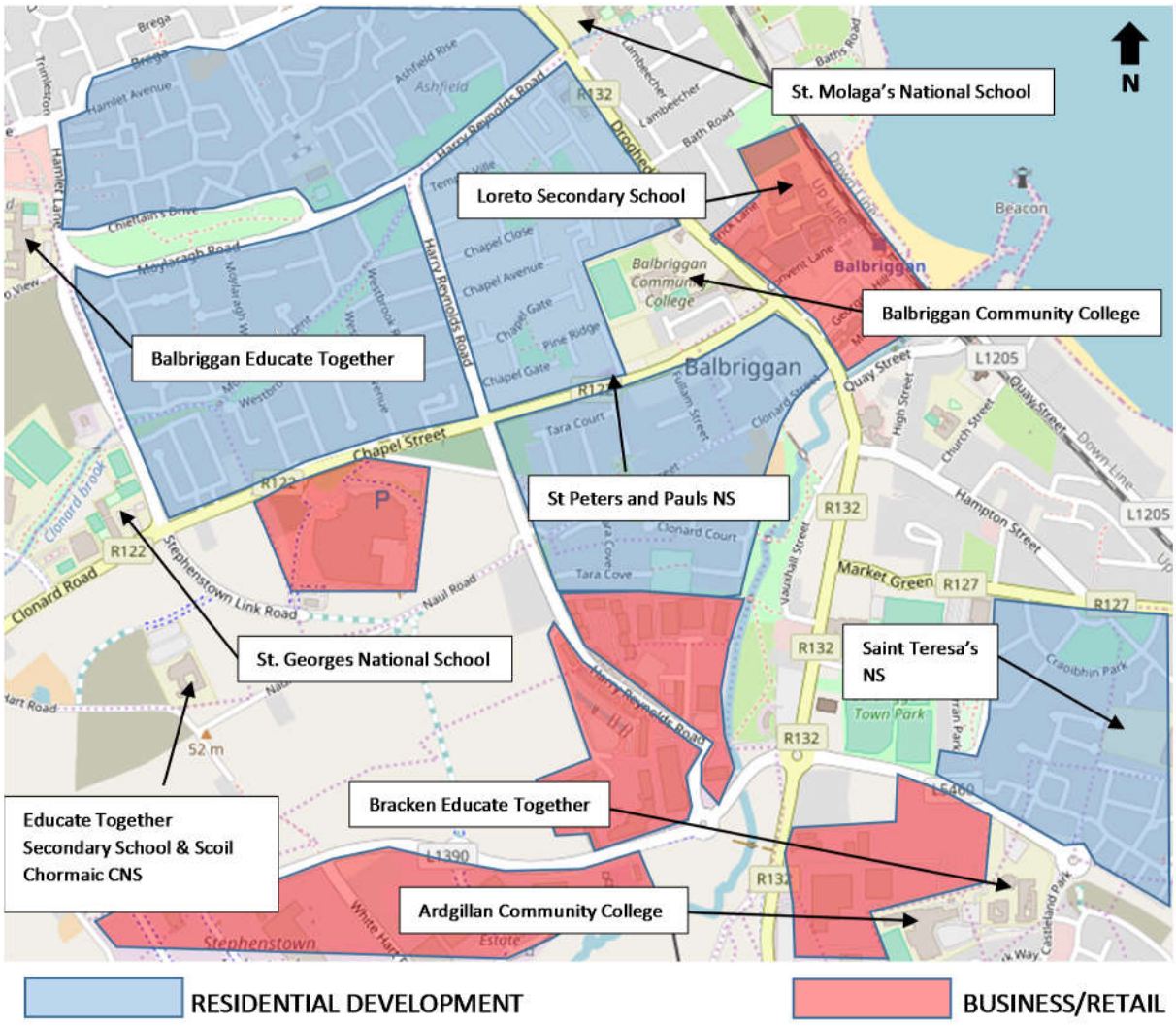


Figure 3-1 Land use

3.2. Population

Figure 3-2 shows the small area population map for Balbriggan (source: 2016 Census). With reference to this it is clear that the north side of the town has higher densities than the southern section.

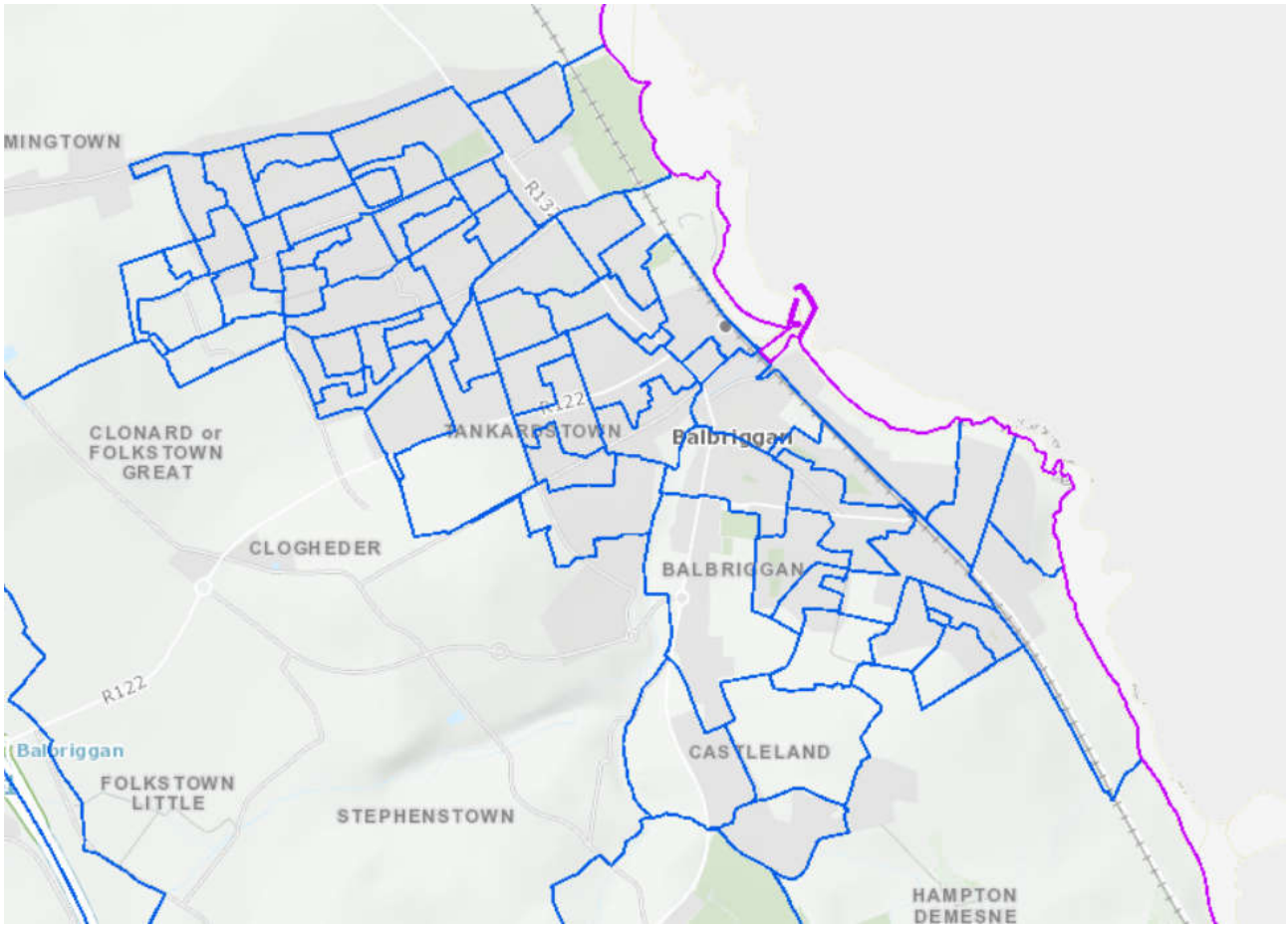


Figure 3-2 SAPMAP for Balbriggan

The Figure 3-3 below shows the areas reachable in 5, 10 and 15 minutes cycle from the proposed route.

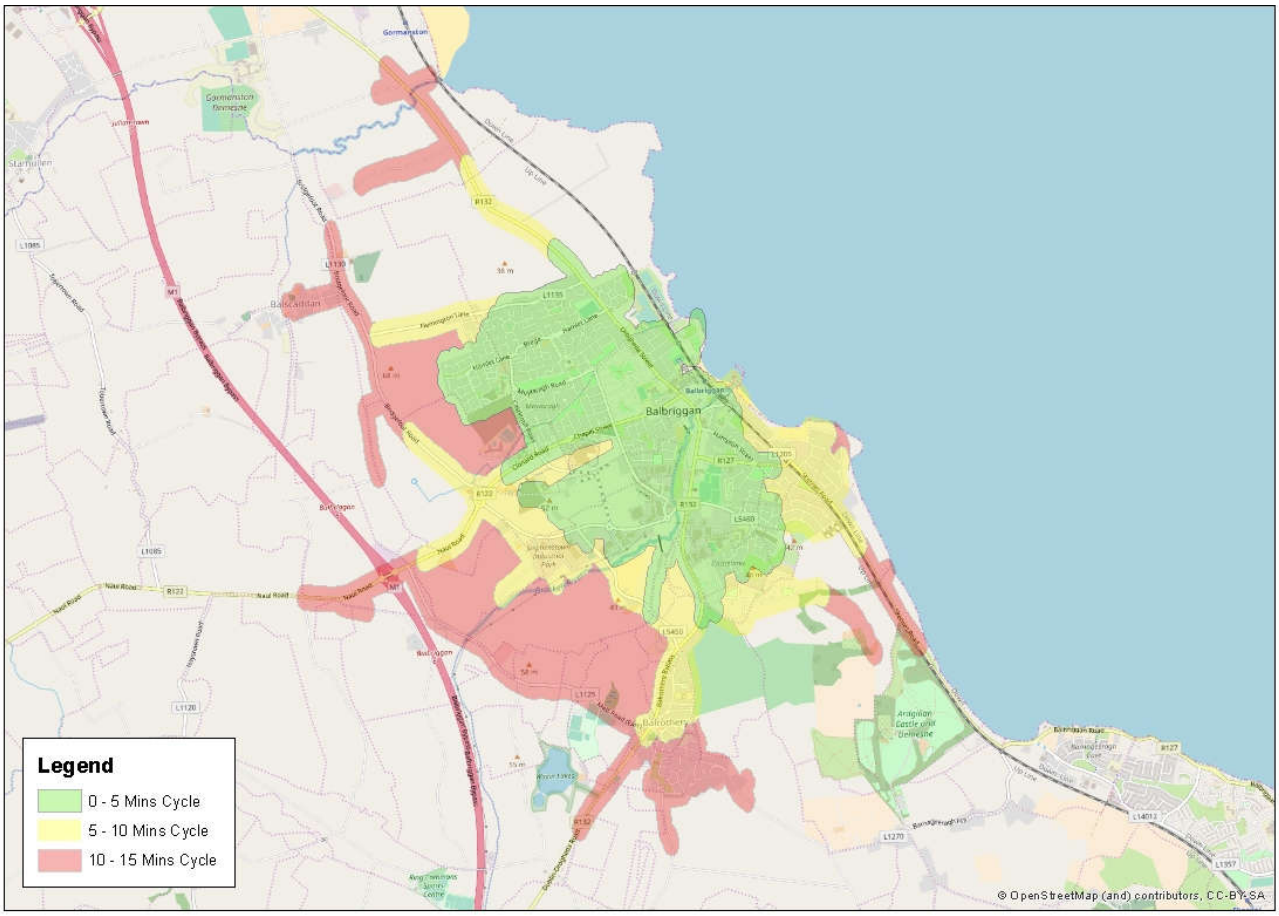


Figure 3-3 Harry Reynolds Road Cycling Times

The population statistics from the 2016 Census Small Areas for each of the above time periods is summarised in the table below.

Table 3-1 2016 Population Statistics

Time to Cycle	Population
0 – 5 Mins	17,904
5 – 10 Mins	21,106
10 – 15 Mins	22,756

From the above data it is clear that the provision of cycle facilities on Harry Reynolds Road will provide excellent service to the majority of those living within Balbriggan. Given its central location, the majority of the population is within 5 minutes cycling distance from the facilities.

3.3. Collision History

The RSA online accident database was reviewed to identify accidents within the Study Area. In total 17 no. accidents occurred from 2004 to 2014 along the proposed cycleway route. All of which were categorised as minor accidents. Two of these accidents involved pedestrians, one of which took place at the junction of Harry Reynolds Rd and Chapel Court. The second taking place at the roundabout junction at Harry Reynolds Rd and the R132. An incident also occurred involving a cyclist over the same timeline, this occurred at the junction of Harry Reynolds Rd and the R132. An overview of the collision history is shown in Figure 3-4 the figure below.

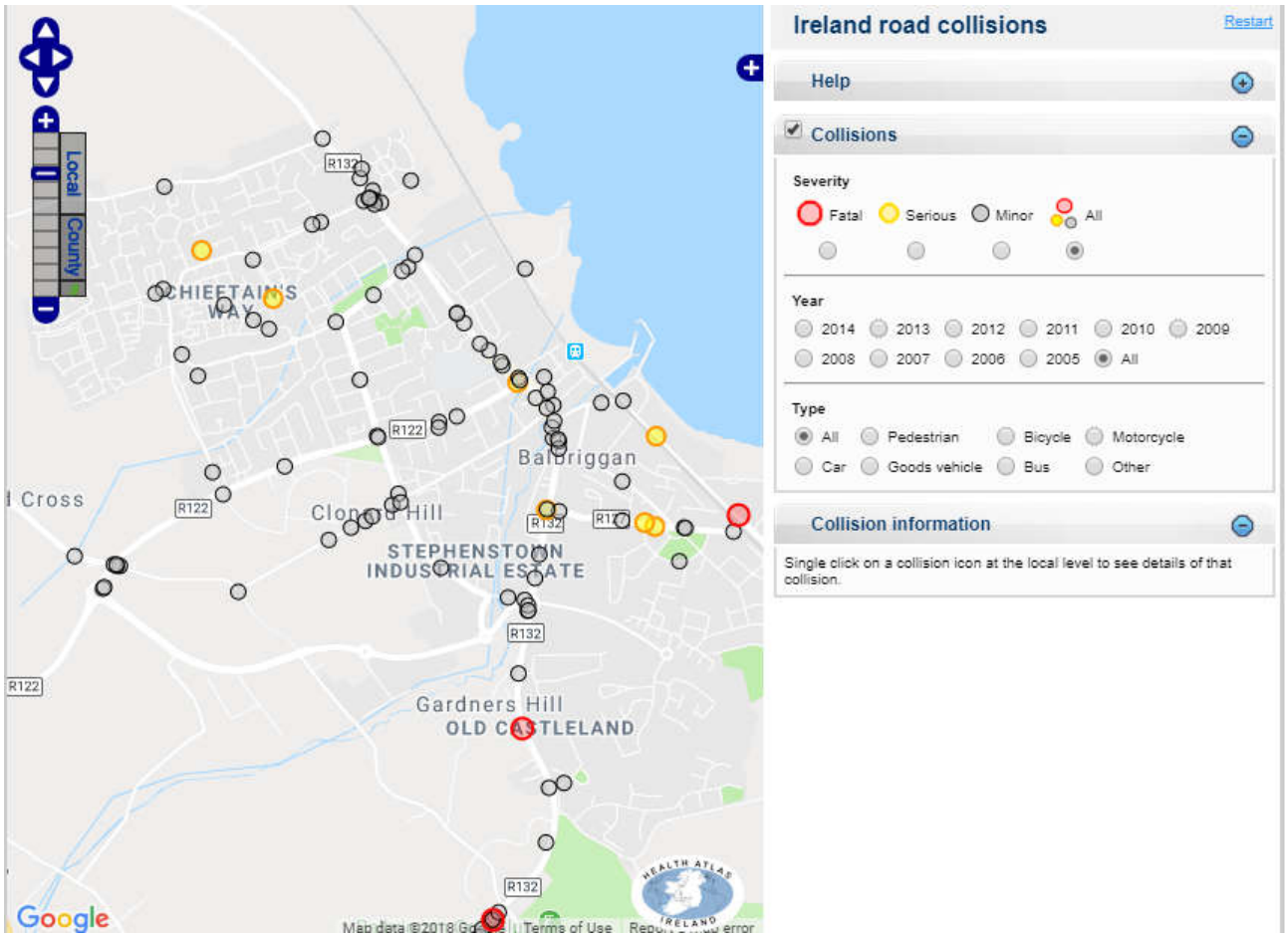


Figure 3-4 Collision History

3.4. Road Infrastructure Review

For the purpose of reviewing the existing road infrastructure, the route was broken up into eight sections as shown in Figure 3-5. Each section is discussed in detail in the following section and are generally described travelling from north to south.

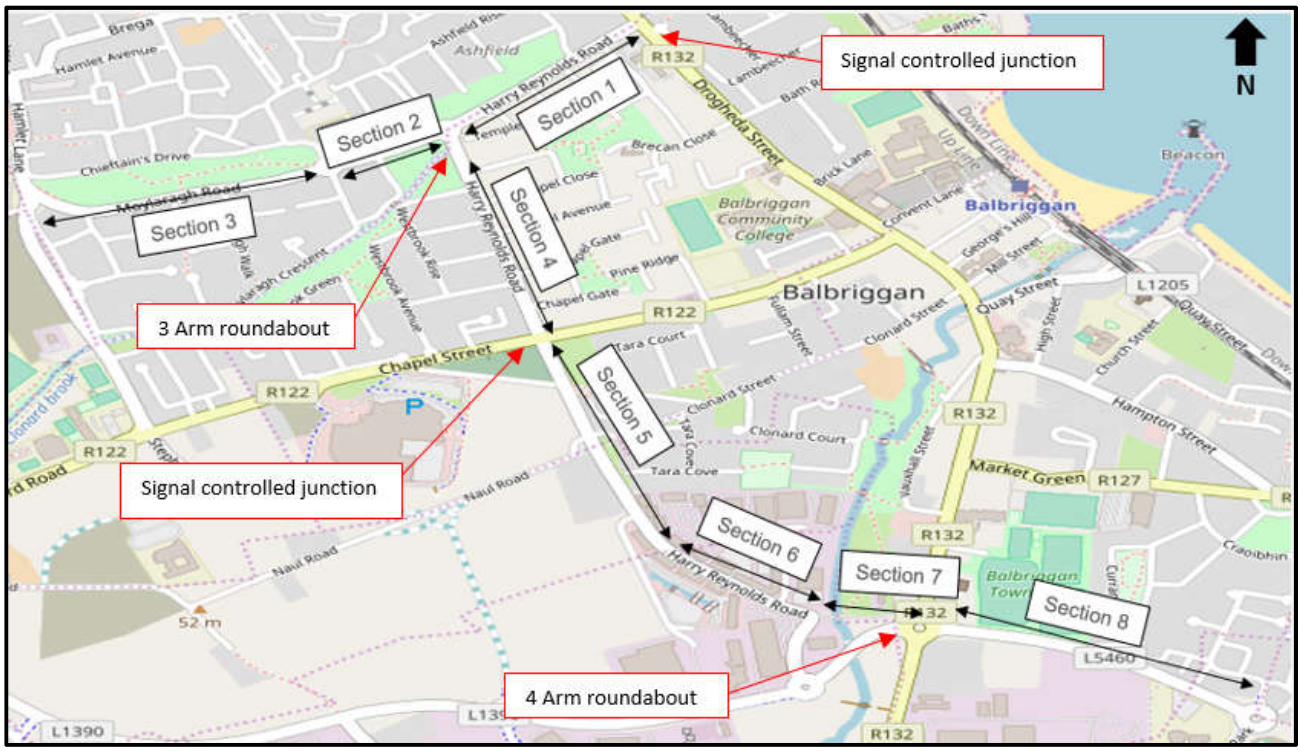


Figure 3-5 Existing road infrastructure sections

3.4.1. Section 1

Section 1 extends from the junction between Harry Reynolds Road and Drogheda Street (R132) in a south-westerly direction to the roundabout junction where Harry Reynolds Road turns southward. The single carriageway has an overall width of approximately 6.5m. Footpaths run adjacent to the carriageway on either side and a buffer is provided by means of a grass verge. There are a number of T-junctions with local estate roads along this section of the route. This section of the scheme has a 50 kph speed limit in place.

3.4.2. Section 2

Section 2 covers the link road between the roundabout in Section 1 and the roundabout at Moylaragh Road. The single lane carriageway has an overall width of approximately 8m. Footpath and cycle lanes run adjacent to the carriageway on both sides. A buffer between the footpath and the carriageway is provided through a grass verge. There is one T-junction with a local estate road and a relatively long section of parallel parking for residents on the southern side of this section of the route. This section of the scheme has a 50 kph speed limit in place.

3.4.3. Section 3

Section 3 covers the Moylaragh Road between the roundabout in Section 2 leading up to the signal controlled junction at Castlemill Link. The single lane carriageway has an overall width of approximately 6.5-7.0m. A footpath runs adjacent to the carriageway on the southern side which is separated from the carriageway by means of a grass verge. Residential properties and driveways directly front along this section of road along the majority of its length with a number of T-junctions providing access to the rest of the estate. This section also includes the grassed park area within Moylaragh. This section of the scheme has a 50 kph speed limit in place.

3.4.4. Section 4

Section 4 extends along Harry Reynolds Road from the roundabout in Section 3 to the signal controlled junction with Chapel Street. The single carriageway has an overall width of approximately 9.0-10.0m. Footpaths run adjacent to the carriageway on either side. A buffer is provided by means of a grass verge also on both sides. A number of access junctions to residential streets are present along the carriageway. A cycle lane develops towards the south of the section on the eastern side. This section of the scheme has a 50 kph speed limit in place.

3.4.5. Sections 5 and 6

Section 5 and 6 covers the link road between Harry Reynolds Road and the three-arm roundabout to the south of Jack Murphy Outdoor Clothing. The single carriageway has an overall width of approximately 9.0m. Footpaths run adjacent to the carriageway on either side. A number of access junctions to industrial and commercial units are present along the carriageway. A permitted speed limit of 60 kph is allocated along section 5 and section 6.

3.4.6. Section 7

Section 7 covers the exit road from the public car park opposite to St Peter and Pauls Church. The carriageway is approximately 6.0m and is one-way road westwards only. There is an existing footpath to the north of the road with a grass buffer while there is grass verge and vegetation to the southern side. The footpath links to the existing roundabout on Dublin Street along the perimeter wall of the car park.

3.4.7. Section 8

Section 8 covers the link road between the roundabout on Dublin Street and the three arm roundabout on Castle Park Avenue. The single carriageway has an overall width of approximately 8.0m. Footpaths and cycle lanes run adjacent to the carriageway on either side. A buffer is provide along both sides by means of a grass verge. A speed limit of 60kph is in place along this section of the scheme.

3.4.8. Key Junctions

There are four key junctions within the extents of the scheme. Two of which are signal controlled junctions with the remaining two being a three and four arm roundabout. These are identified in Figure 3-5 above.

3.5. The Park

The existing park that runs parallel to Dublin Street at the southern end of Harry Reynolds Road is generally linear in nature and follows the Bracken River. There are existing footpaths through the park which link to Harry Reynolds Road, the public car park, Clonard Court and Vauxhall Street. There are two existing bridge crossings of the river which are approximately 1.8m – 2.0m wide.

A Masterplan is currently being prepared for this parkland area and a proposed new skate park is to be constructed within the next year.

3.6. Utilities

Utilities companies and service providers were contacted to determine presence of services and potential impacts. The individual service providers contacted, and their response are shown in Table 3-2.

Table 3-2 Summary of utilities companies' infrastructure

Service Provider	Response Received	Services Present
Aurora Telecom	Yes	No
BT	Yes	Yes
Eir	Yes	No
Enet	Yes	No
ESB Networks	Yes	Yes
Bord Gais	Yes	Yes
Virgin Media	Yes	Yes
Irish Water	Yes	Yes
FCC surface & foul water	Yes	Yes

3.7. Initial Transport Assessment

Traffic count surveys were carried out at six relevant junctions in May 2018. The surveys consist of pedestrian crossing counts, junction turning counts and queue counts at selected locations.

3.7.1. Link Analysis

A link analysis was carried out using the survey data. Two scenarios were assessed a Without Scheme scenario and a With Scheme scenario.

The assessment found that in the With Scheme scenario all of the road links would operate well within capacity, with Ratio of Flow to Capacity (RFC)s generally less than 0.6. A summary of these results is shown in Table 3-3 below.

Table 3-3 Link analysis results

Link	Baseline Capacity (Veh/hr)	Capacity with Scheme (Veh/hr)	Peak	Flow (Veh/hr)	Baseline RFC	With Scheme RFC
Harry Reynold's Rd. (Site 1 to Site 2)	1300	900	Am	235	18%	26%
			PM	279	21%	31%
Harry Reynold's Rd. (Site 2 to Site 3)	1300	900	AM	482	37%	54%
			PM	324	25%	36%
Harry Reynold's Rd. (Site 3 to Site 2)	1300	900	AM	600	46%	67%
			PM	374	29%	42%
Harry Reynold's Rd. (Site 3 to Site 4)	1300	900	AM	424	33%	47%
			PM	363	28%	40%
R132 (Site 4 to Site 5)	1530	900	AM	494	32%	55%
			PM	513	38%	53%
R132 (Site 5 to Site 4)	1300	900	AM	562	43%	62%
			PM	358	28%	40%

3.7.2. Junctions Review

A review of the existing traffic conditions (site visit, traffic counts and online data) indicates that the existing roundabout at Harry Reynolds Road/ Dublin Street/ Hamilton Road is operating close to capacity during the peak hour periods. Two possible options were considered for this junction to cater for cyclists and other road users. These are discussed in further chapters.

The existing roundabout at Harry Reynolds Road/ Moylaragh Road has single lane entries on each arm. A review of the existing traffic conditions (site visit, traffic counts and online data) indicates that the existing roundabout is operating well within capacity during the peak hour periods. Two possible options were considered for this junction to cater for cyclists. These are discussed in further chapters

There are two existing signalised junctions (located at Chapel Street / Harry Reynolds Road and the Harry Reynolds / Drogheda Street) that are situated along the proposed route. The proposed scheme will have minor impacts on these junctions and it is not proposed to alter their operation in any major way.

4. Constraints

4.1. Engineering Constraints

A wide variety of data and information sources were used in identifying the engineering constraints including:

- Data and information obtained through consultations with Fingal County Council.
- Information obtained from public utility companies.
- Mapping data provided by Ordnance Survey Ireland under licence agreement.
- Topographical survey data.
- Road Safety Authority collision data.
- Route character information and road user behaviour collected as part observations recorded during site inspections.

The main constraints are discussed in the following sections.

4.2. Cross Section Options

Following initial site observations, three possible cross-section options were identified. The cross section options identified are shown in Figure 4-1 , Figure 4-2 and Figure 4-3 below.

4.2.1. Link Type 1 – Two way cycle track and segregated footpath

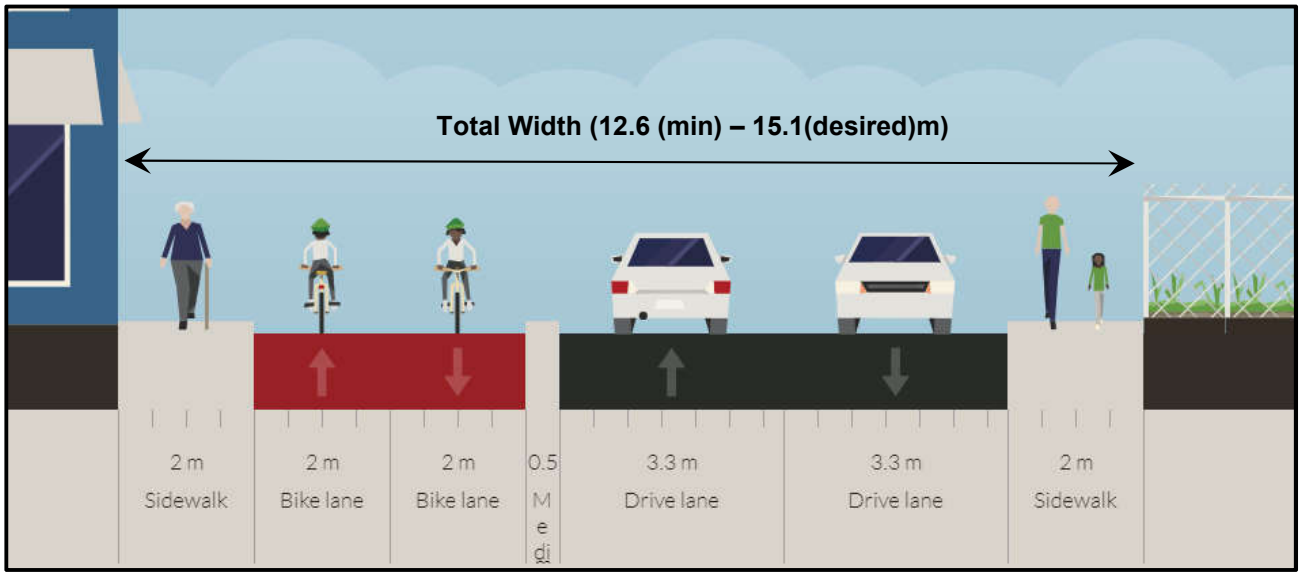


Figure 4-1 Two way cycle track with segregated footpath

4.2.2. Link Type 2 – One way cycle lanes

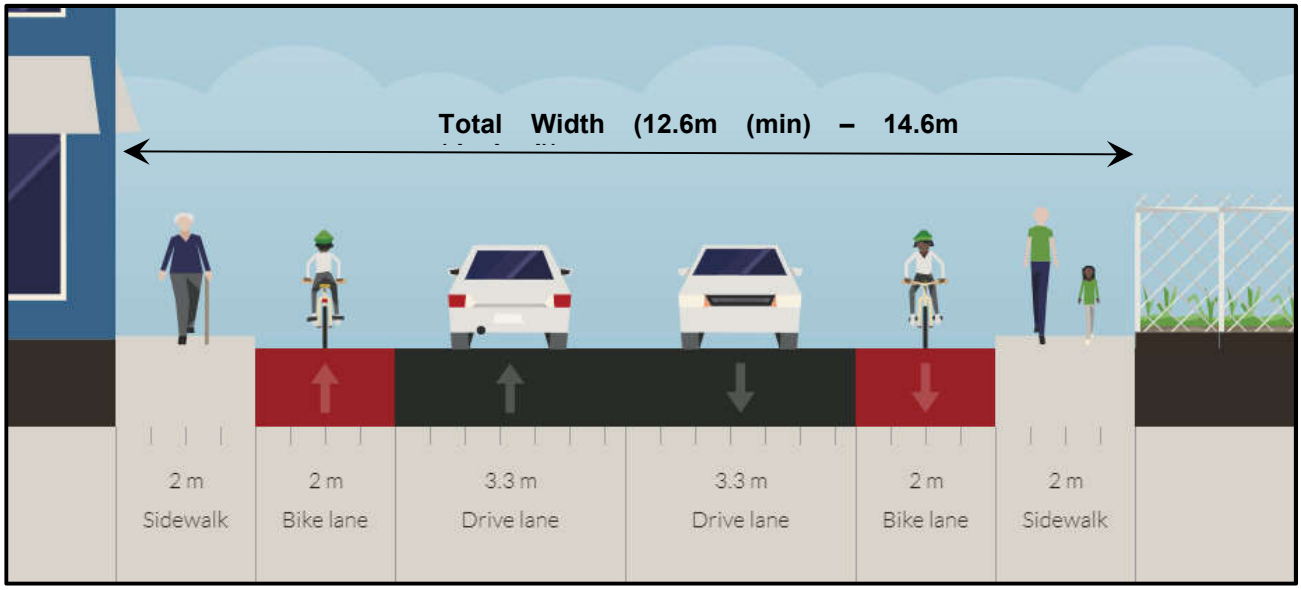


Figure 4-2 One way cycle lanes

4.2.3. Link Type 3 – Two way cycle track and one way cycle track with segregated footpaths

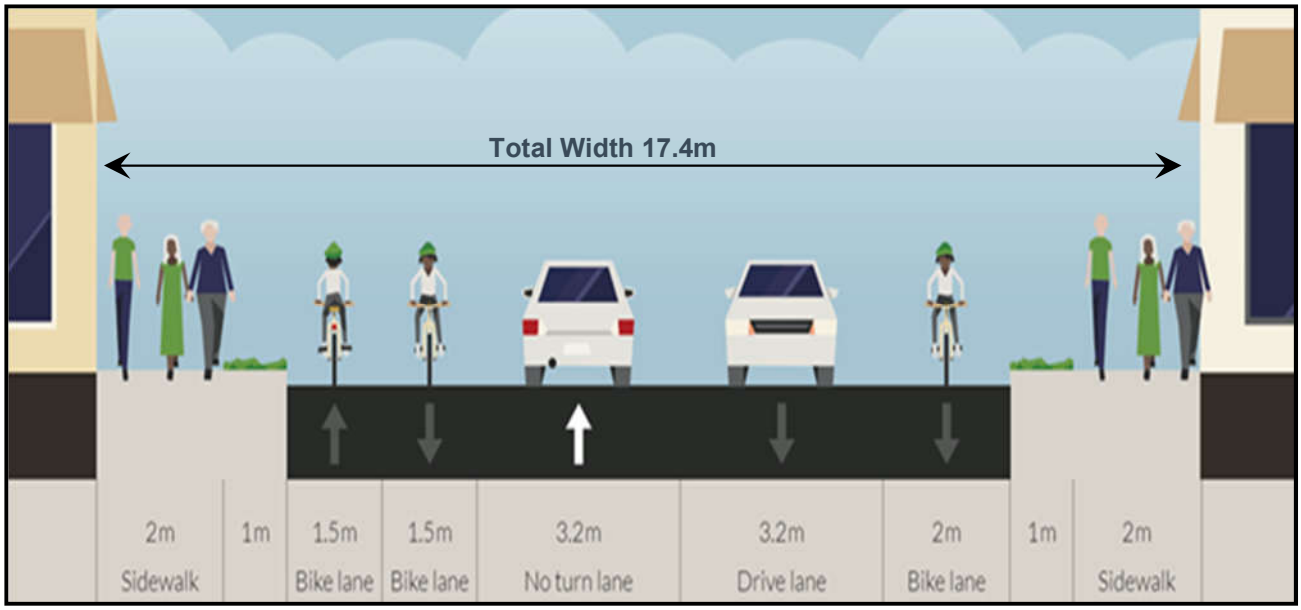


Figure 4-3 Two way cycle track and one way cycle track with segregated footpaths

Figure 4-4 below shows the locations along the scheme where each link type is achievable. Cross-Section Option 2 is the narrowest with Option 3 being the widest. Cross-Section Option 2 is achievable along the full length of the route while Option 1 is achievable for all but a very short section. Option 3 is only achievable along Hamilton Road and a short section of Harry Reynolds Road.

Figure 4-4 Possible locations of link types along the proposed route

4.3. Land Ownership

The proposed facility will be constructed adjacent to the existing carriageway. The majority of these lands are under the control of Fingal County Council.

There are some isolated locations where the ownership of the lands must be further investigated. In particular, there are three areas of interest located to the south of Harry Reynolds Road at Stephenstown Industrial Estate; the first being the grassed area to the south of Casey Doors car park, the second being the grassed area to the north of Aravato Digital Services car park and finally the paved area adjacent to the footpath along the northern side of Harry Reynolds Road. Figure 4-5 below shows the location of these lands.

A second location where the ownership of lands requires further investigation is at the junction of Harry Reynolds Road and Drogheda Street. In order to tie into the existing cycle track the ownership of this land and masonry wall must be established. The location of this wall is shown in Figure 4-6.

The ownership of these lands will be examined in further detail within the next design stage of the project.

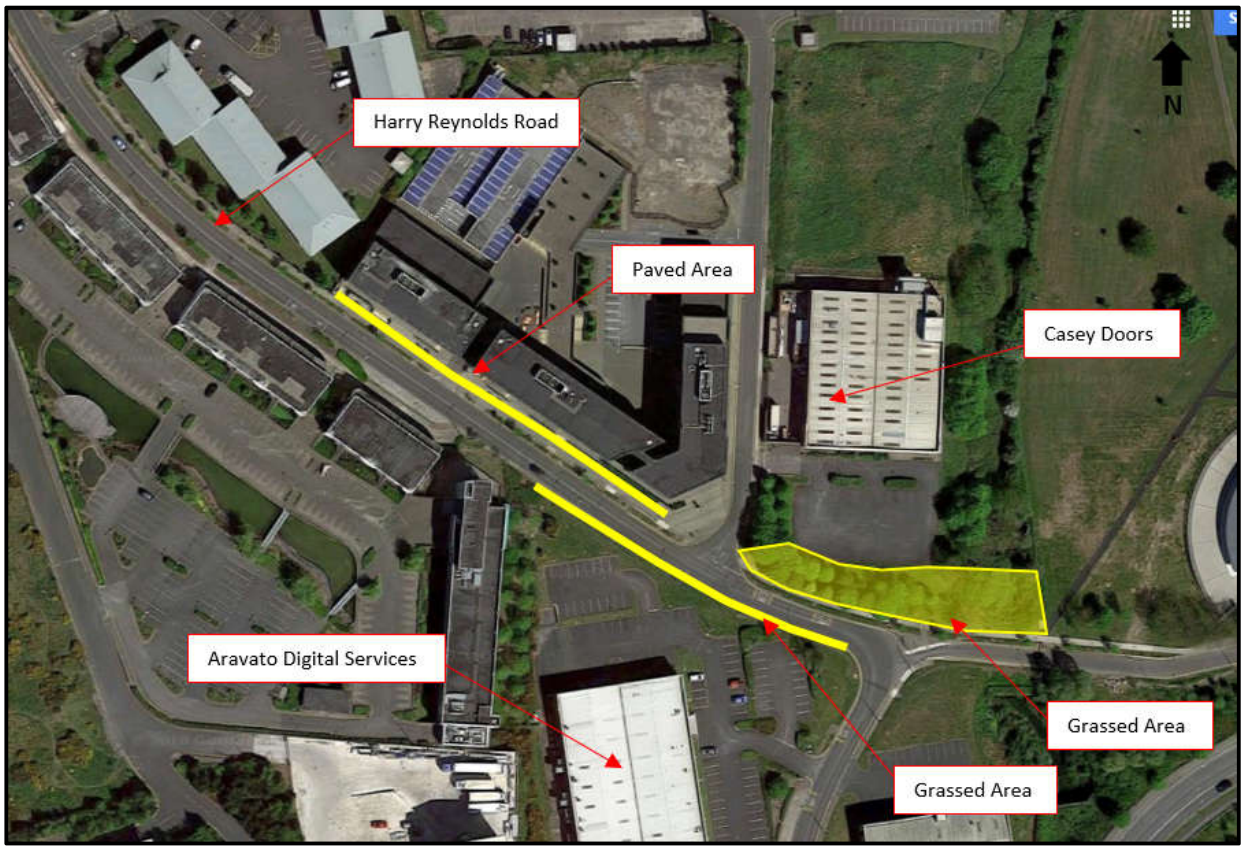


Figure 4-5 Land outside FCC ownership along Harry Reynolds Road

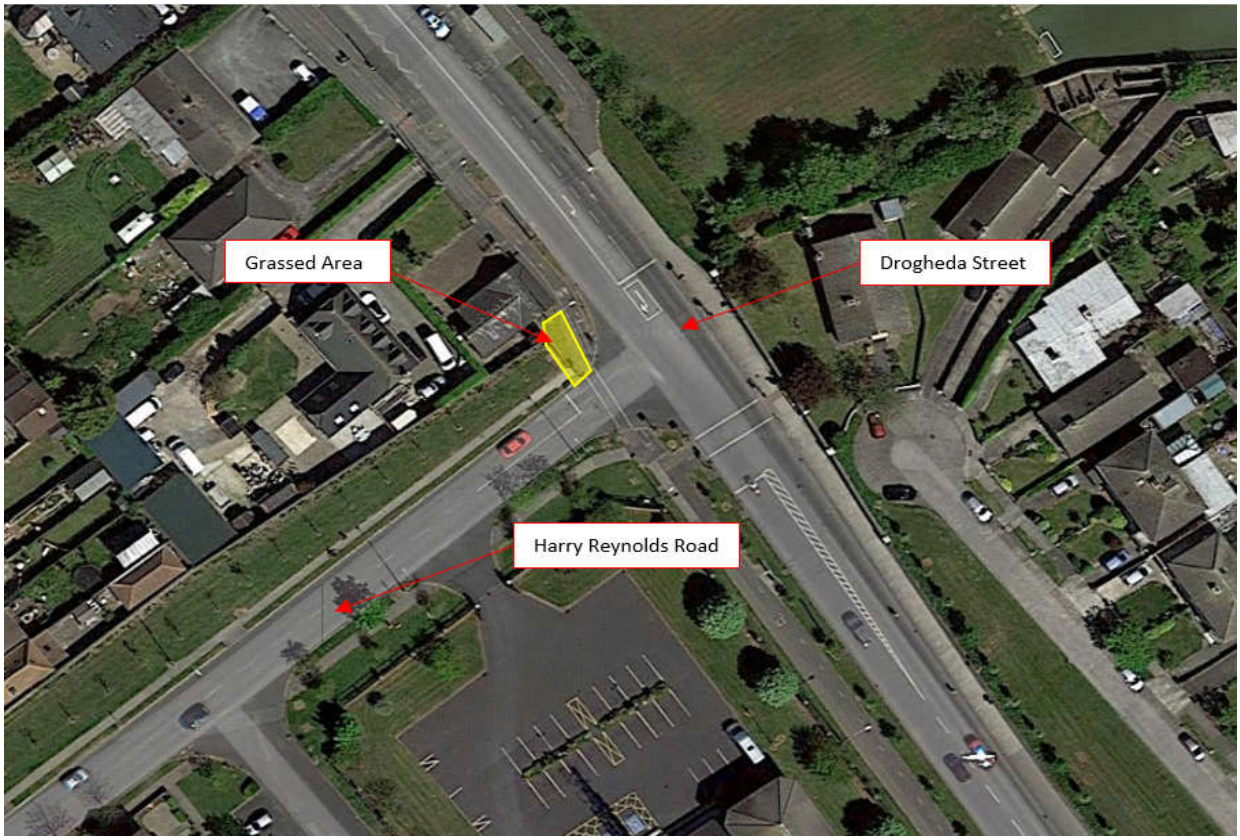


Figure 4-6 Landownership requiring further investigation at Drogheda Street junction

4.4. Environmental Constraints

4.4.1. Methodology

The environmental constraints assessment comprised a desktop study which focussed on the following key environmental topics; ecology / biodiversity, current / historic land-use, geology, hydrology, hydrogeology and flood risk.

The desk-based review was supplemented by a site walkover survey, which was carried out on 18th May 2018 by an Atkins Environmental Consultant, along all accessible portions of the selected study area. The findings of the walkover survey were used to inform the environmental constraints assessment. This assessment represents a preliminary environmental review of the study area to inform the design process and supplementary environmental surveys may be required along the preferred route during the detailed design stage.

4.4.2. Ecological Constraints

The Bracken River, which flows in a northerly direction through the eastern portion of the study area, and the Bremore River, which flows in a general easterly direction through the northern portion of the study area are considered possible environmental constraints within the study area; however from an ecological perspective, neither of these rivers are hydrologically linked to Sites of International or National Importance.

The closest national site, Knock Lake proposed Natural Heritage Area (pNHA: Site Code: 001023), is located ca. 2km south west of the study area and the closest international site, River Nanny Estuary and Shore Special Protection Area (SPA: Site Code: 004158) is located ca. 4.25km north of the study area, as presented in Figure 4-7.

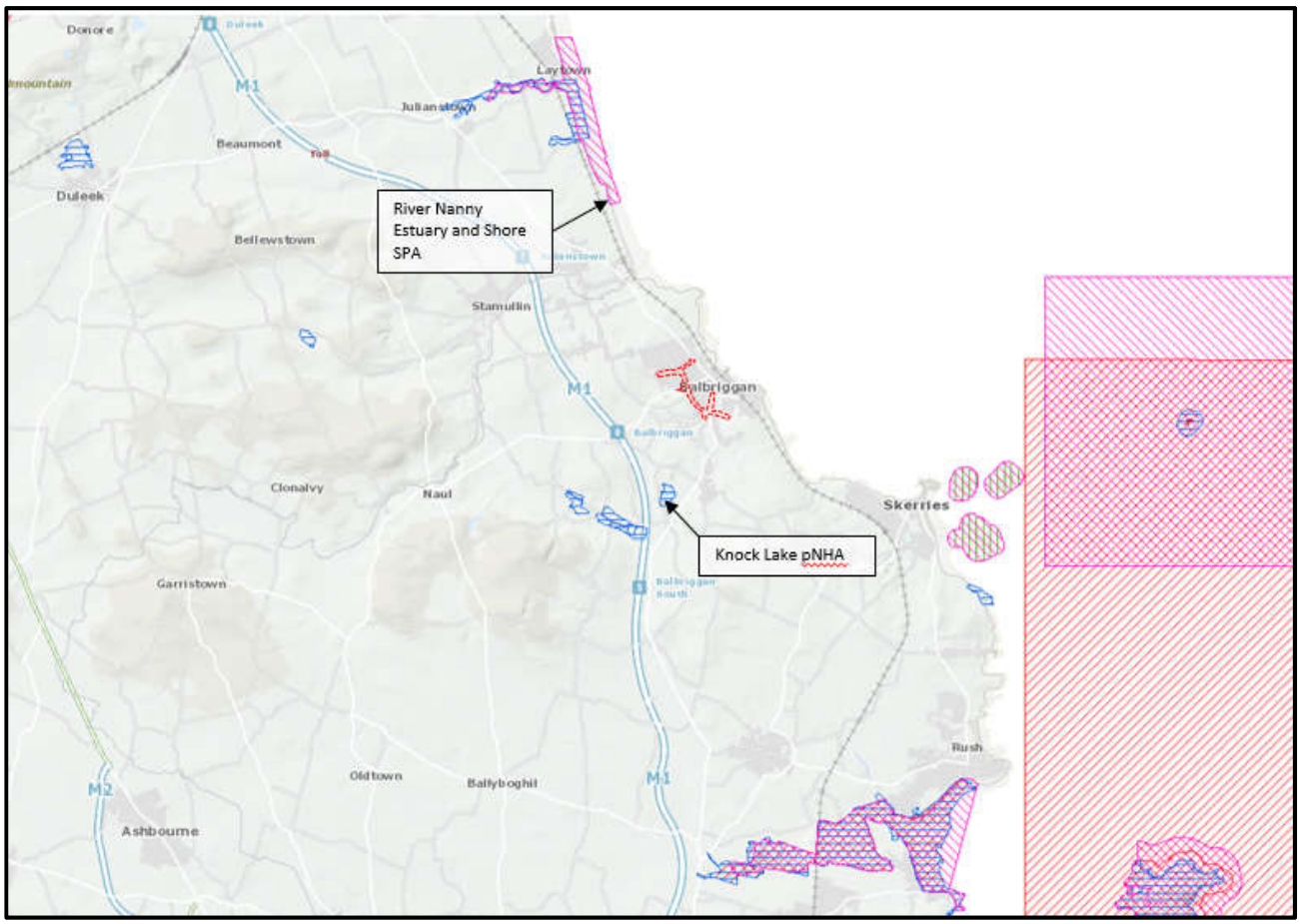


Figure 4-7 Sites of National and International Importance (Source; NPWS 2018)

According to NBDC 2018, there has been a recent record of Japanese Knotweed (Fallopia japonica) within the town of Balbriggan, at No.45, Dublin Street, which is not in the vicinity of the proposed scheme.

During the site walkover there were no sightings of invasive species within the vicinity of the study area. There were a number of areas adjacent to the study area which had restricted access, and therefore could not be visually inspected for the presence of invasive species. However, as these areas are not within the boundary of the study area, it is anticipated that they will not be affected by the proposed scheme.

4.4.3. Current and Historic Land-use

During the site walkover, the dominant land use observed within the study area is residential and commercial, with some amenity grassland. According to EPA 2018 there are no EPA licenced facilities, waste facilities or Waste Water Treatment Plants (WWTP) within the study area.

Based on a review of OSI mapping including historic mapping, a Mill is identified to the east of the study area, with a Mill Pond historically located adjacent to the Mill. However the pond appears to have been filled in, and the area is now covered with Made Ground and consists of amenity grassland, with a river to west of the study area. The entire study area was historically dominated by agricultural land. The general vicinity of the study area was generally developed between 1913 and 1995. The Stephenstown Industrial Park and Balbriggan Business Park were also developed during this time and were developed further between 1995 and 2000.

4.4.4. Geology and Soils

According to the GSI (2018) there are a variety of soil types beneath the vicinity of the study area. The eastern portion of the study area is dominated by Made Ground and deep well drained mineral soils. The central and north-western portions of the study area comprise Made Ground with minor portions of alluvial soils. The south-western portion of the study area is dominated by soils which are poorly drained (mainly acidic).

Bedrock beneath the general vicinity of the study area is dominated by Andesite, pillow breccia, mudstone and tuff of the Belcamp Formation with a portion to the south-east comprising laminated blue-grey siltstone, and sandstone of the Skerries Formation (GSI, 2018).

4.4.5. Hydrology

The Bracken River flows through the eastern portion of the study area. The river flows in a northerly direction before discharging to Balbriggan Harbour ca.0.7km upstream of the study area. The Bremore River flows in an easterly direction through the northern portion of the study area, before discharging to coastal waters ca. 0.45km upstream (east) of the study area. Refer to Figure 4-8. Neither of the Rivers have been assigned a surface water ecological status by the EPA (2010-2015).

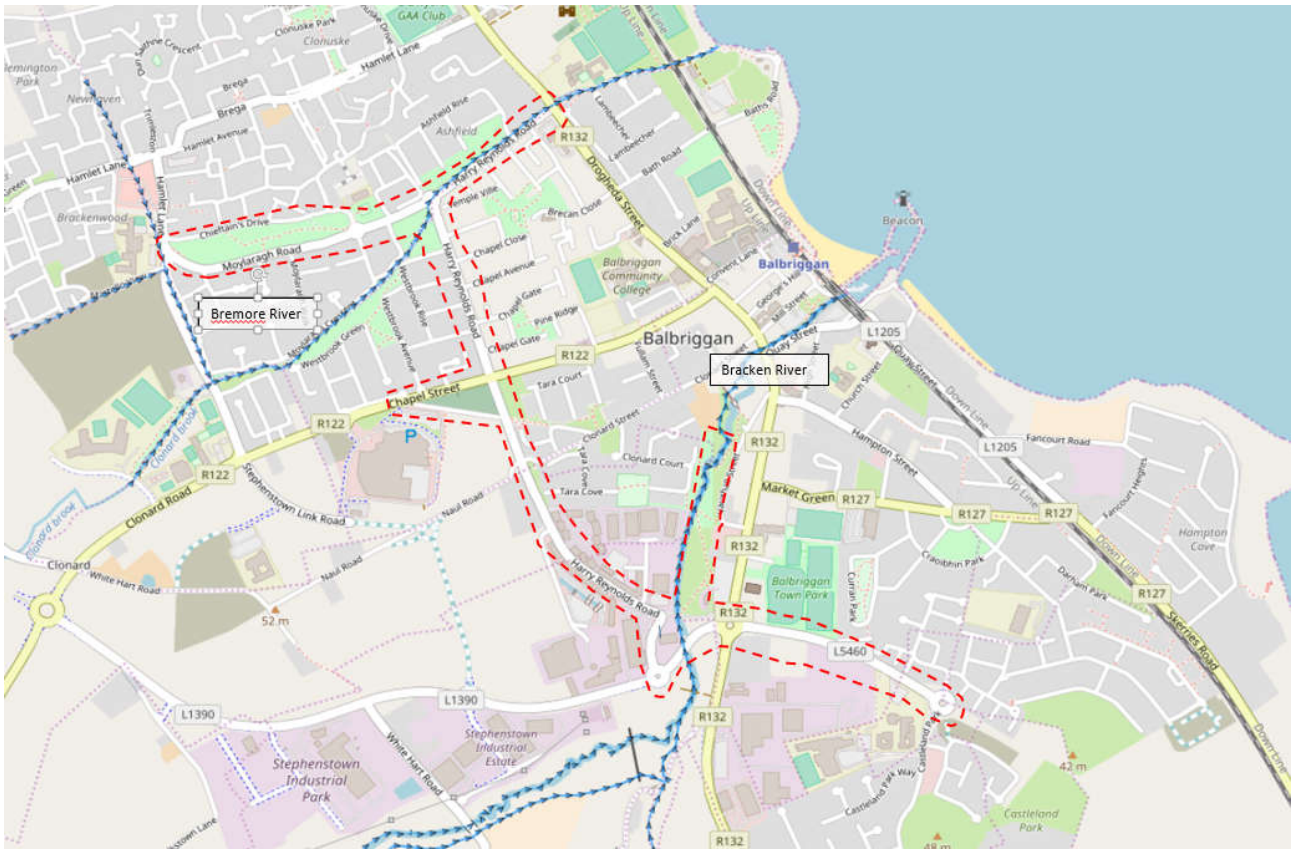


Figure 4-8 Key surface water features (source; EPA 2018)

4.4.6. Hydrogeology

The GSI provides a methodology for aquifer classification based on resource value (regionally important, locally important and poor) and vulnerability (extreme, high, moderate or low).

The bedrock aquifer within the vicinity of the site is classified as '*Lm'*, a locally important aquifer which is generally moderately productive (GSI, 2018). There are no gravel aquifers beneath the study area or within 2km (GSI, 2018).

According to GSI, 2018, the groundwater vulnerability beneath the central and northern portions of the site are classified as '*low*' with the northern and small a portion of the south eastern areas being classified as '*moderate*'. The south eastern corner of the study area has been classified as '*high'* vulnerability, indicating shallow bedrock in this portion of the study area; therefore, groundwater is vulnerable to potential contamination in this area.

4.4.7. Flood Risk Screening

Relevant best practice guidance "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DEHLG, 2009) sets out a risk-based sequential approach to flood risk assessment. Three key stages are identified as follows;

Stage 1 - Flood Risk Identification - To identify whether there may be any flooding or surface water management issues related to a plan area or proposed development site that may warrant further investigation.

Stage 2 - Initial Flood Risk Assessment

Stage 3 - Detailed Flood Risk Assessment

This PFRA has been carried out in accordance with relevant best practice guidance (DEHLG, 2009) and comprised the completion of a 'Stage 1 - Flood Risk Identification' screening assessment.

The following key sources of potential flooding associated with the proposed scheme have been identified;

- Rivers / streams / surface water courses;
- Heavy rainfall and associated surface water ponding; and,
- Coastal /tidal flood waters;

There has been no historic flooding within the study area. The Fingal East Meath (FEM) Flood Risk Assessment and Management Study (FRAMS), predictive flood risk maps suggest that flooding in the vicinity of the Bremore River has a 1 in 10 probability in any given year, while flooding in the vicinity of the Bracken River has a 1 in 100 probability in any given year (OPW, 2018). Refer to Figure 4-9.

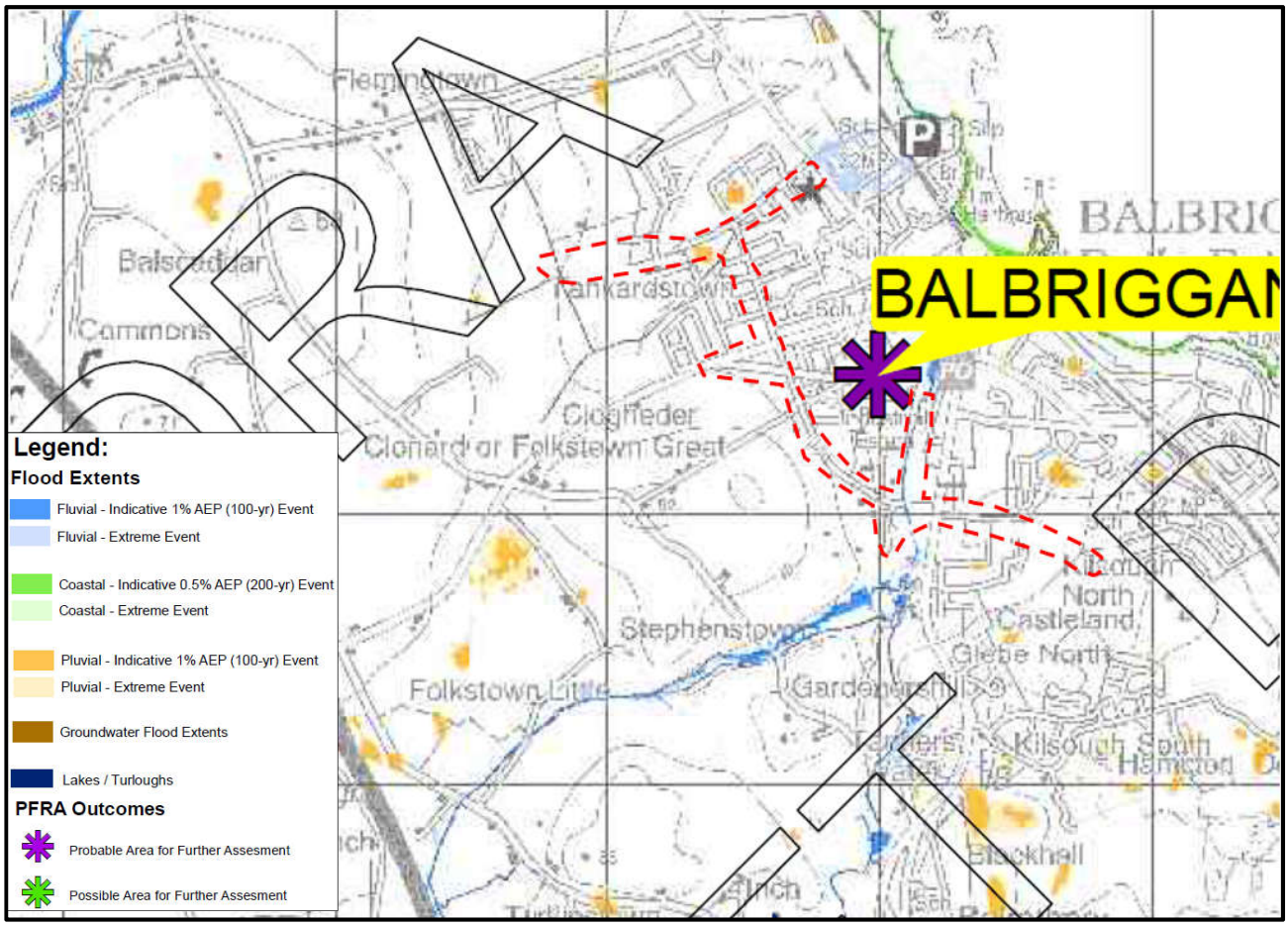


Figure 4-9 Flood Extents Map (Source; OPW 2018)

It is not envisaged that the proposed pedestrian and cyclist scheme would have any adverse impact on flooding along the path, based on the following considerations: -

- The proposed pedestrian and cyclist scheme shall be designed to avoid key low-lying areas identified during the detailed design stage which may be at potential flood risk;

- The preliminary drainage design comprises the following key elements;

    - Adequate drainage has an enormous impact on the quality and safety of cycling facilities. Drainage will be installed to the desired standard and will be compliant with Sustainable Urban Drainage Systems (SuDs) as set out in the Greater Dublin Strategic Drainage Study (2005). Where possible the existing drainage infrastructure is to be maintained.

    - Cycle friendly drainage, such as side entry gullies, will be incorporated where appropriate.

The localised change in land surface and the improved drainage systems may result in a minor increase in rainfall run-off rates. However, such increases will be minor relative to existing conditions, and are unlikely to

have a significant impact on the existing hydrological regime along the route of the proposed scheme. Therefore, it is not envisaged that the proposed development will pose any significant potential flood risk to the surrounding lands, properties or the surrounding road network.

4.5. Constraints Due to Human Beings

The proposed route will not add to operational sources of noise or air pollution from e.g. vehicular traffic but will assist in promoting more sustainable transport with associated reductions in such emissions.

If necessary, environmental disciplines such as noise, air, etc. will be assessed further as the project proceeds as these do not significantly inform the design above and beyond constraints informed by proximity of the route to residential properties etc.

4.6. Tree and Hedgerow (Stage 1)

There will be no impact on any trees with a protection order by the proposed scheme.

The removal of some immature tress along the route is foreseen particularly along Harry Reynolds Road (sections 4, 5 and 6). Efforts will be made mitigate against the impact of the removal of these trees and new trees will be provided in alternative locations along the route. The additional cycle provision through the park lands to the south of the scheme may also necessitate removal of some trees. Should this occur all efforts will be made to minimise the extents of the tree removal.

A Tree and Hedgerow survey will be undertaken as part of the preliminary design.

4.7. Architectural and Built Heritage

There are three protected structures within 500 metres of the proposed route.

- St Peter's & Paul's Church.
  The structure is a mid 19th century Roman Catholic Church
- Parochial House.
  The structure is a turn of the 20th century parochial house serving St Peter's & Pauls Church
- Former Corn Mill.
  The structure is a mid 19th century four storey mill, converted to an apartment block.

The locations of these structures is shown in Figure 4-10 below.

The other notable elements of the Built Heritage are the cemetery adjacent to the Harry Reynolds Road/ Chapel Street/ Nual Road junction and the town monument in the centre of the roundabout on Dublin Street.

Figure 4-10 Locations of protected structures

5. Stakeholder Consultation

5.1. Fingal County Council

FCC Transportation department have consulted with the various internal departments within FCC. The comments recorded from each of the departments are detailed below.

5.1.1. Parks

An on-site meeting was undertaken with undertaken on the 4th September 2018. The key issues arising from this meeting are summarised below:

Planting at roundabout at Dublin st church car park. In general, no overall objection but want to know soon so that maintenance work in the area can be planned for or left out.

Open space area near church car park. There are a lot of plans for development of the park – including development of a possible a running track and a skate park. The opportunity of linking the proposed cycleway/footpath into the running track should be considered.

Removal Trees along harry Reynolds road. As many compensatory trees as possible should be planted, although this may be only half the number removed. The current trees provide an avenue of trees and are soft landscaping to the cold environment of concrete, blacktop and houses. FCC does not maintain any grass along Harry Reynolds road, only the grass in front of FCC open spaces.

North of the Garda station, the preference would be to maintain as many trees as possible.

Trees in Moylaragh Open Space.It is possible to put cycle-lane on southern side of open space away from current footpath. At least 3m width buffer needed from kerb and cycleway for maintenance. Existing open space was not well developed and needs further development. Some trees planted are not long life.

5.1.2. Planning

Planning provided comments on the emerging concept options, these comments are summarised below and consideration of these comments has been taken into the design process and will be given further consideration during the next stage. The planning divided the scheme into nine sections, which are similar to the sections detailed in the road infrastructure review; the difference between the sections is that planning divided Section 1 into two section, with section 1 being just from Drogheda Street to the junction with Ashfield Rise

Table 5-1 FCC Planning Section Comments

Planning Section	Planning Comment	Response
1	Provide 2-way cycleway within grass verge on the northern side.	This option was considered as part of the Multi-Criteria Analysis that follows.
2	Provide a 2-way cycleway in the open space between the railing and the trees.	Consideration of this option was given, to provide this option a number of gaps within the wall would need to be provided to allow access to/from the cycleway. This would require cyclists to cross the footpath at numerous locations, increasing conflicts for pedestrians and cyclists.
3.	Provide a 2-way cycleway in the open space between the railing and the trees.	Consideration of this option was given, however there is limited space between the trees and the railing at this location and this would place the cycleway too close to existing residential properties.
4.	Align a 2-way cycleway inside the southern edge of the public open space	Consideration of this option was given. There are a number of options for this section and a

Planning Section	Planning Comment	Response
		workshop meeting with Parks will be organised to determine the preferred option.
6	Cycleways should be located within the existing wide grass verge on the west side	Consideration was given to this option, however as this side is not as accessible to the local residential population is was not the preferred side for a 2-way facility.
7	A separate track may be needed on both sides of the road.	This option was included as part of the Multi-Criteria Analysis.
8	Align track along narrow road serving the church car park and off-road up to the R132	This option was included as part of the Multi-Criteria Analysis.
9	The existing segregated cycleways along both sides of the road should be maintained	This option was included as part of the Multi-Criteria Analysis.

5.2. National Transport Authority

FCC have consulted with NTA as part of this stage of the project and a summary of their comments is included in the table below.

Table 5-2 NTA Comments

NTA Comments	Response
NTA stated that the existing cycle tracks on Hamilton Road are generally adequate but the entrance to the school could be upgraded.	This option was included as part of the Multi-Criteria Analysis.
NTA stated a preference for not providing a new signal controlled junction to replace the existing roundabout junction at Dublin Road/Hamilton Road but the junction could be configured to a cycle friendly roundabout as per National Cycle Manual.	Both signalised junction and fully cycle friendly roundabout options were included as part of the MCA.
NTA stated a preference for 1 way cycle tracks on both sides of the road whenever possible.	This option was included as part of the Multi-Criteria Analysis for all sections.
NTA suggested that it may be better to widen the existing footpath in the park at Moylaragh or to increase traffic calming on Chieftain's Drive rather than constructing new cycle tracks.	These options were included as part of the MCA. The exact route of new cycle tracks through the park will be determined through consultation with FCC Parks Department as part of the preliminary design.

A further on-site meeting was held with the NTA, Atkins and FCC on the 12th September 2018. At this meeting the scheme was reviewed in detailed and the following points were agreed:

- A new toucan crossing should be provided on Hamilton Road, adjacent the entrance to the Town Park.
- That environmental improvements would be considered for the access lane to the schools on Hamilton Road.
- That environmental improvements would be considered for the laneway from Curran Park to Hamilton Road
- The preferred option for the section of Harry Reynolds Road to the north of the Garda Station would be the provision of a two-way cycleway on the northern side of the carriageway.
- The preferred solution at Moylaragh would be the provision of permeability links within Moylaragh. Cyclists along the Harry Reynolds Road would be signed to use Chieftains Drive. Details of these permeability links are provided within Appendix C.

6. Options Assessment

6.1. Methodology

In order to assess and compare the various options available along each part of the route a Multi Criteria Analysis process was implemented. The scheme was divided into 5 distinct sections for links and 2 sections for junctions and analysed on that basis. Each section was assessed individually but with cognisance of the adjoining sections and a preferred option established for each. The combination of these preferred options is the preferred overall option for the scheme.

6.2. Assessment Criteria

A number of criteria were established with reference to the National Cycle Manual and Common Appraisal Framework accounting for the benefits and impacts on cyclists, pedestrians and other road users as well as on the wider community. The main criteria headings are included below:

6.2.1. Design Context

These assessment criteria primarily relate to the five needs of the cyclists as set out in the National Cycle Manual but also take account of other vulnerable road users. The criteria in this category are:

- Safety
- Directness
- Coherence
- Attractiveness
- Comfort

6.2.2. Community Context

The interests of the local community are also considered within the assessment criteria. These are as follows:

- Impact on business.
- Impact on residents.
- Operational impacts.

6.2.3. Delivery Context

The consideration of risk in terms of construction costs and programme are also considered within the assessment criteria. These are as follows:

- Budget risk.
- Programme risk.

6.2.4. Sub-Criteria

The full definition of all items considered under each criterion is shown in the table below. Each of the sub-criteria was accounted for when comparing each option.

As safety is at the core of all good designs it is considered to be one of the most critical criteria and has been weighted higher than other criteria.

Level of service has been weighted the highest as the purpose of the scheme is to provide the highest possible level of service.

Table 6-1 MCA Assessment Criteria

Context	Main Criteria	Sub Categories	Weighting
Design	Safety	• Traffic volume and speed • Vehicle conflicts – links • Vehicle conflicts – junctions • Pedestrian conflicts • Pedestrian safety	15
	Directness	• Transitions between links • Treatment of side roads and junctions • Ability to overtake	10
	Coherence	• Route continuity and consistency • Route legibility • Obstructions (illegal parking)	10
	Attractiveness	• Integration • Cycling experience • Contribution to urban design • Impact on heritage and landscape	10
	Comfort	• Provision of adequate width • Maintain cyclist progress • Suitability for all users	10
	Level of service	• Progression of cyclists • Quality of facility	20
Community	Business impact	• Property access • Loading • Parking	10
	Residential impact	• Property access • Impact on land / land acquisition • Traffic management impacts on journey times	10
	Operational impact	• Impact on junctions • Impact on maintenance cost	10
	Environmental	• Impact on the surrounding environment	10
Delivery	Capital cost	• Construction cost • Land / property acquisition cost • Overall scheme cost	10
	Programme risks	• Land / property acquisition legal process • Construction risks including utilities	10

6.2.5. Scoring Procedure

Each of the design options are assessed against the criteria specified above in a performance matrix which indicates how each option performs against the criteria and in comparison to the other design option. The assessment is, therefore, comparative and the scoring reflects the performance of each option against other options.

Each criterion is assessed on a five-point colour coded scale as presented in the table below. This scale rates how each option satisfies a particular criterion.

Table 6-2 Scoring Scale

Colour Coding	Rank Description
	Very Positive
	Slightly Positive
	Neutral
	Slightly Negative
	Very Negative

6.3. Link Assessments

As discussed, for the purposes of the assessment, the proposed scheme has been divided into various sections, with the sections for the link assessment shown in Figure 6-1 below. Varying options were developed for each link section and each option assessed under the criteria set out above.

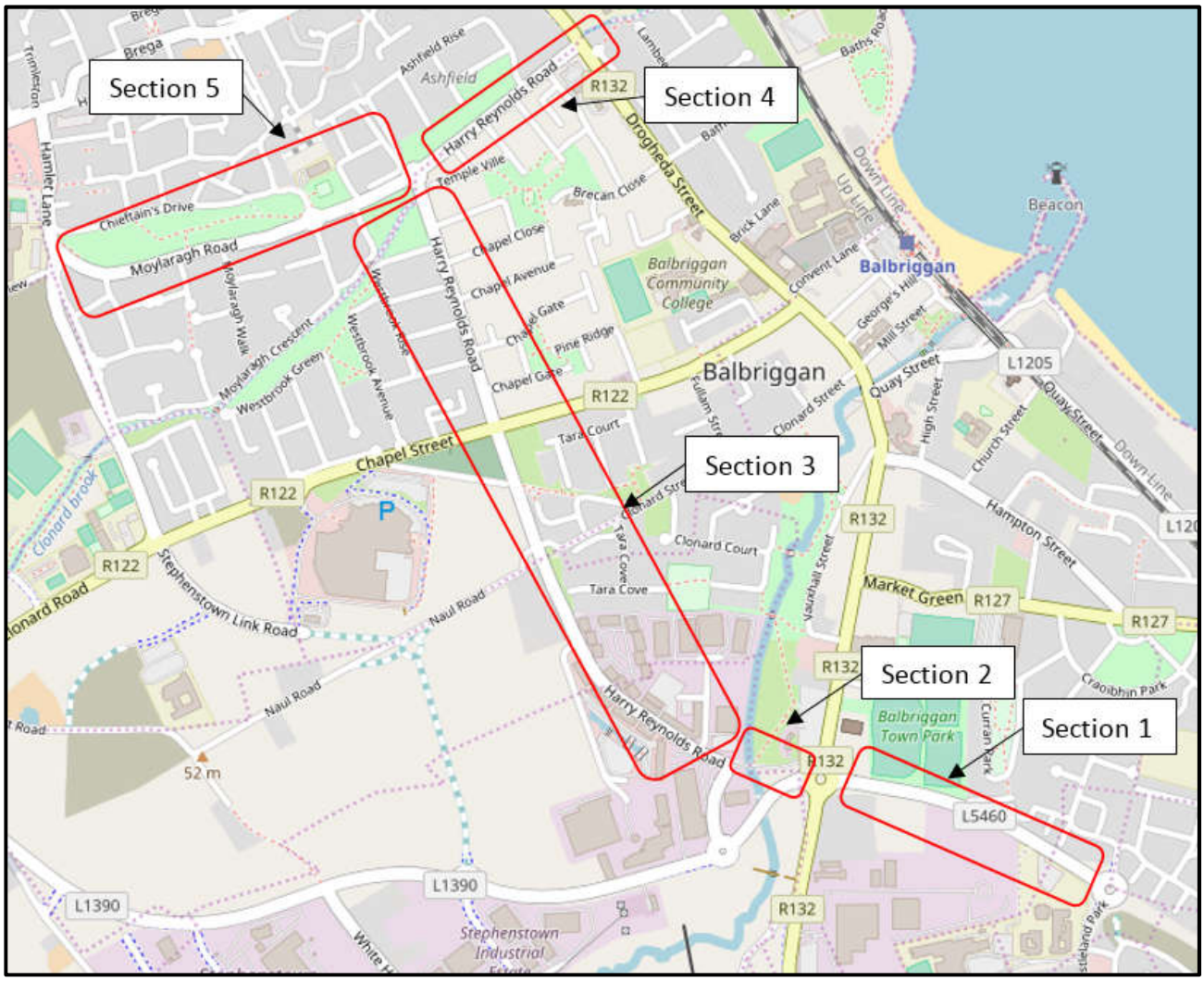


Figure 6-1 Sections for Link Assessment

6.3.1. Link Section 1

Link Section 1 covers Hamilton Road, The road links the four arm roundabout on Dublin Street and the three arm roundabout on Castle Park Avenue. Three options were identified for this section and are set out below

6.3.1.1. Option 1 – Do Minimum

This option would retain the existing cycle and pedestrian facilities along this section of road. The existing toucan crossing may be relocated to better serve the existing schools to the southern side of the road. This option would require minimal works to implement.

Following on-site meetings, it was agreed that this option would include the provision of the toucan crossing adjacent to the entrance to Town Parks and that a two way cycle facility would be provided to link the new crossing to the entrance to the school.

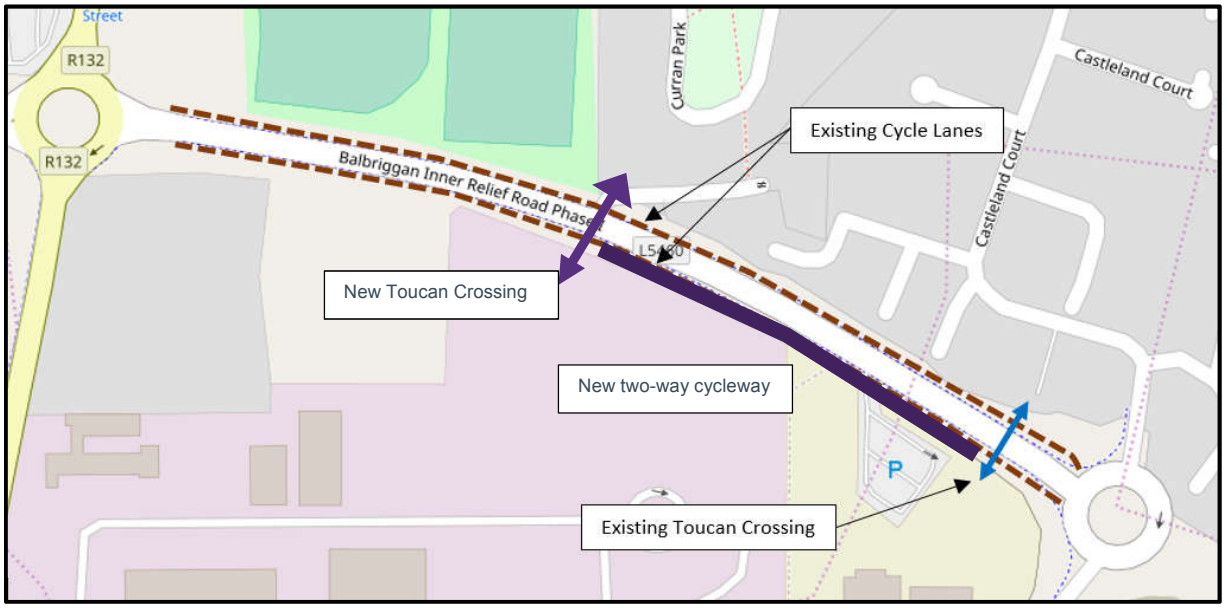


Figure 6-2 Option 1 - Do Minimum

6.3.1.2. Option 2 – Two Way Segregated Cycle Track

For this option, a two way segregated cycle track would be provided along the northern side of Hamilton Road while the existing facilities to the southern side of the road would remain in place. The cycle track would be 3.0m in width. Pedestrians will be catered for by a 2.0m wide footpath to the rear of the cycle track. The northern location of these facilities would allow greater access to the large residential areas to the north of the road. A toucan crossing will be provided in advance of the education centres, Ardgillan Community College and Braken Educate Together. The figure below shows the location of the potential two way cycle facility and relocated toucan crossing. This option would require construction of the new cycle track and footpath within the existing grass verges, cycle track and footpaths but would not require alterations to the kerblines.

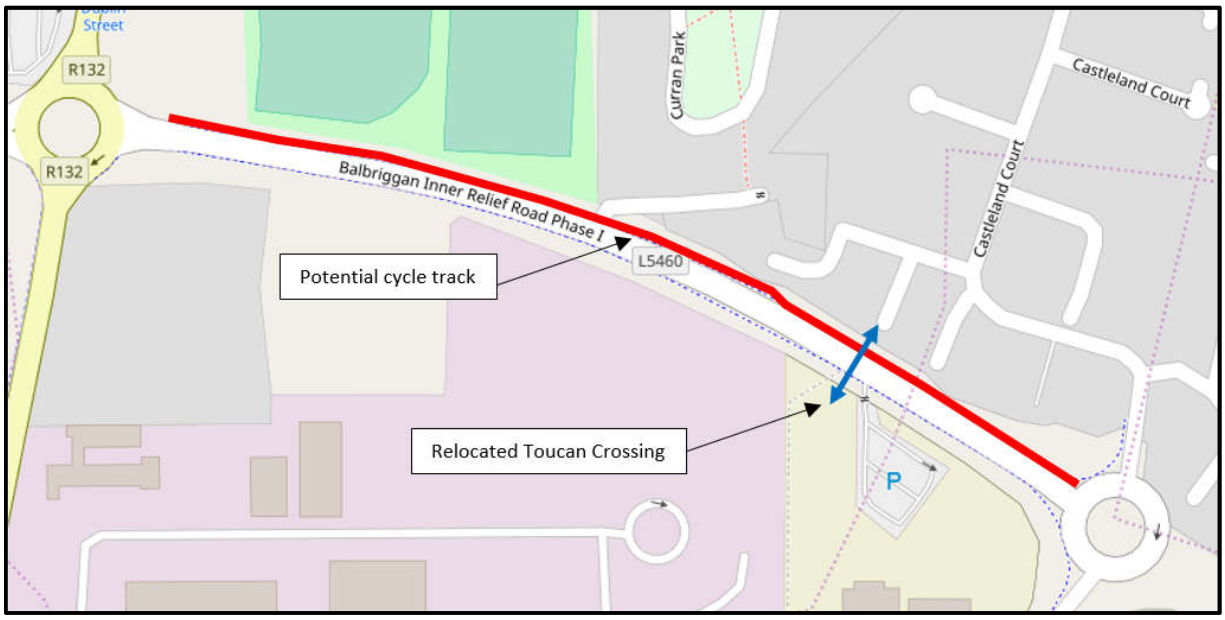


Figure 6-3 Option 2 - Two Way Segregated Cycle Track

6.3.1.3. Upgraded One Way Cycle Tracks Both Sides

This option would upgrade the existing cycle tracks on both sides to provide 2.0m wide cycle tracks. The existing footpaths would also be upgraded to 2.0m in width. Upgrading of these cycle tracks would be carried out by removing the existing grass verges and widening into the grassed areas to the rear of the existing footpath but would not require relocation of kerblines. The existing crossing location in advance of the Castle Park Avenue roundabout could be relocated as in Option 1. The figure below shows the potential upgraded cycle tracks and toucan crossing.

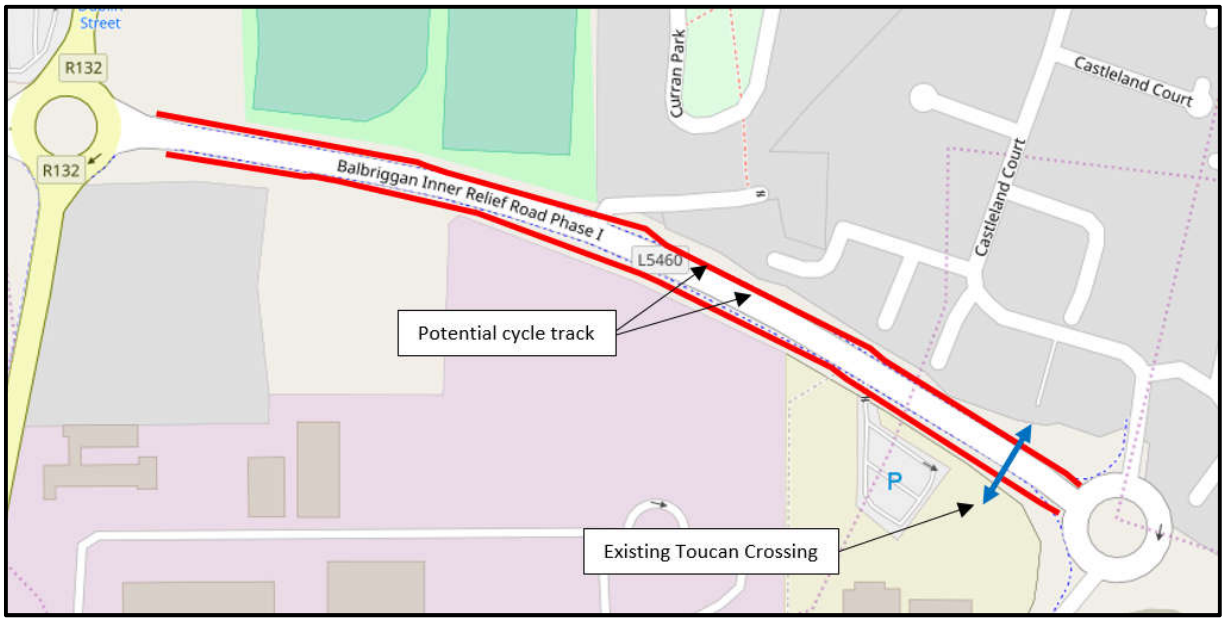


Figure 6-4 Option 3 - Upgraded One Way Cycle Tracks Both Sides

6.3.1.4. Link Section 1 – MCA

The Multi Criteria Analysis and comparison between each option for Link Section 1 is summarised in the table below.

Table 6-3 Link Section 1 - MCA Comparison Matrix

Context	Criteria	Option 1	Option 2	Option 3
Design	Safety*	Provides a safe environment for pedestrians and cyclists. The channels of travel are well defined and a buffer is provided between the facility and the carriageway.	Provides a safe environment for pedestrians and cyclists. Segregated cycle track and footpath minimises conflicts between cyclists and pedestrians.	Provides a safe environment for pedestrians and cyclists. The channels of travel are well defined and a buffer is provided between the facility and the carriageway.
	Directness	Provides as direct a route as possible along the section.	Provides as direct a route as possible along the section.	Provides as direct a route as possible along the section.
	Coherence	A highly legible route which is well defined and free of obstructions.	A highly legible route which is well defined and free of obstructions.	A highly legible route which is well defined and free of obstructions.
	Attractiveness	Provides a well-integrated cycle and pedestrian route.	Provision is somewhat isolated from southern area as it is on northern side of carriageway.	Provides a well-integrated cycle and pedestrian route.
	Comfort	Provides a comfortable facility, suitable for all users.	Provides a comfortable facility, suitable for all users.	Provides a comfortable facility, suitable for all users.
	Level of Service*	Separated cyclist and pedestrian channels of travel not segregated but providing adequate level of service. Conflicts between modes is minimised allowing greater service level.	Segregated cycle and pedestrian facility allows for level of service A. Conflicts between modes is minimised allowing greater service level.	Separated cyclist and pedestrian channels of travel allows for level of service A. Conflicts between modes is minimised allowing greater service level.
Community	Business impact	No impact on businesses.	No impact on businesses.	No impact on businesses.
	Residential impact	No impact on residents.	Minimal impact on residents during construction.	Minimal impact on residents during construction.
	Operational impact	Facility will require routine maintenance.	Facility will require routine maintenance.	Facility will require routine maintenance.
	Environmental	Facility has no impact on environment as is currently in place.	Facility will have some impact on surrounding environment during construction. Proposed facility requires widening into grassed verges.	Facility will have some impact on surrounding environment during construction. Proposed facility requires widening into grassed verges

Context	Criteria	Option 1	Option 2	Option 3
Delivery	Capital cost	Minimal additional costs to scheme.	3m wide cycle track and 2m wide footpath requires widening into grassed verge. Additional capital costs may not be justified given existing facilities.	3m wide cycle track and 2m wide footpath requires widening into grassed verge. Additional capital costs may not be justified given existing facilities.
	Programme risks	Minimal risks to programme delivery.	Programme could suffer due to works requirements. Potential conflicts with utilities due to widening.	Programme could suffer due to works requirements. Potential conflicts with utilities due to widening.
Ranking		**1st**	**3rd**	**2nd**

6.3.1.5. Link Section 1 – Preferred Option

Option 1 is the preferred option in this location. The existing facility delivers a well-designed provision which performs well against the design criteria while requiring little capital cost. The facility also has a marginal impact on the community and does not raise any concerns towards budgets or programme delivery. A new toucan crossing will be provided and a two-way cycleway will be provided between the toucan crossing and the access to the school. The figure below shows the preferred route for Link Section 1.

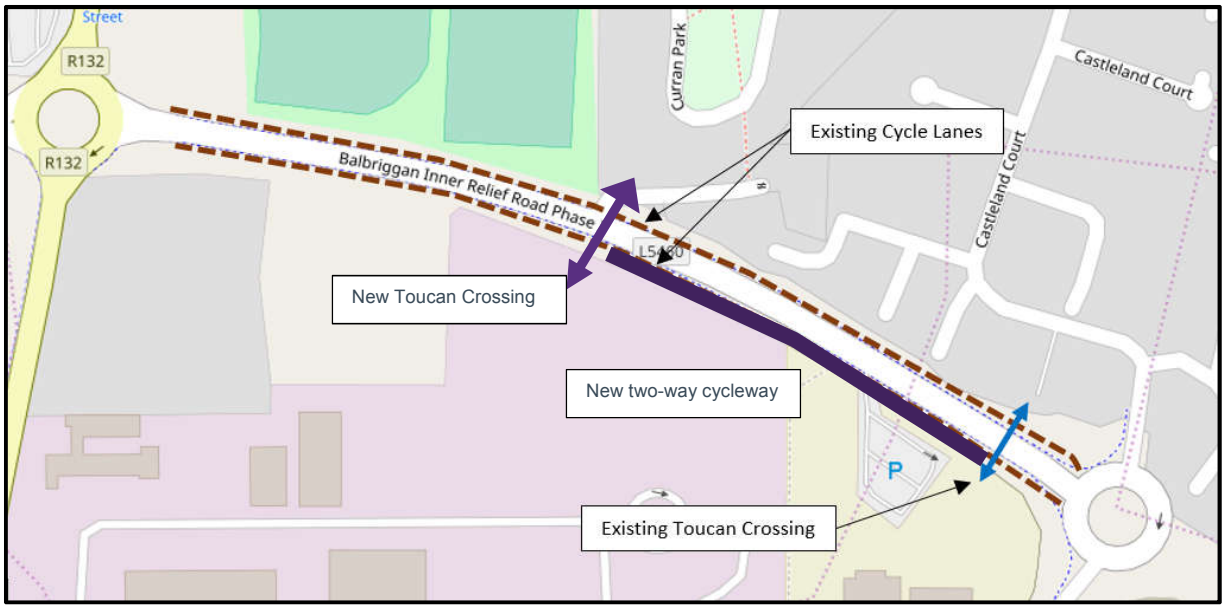


Figure 6-5 Link Section1 - Preferred Option

6.3.2. Link Section 2

Section 2 covers the one-way exit road from the public car park adjacent to St Peter and Pauls Church. Three possible options were considered for this section and are described below.

6.3.2.1. Option 1 – Do Nothing

This option would retain the existing footpath link that runs along the perimeter of the car park between the Dublin Street roundabout and the car park exit road. No cycle facilities would be provided along this section but the existing narrow, unsegregated cycle tracks along the L1360 would be maintained on both sides along with the section of cycle track on one side of the Harry Reynolds Road. Two new toucan crossings would also be required. The proposed option is shown in the figure below.

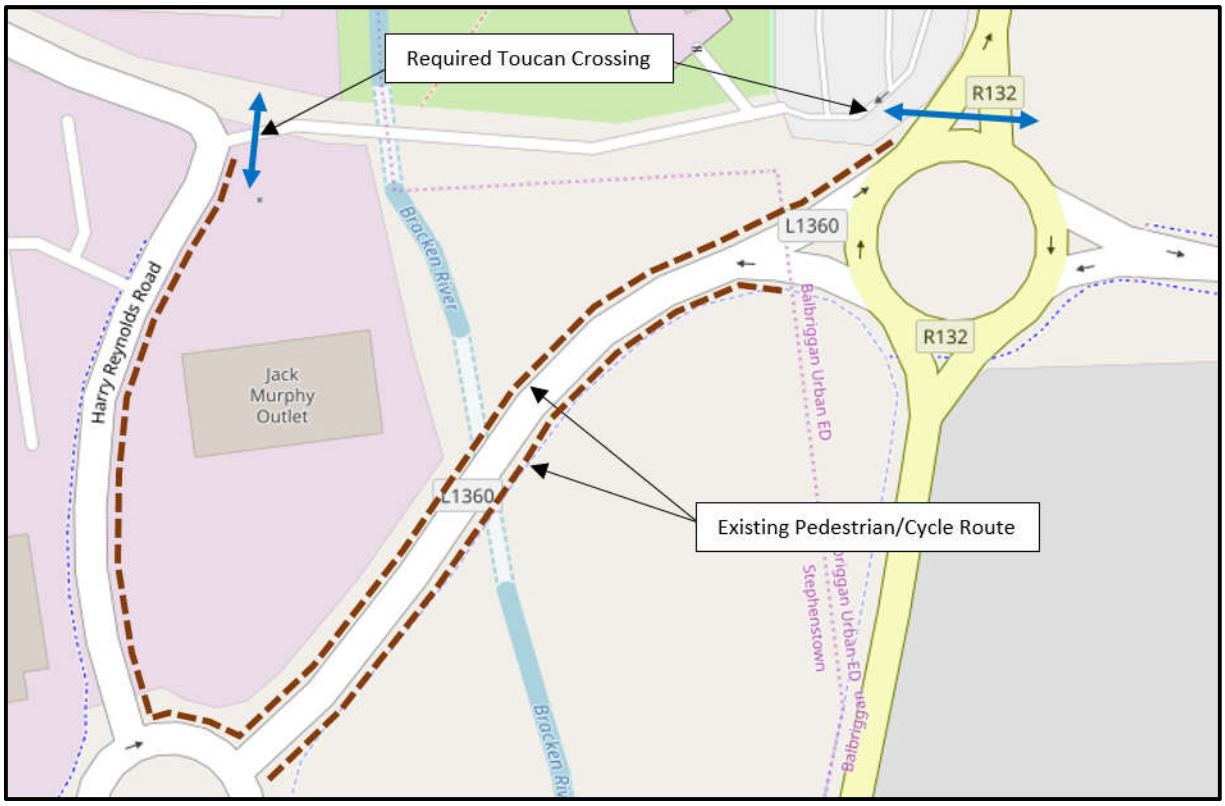


Figure 6-6 Option 1 - Do Nothing

6.3.2.2. Option 2 – Two Way Segregated Cycle Track.

A two-way segregated cycle track will be provided along the northern side of the car park exit road. Cycle provision will be by a 3.0m wide track with a 2.0m wide footpath also provided to the rear of the cycle track. A 2.5m footpath will provide a link from this facility to the R132 roundabout enabling progression. A raised zebra crossing would be provided to link the new facility to the existing footpath that runs along the perimeter wall of the existing car park. This footpath would be upgraded to the same standard including a 3m wide two-way cycle track 2m wide footpath. A new toucan crossing facility would be provided along the Harry Reynolds Road to the west of the car park exit road. The proposed facilities are shown in the figure below.

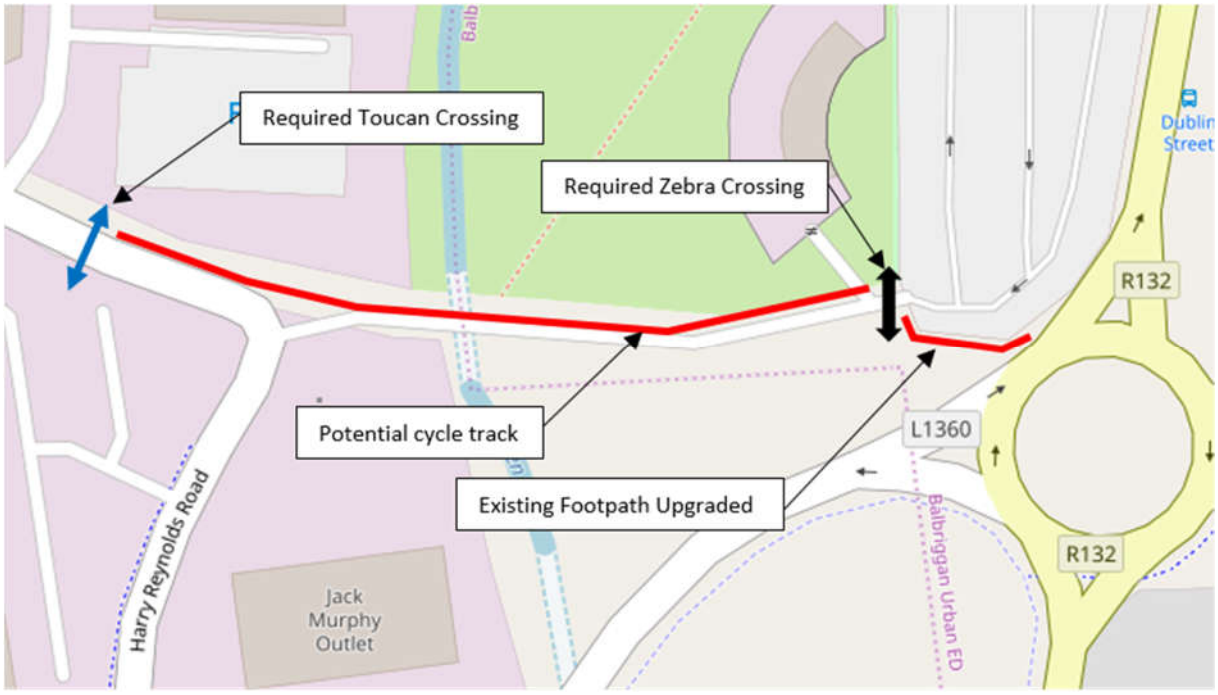


Figure 6-7 Option 2 - Two-Way Segregated Cycle Track

6.3.2.3. Option 3 - One Way Cycle Tracks Both Sides

One way cycle tracks will be provided along both sides of the car park exit road. Cycle provision will be gained by 2m wide tracks while 2m wide footpaths will also be provided to the rear of the cycle tracks. A raised zebra crossing would be provided to link the new facility to the existing footpath that runs along the perimeter wall of the existing car park. This footpath would be upgraded to include a 3m wide two-way segregated cycle track and 2m wide footpath. The existing priority junction between the car park exit road and Harry Reynolds Road would be upgraded to a new signalised junction with toucan crossings. The proposed layout is shown in the figure below.

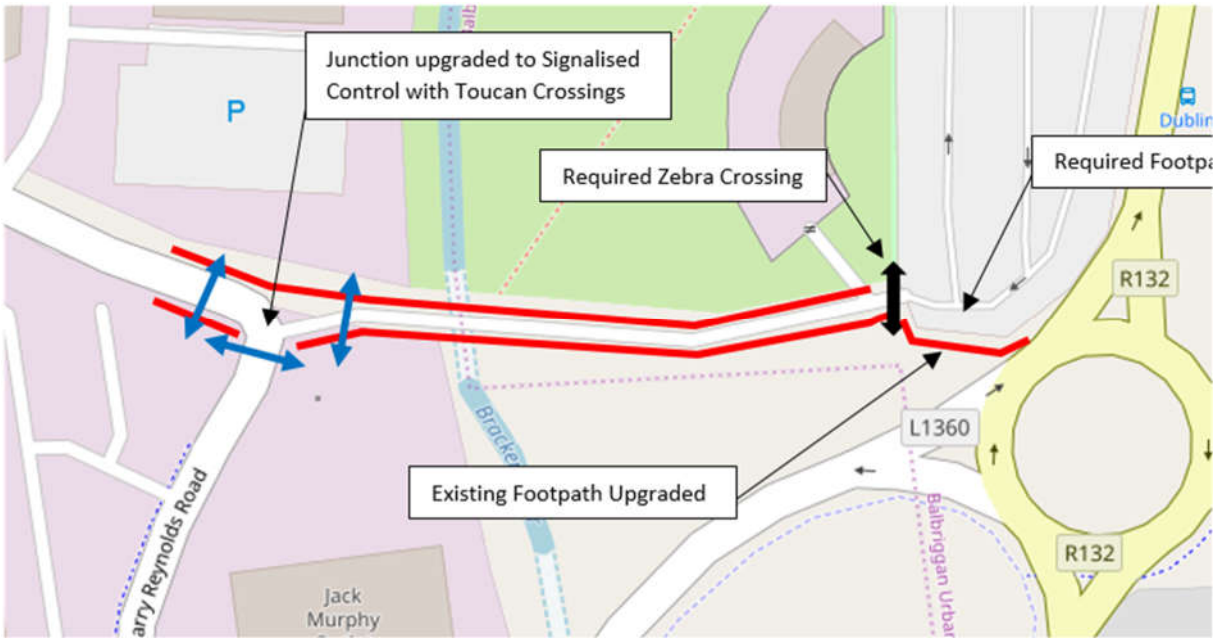


Figure 6-8 Option 3 - One Way Cycle Tracks Both Sides

6.3.2.4. Link Section 2 – MCA

The Multi Criteria Analysis and comparison between each option for Link Section 2 is summarised in the table below.

Table 6-4 Link Section 2 - MCA Comparison Matrix

Context	Criteria	Option 1	Option 2	Option 3
Design	Safety*	Provides a relatively safe environment for cyclists travelling westwards but not for cyclists travelling eastwards who have intermittent facilities and need to cross at two roundabouts. Cyclists may use existing footpath link increasing conflicts with pedestrians.	Provides a safe environment for pedestrians and cyclists with appropriate crossings. Segregated cycle way and footpath minimises conflicts between cyclists and pedestrians.	Provides a safe environment for pedestrians and cyclists with appropriate crossings. Segregated cycle way and footpath minimises conflicts between cyclists and pedestrians.
	Directness	Not a desirable route as it adds approximately 300m to the overall length of the scheme.	Provides as direct a route as possible along the section.	Provides as direct a route as possible along the section.
	Coherence	Legible along much of the route but no cycle facilities present on western side of Harry Reynolds Road.	A highly legible route which is well defined and free of obstructions.	A highly legible route which is well defined and free of obstructions.
	Attractiveness	Does not provide an enjoyable cycling experience due to additionl length and variations in level.	Provides a well-integrated cycle and pedestrian route on the obvious desire line.	Provides a well-integrated cycle and pedestrian route on the obvious desire line.
	Comfort	Slows cyclist progress due to length. Requires additional effort due to level variations.	Provides a comfortable facility, suitable for all users. Lessens overall route length.	Provides a comfortable facility, suitable for all users. Lessens overall route length.
	Level of service	Narrow cycle tracks with no segregation to footpath and lack of crossings at roundabouts means that level of service can't be achieved.	Separated cyclist and pedestrian channels of travel allows for level of service A. Conflicts between modes is minimised allowing greater service level.	One way cycle tracks and pedestrian footpaths minimise conflicts between modes allowing greater service level.
Community	Business impact	No impact to businesses.	Potential impact on Casey Doors lands under long term lease from FCC.	Potential impact on lands under ownership of Casey Doors and Jack

Context	Criteria	Option 1	Option 2	Option 3
				Murphy Outdoor Clothing.
	Residential impact	No impact to residents.	No impact to residents.	No impact to residents.
	Operational impact	Marginal impact on junctions as additional cyclists will need to cross at existing roundabouts. Facility will require routine maintenance.	Marginal impact on junctions due to inclusion of new crossing points. Facility will require routine maintenance.	Marginal impact on traffic flows due to need for new signal controlled junction between Harry Reynolds Road and car park exit. Facility will require routine maintenance.
	Environmental	No environmental impact.	Minor impact on environment with removal of some grassed area to south of Casy Doors.	Minor Impact on invironment with removal of some grassed area to south of Casy Doors and to north of Jack Murphy Outdoor Clothing .
Delivery	Capital cost	No additional costs to scheme.	3m wide cycle track and 2m wide footpath requires widening into grassed verge. Works would be carried out off carriageway with some minor kerb relocations possible.	3m wide cycle track and 2m wide footpath requires widening into grassed verge. Works would be carried out off carriageway with some minor kerb relocations possible. New signalised junction required.
	Programme risks	No risks to programme delivery.	Possible programme slips due to utilities etc. Potential conflicts with land owners to be mitigated prior to construction.	Possible programme slips due to utilities etc. Potential conflicts with land owners to be mitigated prior to construction.
Ranking		3rd	1st	2nd

6.3.2.5. Link Section 2 – Preferred Option

Option 2 is the preferred option in this location. It will provide a safe, attractive route which with a very high level of quality of service through this section. While Options 2 and 3 score similarly in many categories, Option 2 does not require a new signalised junction at Harry Reynolds Road and the car park exit road, thus reducing impacts to traffic in the area and reducing the overall cost. The figure below shows the preferred route for Link Section 2.

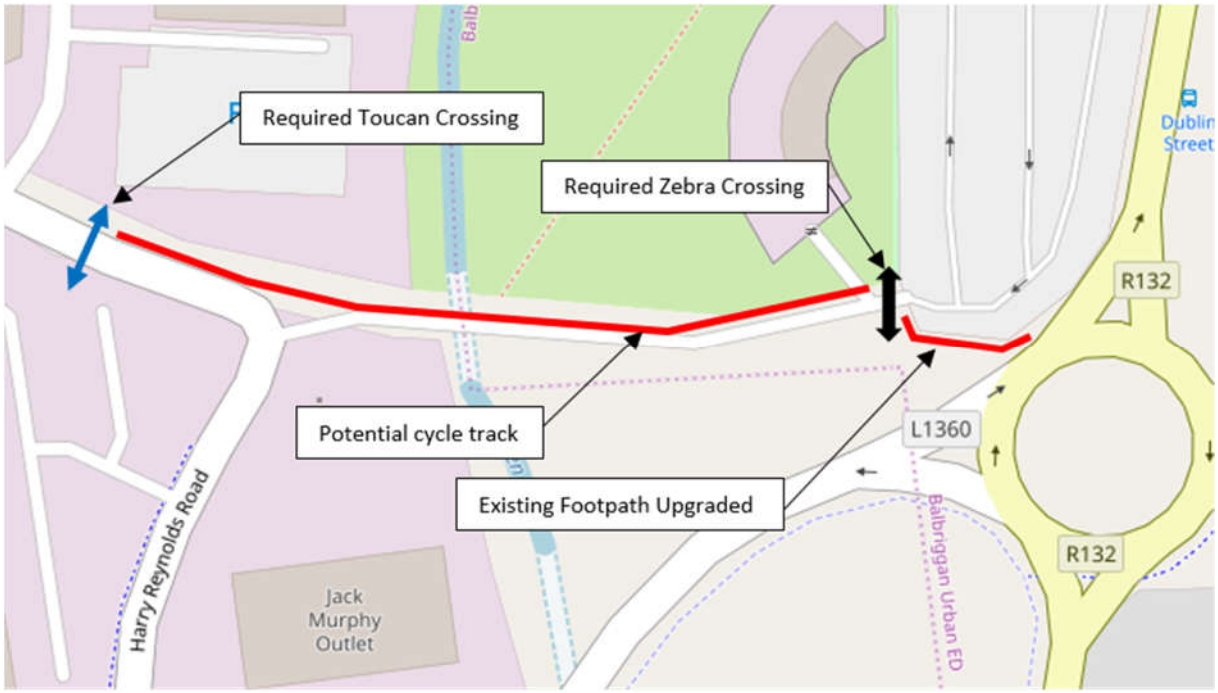


Figure 6-9 Link Section 2 - Preferred Option

6.3.3. Link Section 3

Section 3 extends along Harry Reynolds Road in a northward direction. In the southern section the route passes through Balbriggan Business Park. The single carriageway has an overall width of approximately 7.0m with footpaths running adjacent to the carriageway on either side. There is an existing cycle track along the western side of the road to the rear of on street parking. A speed limit of 60km/h applies through this part of the section.

The central section extends from the Balbriggan Business Park to the signal controlled junction at Chapel Street. The single carriageway has an overall width of approximately 9.0m. A footpath runs adjacent to the carriageway on the eastern side only. A number of access junctions to industrial and residential developments are present along the carriageway. A 60km/h speed limit also applies to this part of the section.

The northern section extends between the roundabout junction at the northern end of Harry Reynolds Road and the Chapel Street junction. There are existing one way cycle tracks on the eastern side of the carriageway extending approximately 90m from the Chapel Street junction. The single carriageway has an overall width of approximately 9.0-10.0m. Footpaths run adjacent to the carriageway on either side with a buffer provided by means of a grass verge also on both sides. The eastern verge is lined with immature trees. A number of access junctions to residential streets are present along the carriageway. This section of the scheme has a 50 kph speed limit in place. Four possible options were considered for this section and are discussed below.

6.3.3.1. Option 1 – Do Nothing

No provision would be made for cyclists aside from the existing provision at the junction of Harry Reynolds Road and Chapel Street, as highlighted in the figure below. Outside of this provision, cyclists must share the carriageway with vehicular traffic while pedestrian facilities will remain as is.

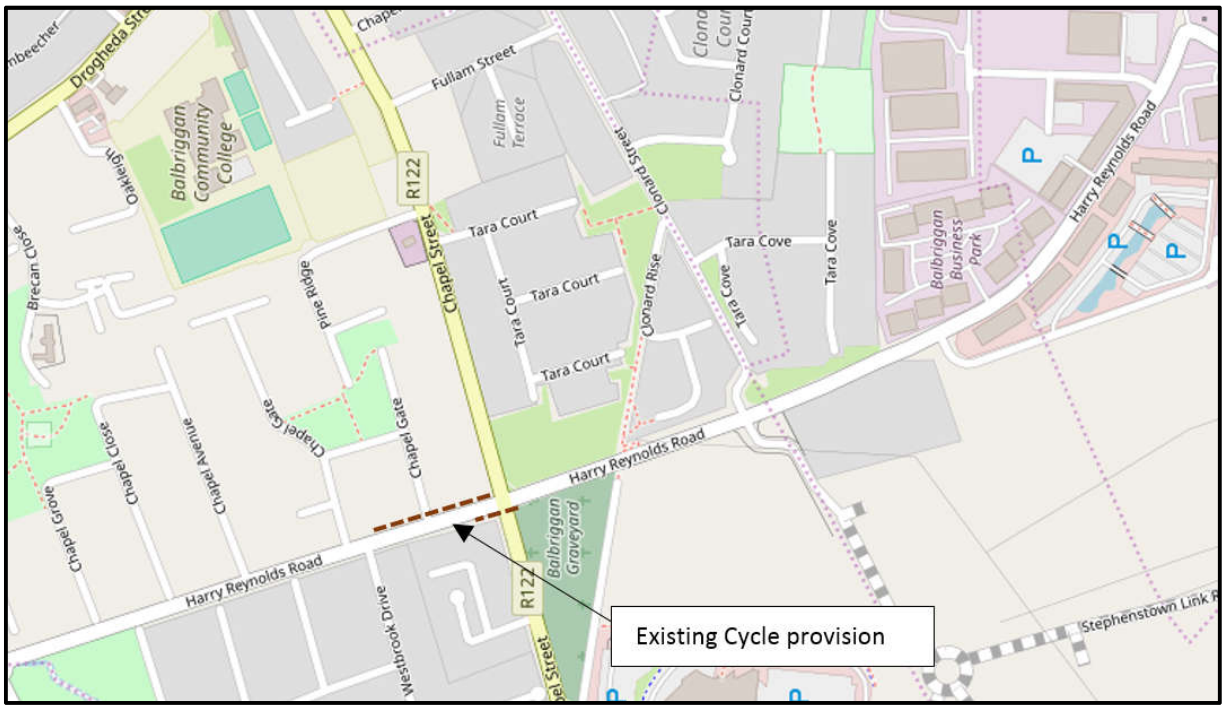


Figure 6-10 Option1 - Do Nothing

6.3.3.2. Option 2 – Two Way Segregated Cycle Track.

A two way segregated cycle track would be provided along the eastern side of Harry Reynolds Road. The eastern side of the carriageway has been selected as the bulk of the population in the area lie to the east. Cycle provision will be gained by a 3m wide track with a 2m footpath also provided to the rear of the cycle track. The existing kerbs would be relocated with new carriageway widening required on the western side of the road. Grass verges would be removed to accommodate the new facilities. Some alterations to the existing signalised junction at Chapel Street will be required to facilitate the new layout. The proposed option is shown in the figure below.

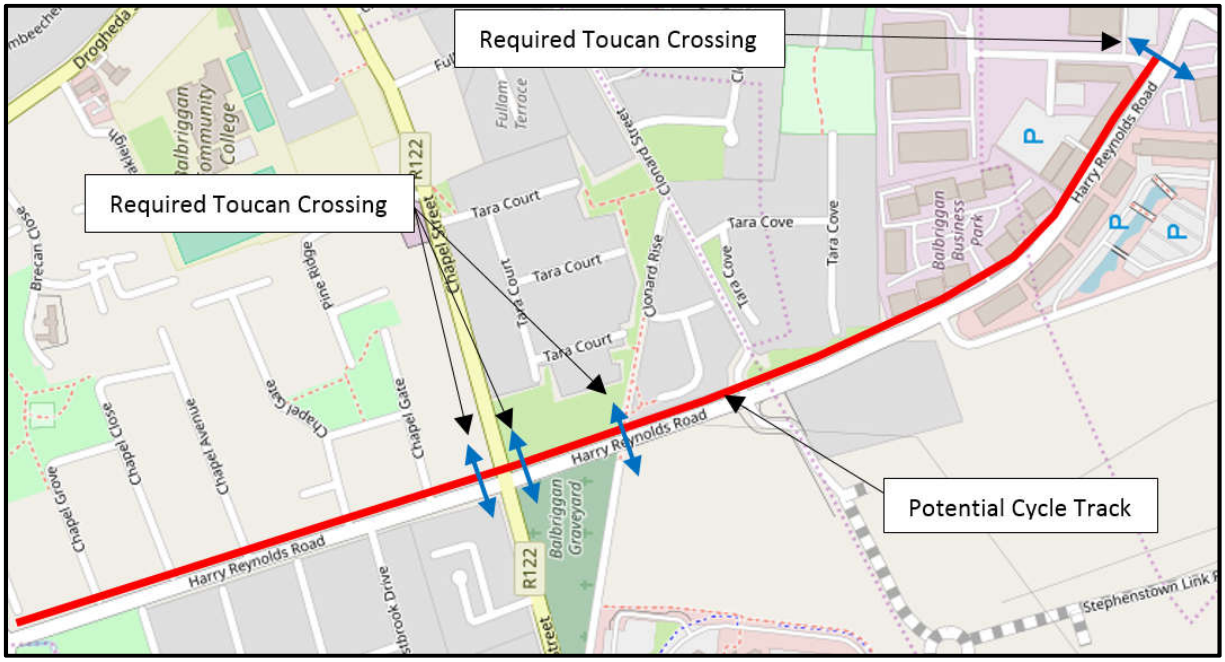


Figure 6-11 Option 2 - Two Way Segregated Cycle Track

6.3.3.3. Option 3 – One Way Cycle Tracks Both Side

One way cycle tracks would be provided along both sides of Harry Reynolds Road. Cycle provision will be gained by 2m wide raised adjacent cycle tracks with 2m wide footpaths also provided to the rear of the cycle tracks. The existing carriageway would be narrowed and kerblines relocated to accommodate the proposed cycle tracks and footpaths. Grass verges would be removed along the length of the road. The proposed cycle tracks would tie into the existing cycle facilities at the Chapel Road junction with no alterations proposed. The proposed option is shown in the figure below.

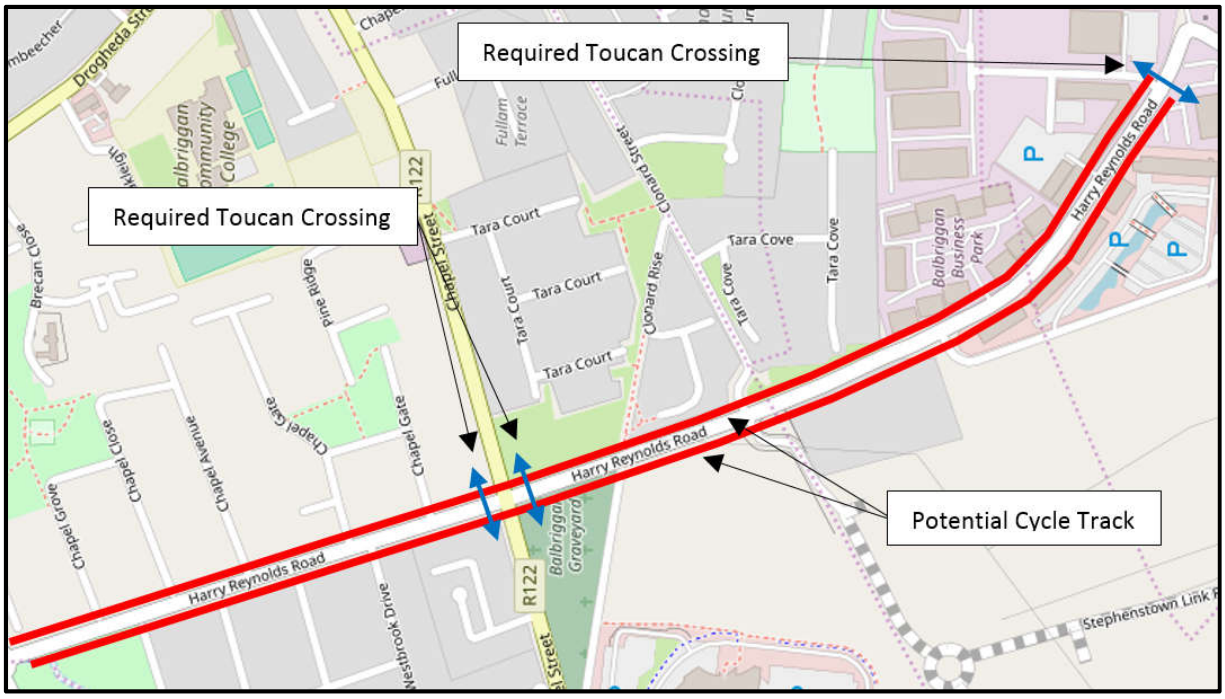


Figure 6-12 Option 3 - One Way Cycle Tracks Both Sides

6.3.3.4. Option 4 – On-Road Cycle Lanes.

On road cycle tracks would be provided along both sides of Harry Reynolds Road. Cycle provision will be gained by 2m wide lanes on carriageway. The existing carriageway will be widened to allow for the inclusion of the cycle lanes with existing kerbs relocated. Pedestrians will be catered for utilising the existing footpaths. The proposed cycle lanes and footpaths would be segregated by means of a 0.5m wide buffer. Grass verges would be removed along the length of the road. The proposed on-road cycle lanes would tie into the existing layout at the Chapel Street junctions with no alterations proposed. The proposed option is shown in the figure below.

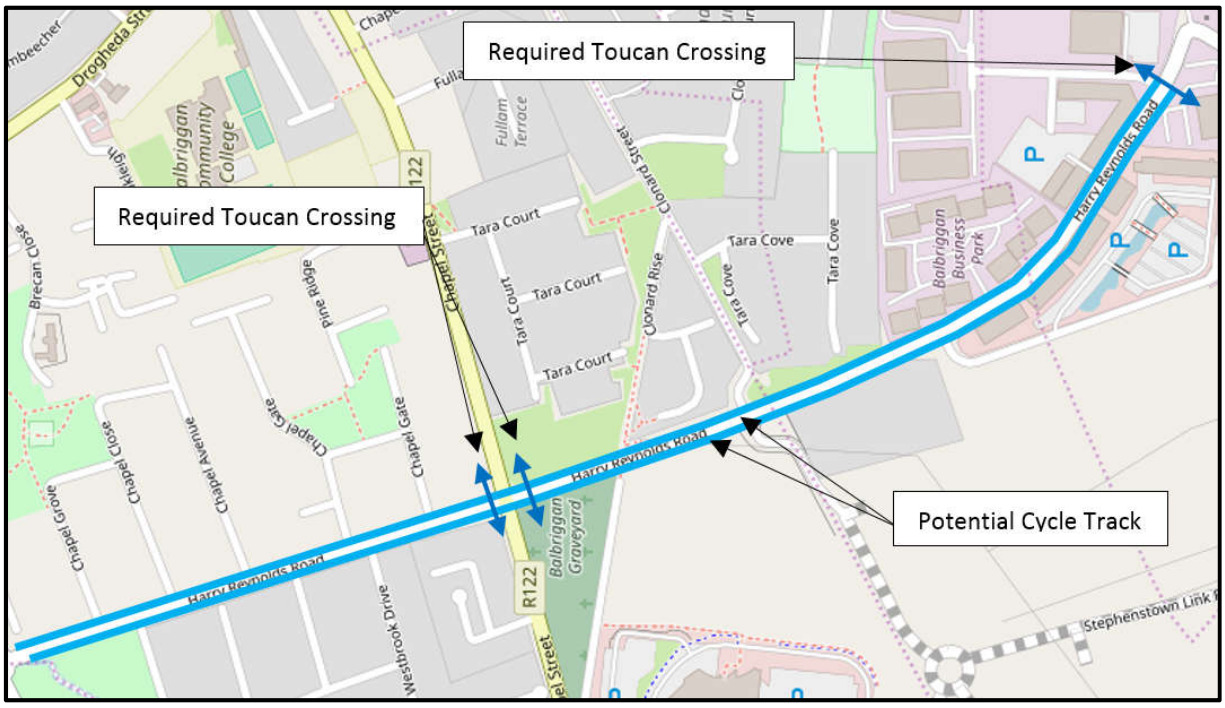


Figure 6-13 Option 3 - On Road Cycle Tracks

6.3.3.5. Link Section 3 – MCA

The Multi Criteria Analysis and comparison between each option for Link Section 3 is summarised in the table below.

Table 6-5 Link Section 3 - MCA Comparison Matrix

Context	Criteria	Option 1	Option 2	Option 3	Option 4
Design	Safety*	Does not provide a safe environment for cyclists as they must share the carriageway with vehicular traffic.	Provides a safe environment for pedestrians and cyclists. Segregated cycle way and footpath minimises conflicts between cyclists and pedestrians.	Provides a safe environment for pedestrians and cyclists. The channels of travel are well defined.	Provides a designated area for cyclists delivering improved safety but with no physical segregation.
	Directness	Does not provide opportunity to overtake as environment is shared with vehicular traffic.	Provides as direct a route as possible along the section.	Provides as direct a route as possible along the section.	Provides as direct a route as possible along the section.
	Coherence	Route does not provide continuity with the rest of the scheme.	A highly legible route which is well defined and free of obstructions.	A highly legible route which is well defined and free of obstructions.	A highly legible route but may be subject to encroachment and illegal

Context	Criteria	Option 1	Option 2	Option 3	Option 4
		There is potential for obstructions throughout.			parking by vehicles.
	Attractiveness	Option is not attractive to cyclists. Design does not contribute to the urban design.	Provision is somewhat isolated on eastern side of carriageway.	Provides a well-integrated cycle and pedestrian route serving all of the surrounding area.	Provision is not as attractive as segregated cycle tracks.
	Comfort	No provision of cyclist own space cyclist may feel uncomfortable interacting with vehicles.	Provides a comfortable facility, suitable for all users. Cyclist progression may be reduced due to necessity of crossing points.	Provides a comfortable facility, suitable for all users. Cyclist progression is maintained throughout the section with minimal crossing points.	Sharing the carriageway with vehicles is less comfortable for many cyclists. Surface is subject to greater levels of damage as it is shared with vehicles.
	Level of service	No level of service provided.	Separated cyclist and pedestrian channels of travel allows for level of service A. Conflicts between modes is minimised allowing greater service level.	One way cycle tracks and pedestrian footpaths allow conflicts between modes is minimised. Raised adjacent tracks allowing greater service level as they provide segregation and avoid delays.	On road cycle tracks provide a good level of service but may be subject to delays etc due to vehicles in the cycle lane.
Community	Business impact	No impact on businesses	Minor impact to businesses in general through the Business Park area only.	Minor impact to businesses in general through the Business Park area only	Minor impact to businesses in general through the Business Park area only
	Residential impact	No residential impact.	No residential impacts.	No residential impacts.	No residential impacts.
	Operational impact	Some very minor operational impacts possible due to presence of increased cyclists on road with from adjacent new facilities.	Some operational impacts due to need to alter existing junction at Chapel Street.	Minor operational impacts possible due to narrowing of carriageway but no alterations to Chapel Street junction required.	Minor operational impacts possible due to narrowing of carriageway but no alterations to Chapel Street junction required.

Context	Criteria	Option 1	Option 2	Option 3	Option 4
	Environmental	No impact to environment.	Upgrades to facility will have marginal impact on surrounding environment during construction and some existing trees will be removed.	Upgrades to facility will have marginal impact on surrounding environment during construction and some existing trees will be removed.	Upgrades to facility will have marginal impact on surrounding environment during construction and some existing trees will be removed..
Delivery	Capital cost	No additional costs to scheme.	Significant cost implications to widening of carriageway on western side with possibility of utility diversions etc.	Costs associated with kerb relocation and construction of new cycle tracks/footpaths. No carriageway widening required.	Significant cost implications to widening of carriageway on both sides with possibility of utility diversions etc.
	Programme risks	No risks to programme delivery.	Programme could suffer due to additional difficulties because of widening. Potential conflicts with utilities.	Minor risk to programme as a result of unknown services etc but minimised due to raised adjacent construction.	Programme could suffer due to additional difficulties because of widening. Potential conflicts with utilities..
Ranking		4th	2nd	1st	3rd

6.3.3.6. Link Section 3 – Preferred Option

Option 3 is the preferred option in this location. The provision of new raised adjacent cycle tracks on both sides along the entire section will provide a safe, attractive and accessible route for all road users. It will have minimal impact on the surrounding businesses and has no impact on any residences while providing a high quality of service. It is also advantageous from a delivery point of view as capital costs and risks are minimised in comparison to other options.

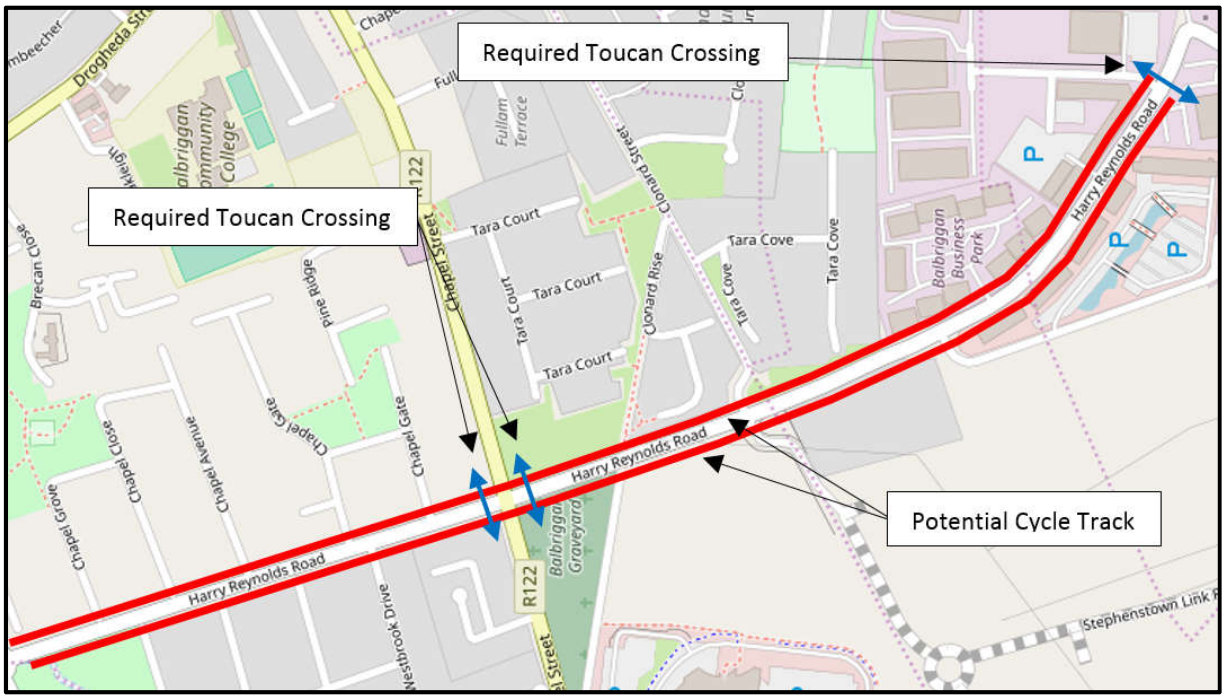


Figure 6-14 Link Section 3 - Preferred Option

6.3.4. Link Section 4

Section 4 extends from the junction between Harry Reynolds Road and Drogheda Street (R132) in a south-westerly direction to the roundabout junction where Harry Reynolds Road turns southward. The single carriageway has an overall width of approximately 6.5m. Footpaths run adjacent to the carriageway on either side with a buffer provided by means of a grass verge. The southern verge is generally lined with immature trees. This section of the scheme has a posted speed limit of 50 kph. Four possible options were considered for this section and are discussed below.

6.3.4.1. Option 1 – Do Nothing

No provision would be made for cyclists aside from the existing provision at the junction of Harry Reynolds Road and Drogheda Street, as shown in the figure below. Outside of this provision cyclist must share the carriageway with vehicular traffic. Pedestrians provision would remain as is.

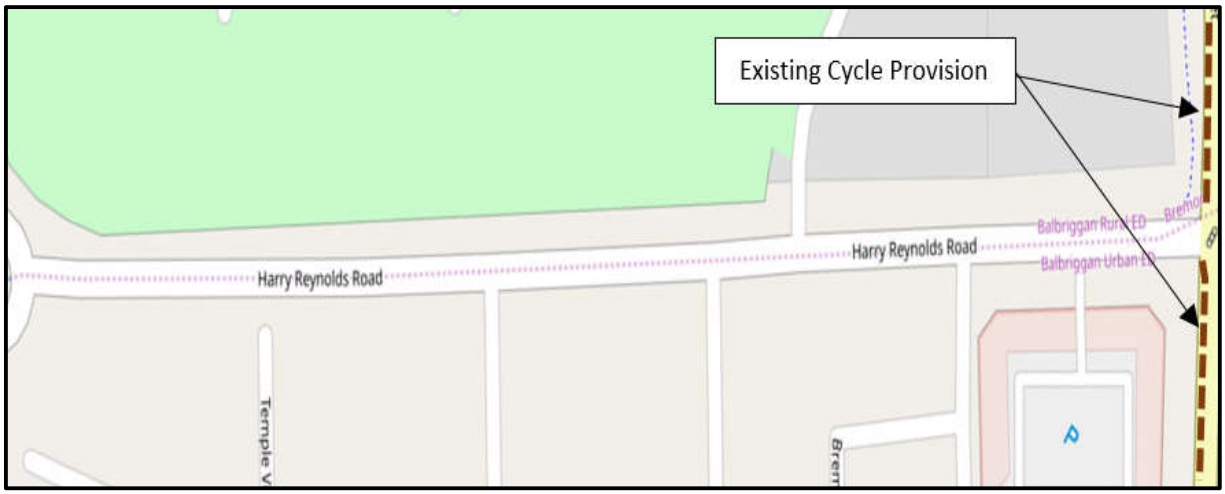


Figure 6-15 Option 1 - Do Nothing

6.3.4.2. Option 2 – Two Way Segregated Cycle Track

A two way segregated cycle track would be provided along the northern side of Harry Reynolds Road. The northern side of the carriageway has been selected to provide the facility as there are fewer access points resulting in a less interruptions for cyclists. Cycle provision would be a 3m wide track with a 2m footpath also be provided to the rear of the cycle track. The proposed facilities would be constructed without relocating any kerbs where possible resulting in the removal of the existing grass verge on the northern side of the road. The existing junction between Harry Reynolds Road and Dublin Road could be upgraded with the existing two-way cycle track tying into the proposed new one. The proposed option is shown in the figure below.

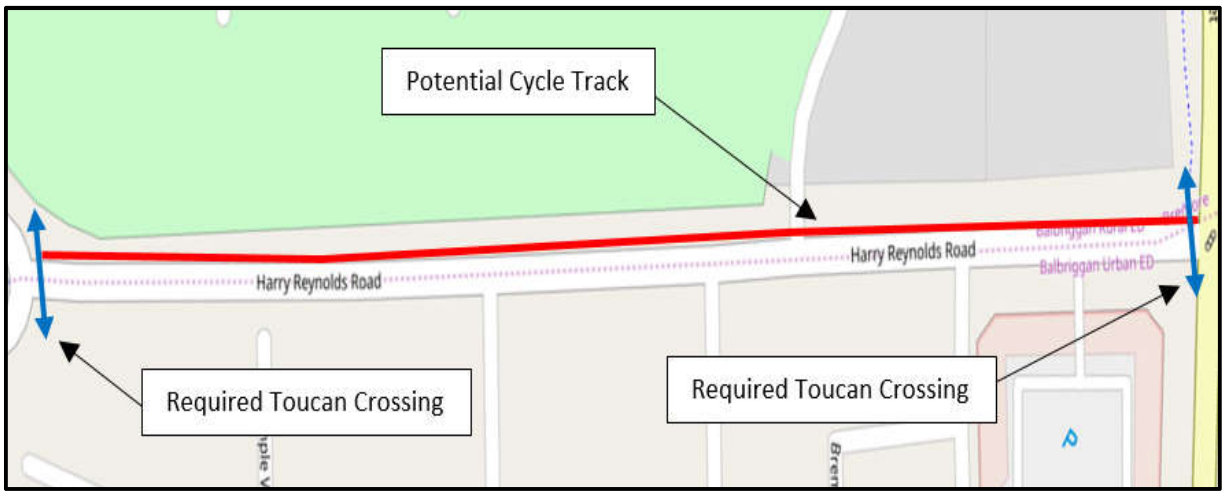


Figure 6-16 Option 2 - Two Way Segregated Cycle Track

6.3.4.3. Option 3 – One Way Cycle Tracks Both Sides

One way cycle tracks would be provided along both sides of Harry Reynolds Road. Cycle provision would be 2m wide raised adjacent cycle tracks with 2m wide footpaths also provided to the rear of the cycle tracks. The existing kerbs would be kept in place where possible with the facilities constructed over the existing grass verge and footpaths on both sides. However, some areas may require narrowing of the existing carriageway and associated kerb relocation. The existing junction between Harry Reynolds Road and Dublin Road could be upgraded with the existing two-way cycle track tying into the proposed new cycle tracks on both sides. The proposed option is shown in the figure below.

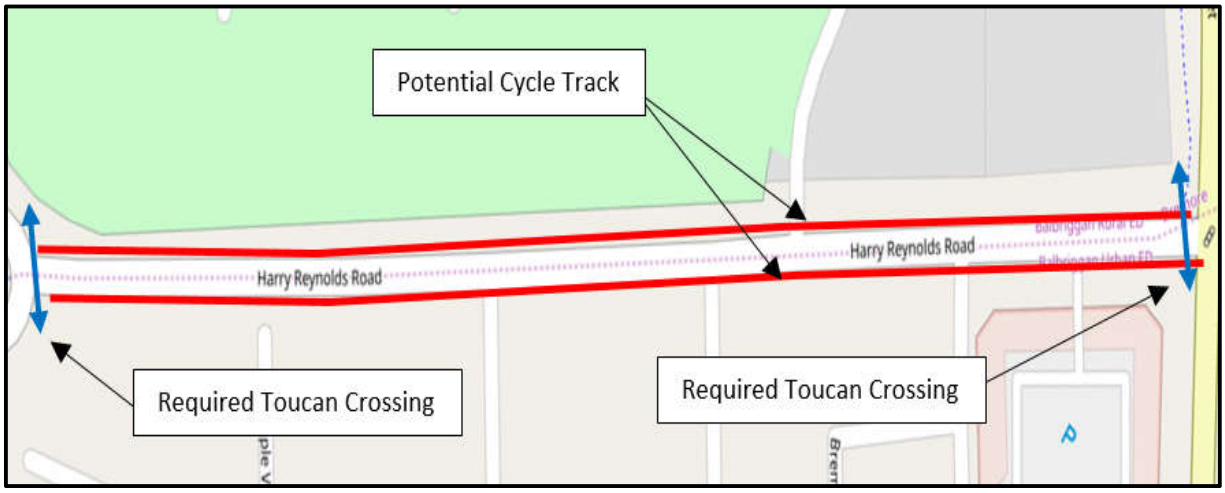


Figure 6-17 Option 3 - One Way Cycle Tracks Both Sides

6.3.4.4. Option 4 – On Road Cycle Lanes.

On road cycle tracks would be provided along both sides of Harry Reynolds Road. The existing carriageway would be widened to allow for the inclusion of 2m wide cycle lanes. This widening will be catered for by utilising the green area to the north of the carriageway Pedestrians will be catered for utilising the existing footpaths. The cycle lanes and footpaths will be segregated by means of a minimum 0.5m buffer. The existing junction between Harry Reynolds Road and Dublin Road could be upgraded with the existing two-way cycle track tying into the proposed new cycle lanes which would be required to ramp up to the same level. The proposed option is shown in the figure below.

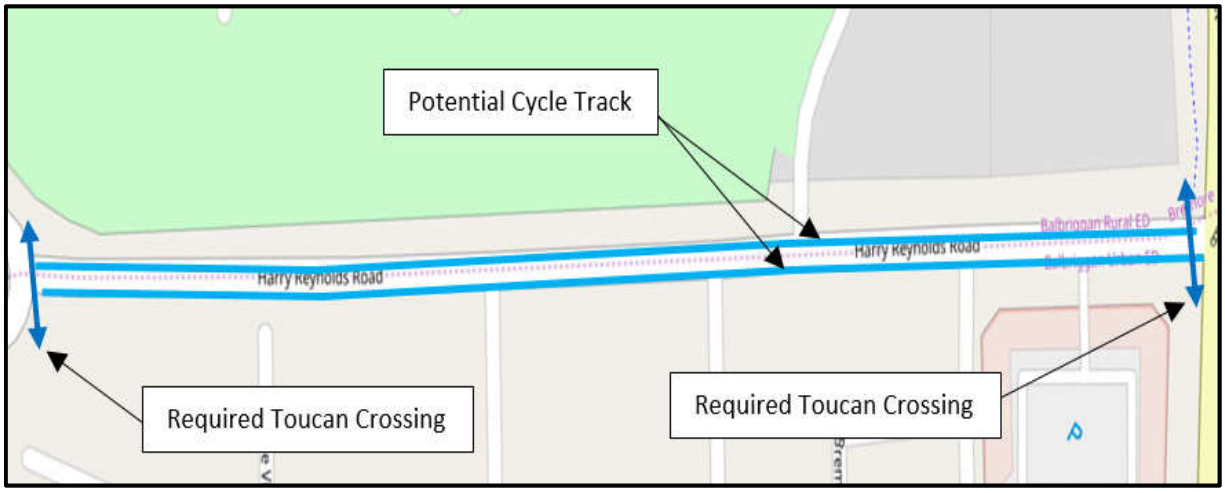


Figure 6-18 Option 4 - On Road Cycle Lanes

6.3.4.5. Link Section 4 – MCA

The Multi Criteria Analysis and comparison between each option for Link Section 4 is summarised in the table below.

Table 6-6 Link Section 4 - MCA Comparison Matrix

Context	Criteria	Option 1	Option 2	Option 3	Option 4
Design	Safety*	Does not provide a safe environment for cyclists as they must share the carriageway with vehicular traffic.	Provides a safe environment for pedestrians and cyclists. Segregated cycle way and footpath minimises conflicts between cyclists and pedestrians.	Provides a safe environment for pedestrians and cyclists. The channels of travel are well defined.	Provides a designated area for cyclists delivering improved safety but with no physical segregation.
	Directness	Does not provide opportunity to overtake as environment is shared with vehicular traffic.	Provides as direct a route as possible along the section.	Provides as direct a route as possible along the section.	Provides as direct a route as possible along the section.
	Coherence	Route does not provide continuity with the rest of the scheme. There is potential for obstructions throughout.	A highly legible route which is well defined and free of obstructions.	A highly legible route which is well defined and free of obstructions.	A highly legible route but may be subject to encroachment and illegal parking by vehicles.
	Attractiveness	Option is not attractive to cyclists. Design does not contribute to the urban design.	Provision is somewhat isolated on northern side of carriageway.	Provides a well-integrated cycle and pedestrian route.	Provision is not as attractive as segregated cycle tracks.
	Comfort	No provision of cyclist own space. Cyclist may feel uncomfortable interacting with vehicles.	Provides a comfortable facility, suitable for all users. Cyclist progression may be reduced due to necessity of crossing points.	Provides a comfortable facility, suitable for all users. Cyclist progression is maintained throughout the section with minimal crossing points.	Sharing the carriageway with vehicles is less comfortable for many cyclists. Surface is subject to greater levels of damage as it is shared with vehicles.
	Level of service	Level of service is poor.	Separated cyclist and pedestrian channels of travel allows for level of service A.	One way cycle tracks and pedestrian footpaths allow conflicts between modes is minimised.	On road cycle tracks provide a good level of service but may be subject to delays etc due to vehicles in the cycle lane.

Context	Criteria	Option 1	Option 2	Option 3	Option 4
			Conflicts between modes is minimised allowing greater service level.	Raised adjacent tracks allowing greater service level as they provide segregation and avoid delays..	
Community	Business impact	No business impacts.	No business impacts.	No business impacts.	No business impacts.
	Residential impact	No residential impact.	No residential impact.	No residential impact.	No residential impact.
	Operational impact	Some very minor operational impacts possible due to presence of increased cyclists on road with from adjacent new facilities.	Marginal impact on junctions due to inclusion of new crossing points. Facility will require routine maintenance.	Marginal impact on junctions due to inclusion of new crossing points. Facility will require routine maintenance.	Marginal impact on junctions due to inclusion of new crossing points. Facility will require routine maintenance.
	Environmental	No impact to environment.	Facility will have some impact on surrounding environment during construction. Existing footpaths requires reconfiguring to allow for two way cycle track by widening into verge on northern side of carriageway.	Facility will have some impact on surrounding environment during construction. Existing footpaths requires reconfiguring to allow for one way cycle tracks with removal of grass verges required.	Facility will have some impact on surrounding environment during construction. Existing footpaths requires reconfiguring to allow for one way cycle tracks with removal of grass verges required.
Delivery	Capital cost	No additional costs to scheme.	Costs associated with kerb relocation and construction of new cycle tracks/footpaths. No carriageway widening required.	Costs associated with kerb relocation and construction of new cycle tracks/footpaths. No carriageway widening required.	Significant cost implications to widening of carriageway on both sides with possibility of utility diversions etc.
	Programme risks	No risks to programme delivery.	Minor risk to programme as a result of unknown services etc but minimised due to construction in verge.	Minor risk to programme as a result of unknown services etc but minimised due to raised adjacent construction	Programme could suffer due to additional difficulties because of widening.

Context	Criteria	Option 1	Option 2	Option 3	Option 4
					Potential conflicts with utilities.
Ranking		4th	2nd	1st	3rd

6.3.4.6. Link Section 4 – Preferred Option

Option 3 is the preferred option in this location. The provision of new raised adjacent cycle tracks on both sides along the entire section will provide a safe, attractive and accessible route for all road users. It will have no impact on the surrounding businesses and has no impact on any residences while providing a high quality of service. It allows greater access to both sides of the road than Option 2 and reduces the need for crossing points etc. The preferred option is shown below.

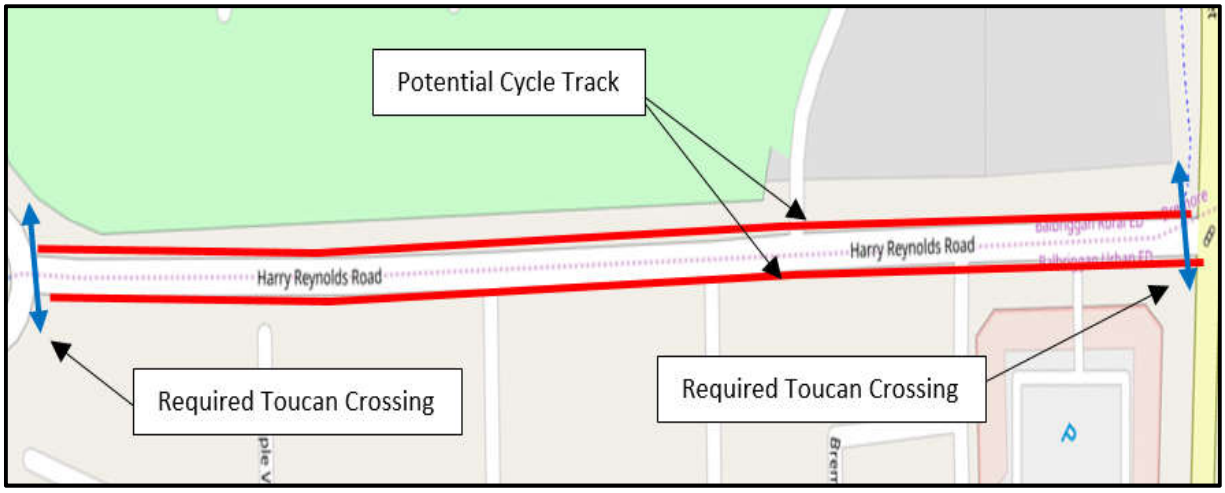


Figure 6-19 Link Section 4 - Preferred Option

6.3.5. Link Section 5

Section 5 extends from the three arm roundabout on Harry Reynolds Road along Moylaragh Road to the signal controlled junction on the Castlemill Link Road. This section also includes the park lands to the north of Moylaragh Road.

The link road between the Harry Reynolds Road roundabout and the roundabout at Moylaragh Road has an overall width of approximately 8m. On street parking is provided on the southern side of the carriageway. Footpaths and cycle lanes run adjacent to the carriageway on both sides. A buffer between the footpath and the carriageway is provided through a grass verge. This section of the scheme was a 50 kph speed limit in place.

Moylaragh Road has an overall width of approximately 6.5-7.0m. A footpath runs adjacent to the carriageway on the southern side which is separated from the carriageway by means of a grass verge. The verge is lined with immature trees. There are residences fronting directly onto this road on the southern side along the majority of its length with driveways access across the footpath.

The park land to the north of the road has immature trees planted throughout. A shared path passes through the centre of the park with links to Chieftain's Drive.

Four options were considered for this section and are discussed below.

6.3.5.1. Option 1 – Do Nothing.

No provision would be made for cyclists aside from the short sections of existing one-way cycle provision on either side of Moylaragh Road, as indicated in the figure below. Outside of this provision cyclist must share the carriageway with vehicular traffic. Pedestrians would continue to use the existing facilities.

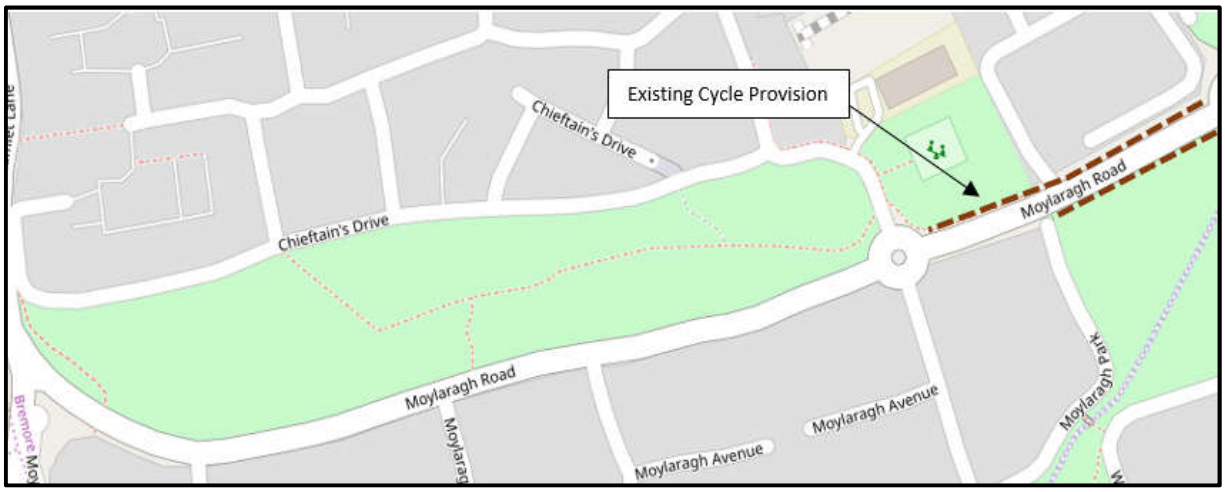


Figure 6-20 Option 1 - Do Nothing

6.3.5.2. Option 2 – Cycle Tracks Both Sides with Two Way Segregated Cycle Track Through Park

A two-way segregated cycle track will be provided through the park lands, north of Moylaragh Road. Links from Moylaragh Road will allow pedestrians and cyclist to gain access to the facility. The exact location of this cycle route would be determined during preliminary design in consultation with Fingal County Council's Parks Department. The two-way cycle track would be 3m wide through the park with the existing footpath through the park maintained for pedestrians. The existing one-way cycle tracks on both sides of Moylaragh Road would be upgraded to 2m wide raised adjacent with 2m wide footpaths between Harry Reynolds Road and Chieftain's Drive. The existing roundabout at Chieftain's Drive would be upgraded to a cycle friendly one. The proposed option is shown in the figure below.

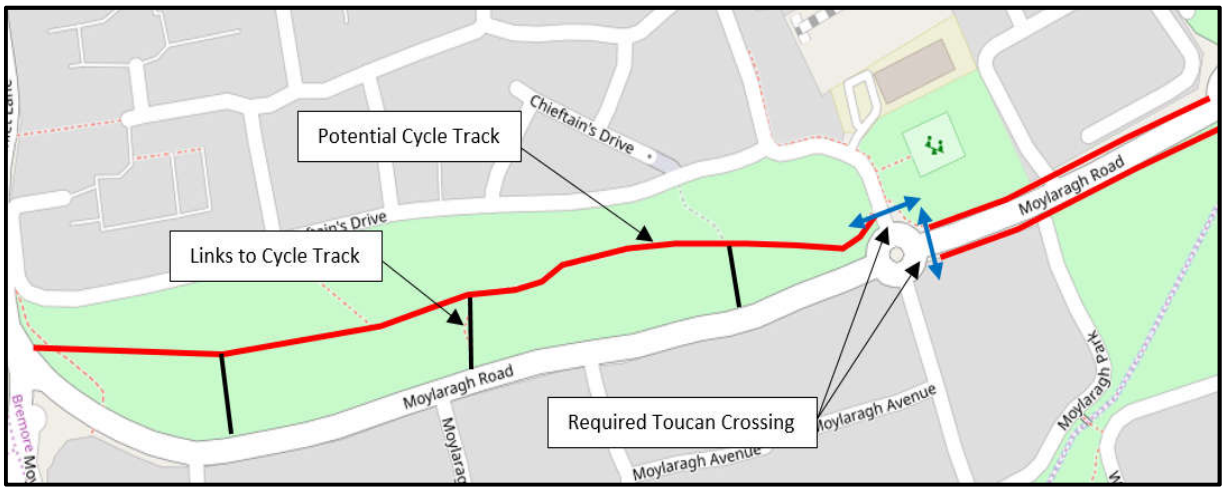


Figure 6-21 Option 2 - Two-Way Segregated Cycle Track

6.3.5.3. Option 3 – One Way Cycle Tracks Both Sides Along Moylaragh Road

This option includes 2m wide raised adjacent cycle tracks being provided along both sides of Moylaragh Road between Harry Reynolds Road and the signalised junction at Castlemill Link Road. The existing footpath on the southern side of the road would be widened to 2m with the raised adjacent cycle tracks constructed generally in the existing grass verge. This option would require relocation of the kerb to the southern side of Moylaragh Road and possible widening of the carriageway to maintain acceptable widths for vehicular traffic. The existing roundabout at Chieftain's Drive would be upgraded to a cycle friendly roundabout while the proposed cycle tracks would tie into the existing facilities at the Castemill Link Road. This option is shown in the figure below.

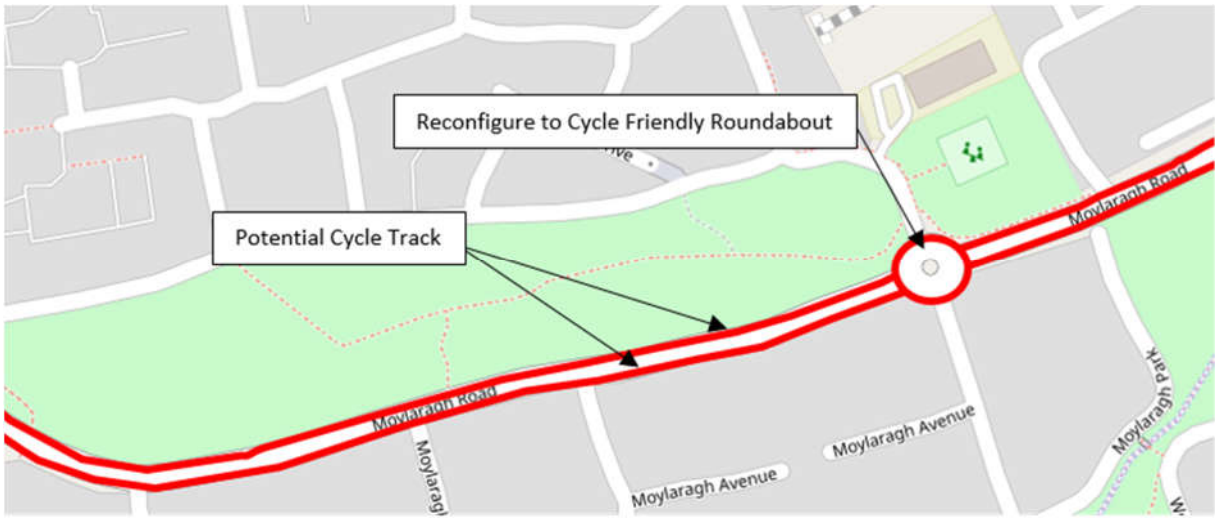


Figure 6-22 Option 3 - One Way Cycle Tracks Both Sides on Moylaragh Road

6.3.5.4. Option 4 – Two Way Cycle Track With Shared Street on Chieftain's Drive and Permeability Links in Moylaragh

This option would designate Chieftain's Drive as a shared street, given the character of the road with low speeds and volumes. Designation of the shared space could be achieved with the use of minimal road markings and signage.

Within Moylargah new permeability links would be provided to connect them to the new cycle provisions along the CastleMill Link Road.

The existing roundabout at Chieftain's Drive would be upgraded with a new zebra crossing on the northern arm to allow access to/from the two-way cycle track. A new shared cycle and pedestrian link would be provided between Chieftain's Drive and Castelmilll Link Road. A 3m wide two way segregated cycle track and 2m wide footpath would be provided on the northern side of Moylaragh Road between Harry Reynolds Road and

Chieftain's Drive. This would require removal of the existing grass verge and possible relocation of the existing kerbline to narrow the carriageway width. This option is shown below.

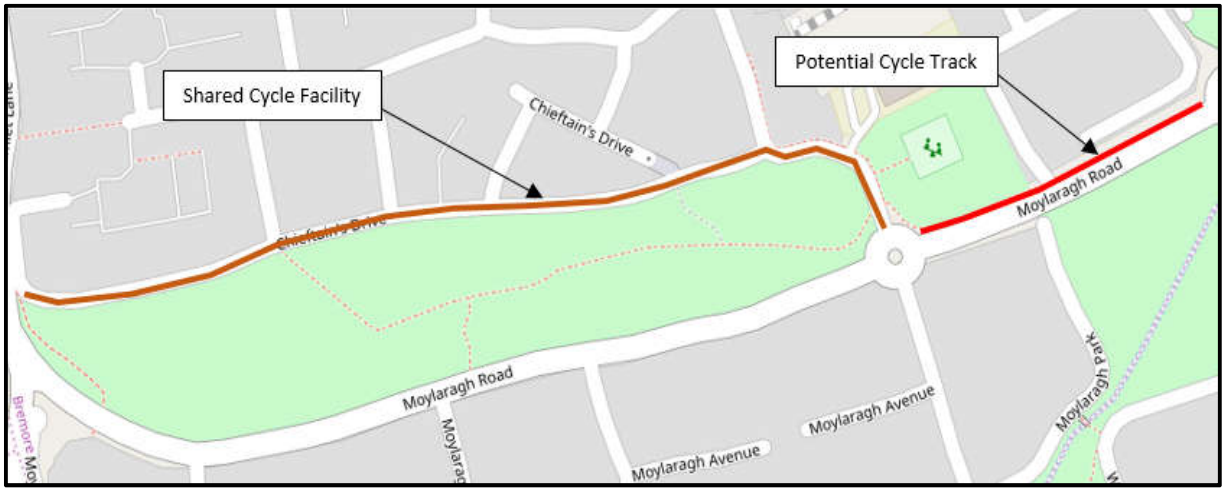


Figure 6-23 Option 4 - Two Way Cycle Track With Shared Street on Chieftain's Drive

6.3.5.5. Option 5 – Two Way Segregated Cycle Track Throughout Section

This option is similar to Option 2 and Option 4 with a 3m wide two-way segregated cycle tracks and 2m footpath provided on the northern side of Moylaragh Road between Harry Reynold's Road and Chieftain's Drive. This would require removal of the existing grass verge and possible relocation of the existing kerbline to narrow the carriageway width. The option then continues on to a new two-way cycle track through the park lands between Moylaragh Road and Chieftain's Drive. As in Option 2, links from Moylaragh Road and Chieftain's Road to this cycle track would be provided where possible. A new zebra crossing would be provided on the northern arm only of the roundabout at Chieftain's Drive to allow safe crossing for cyclists and pedestrians. The proposed option is shown below.

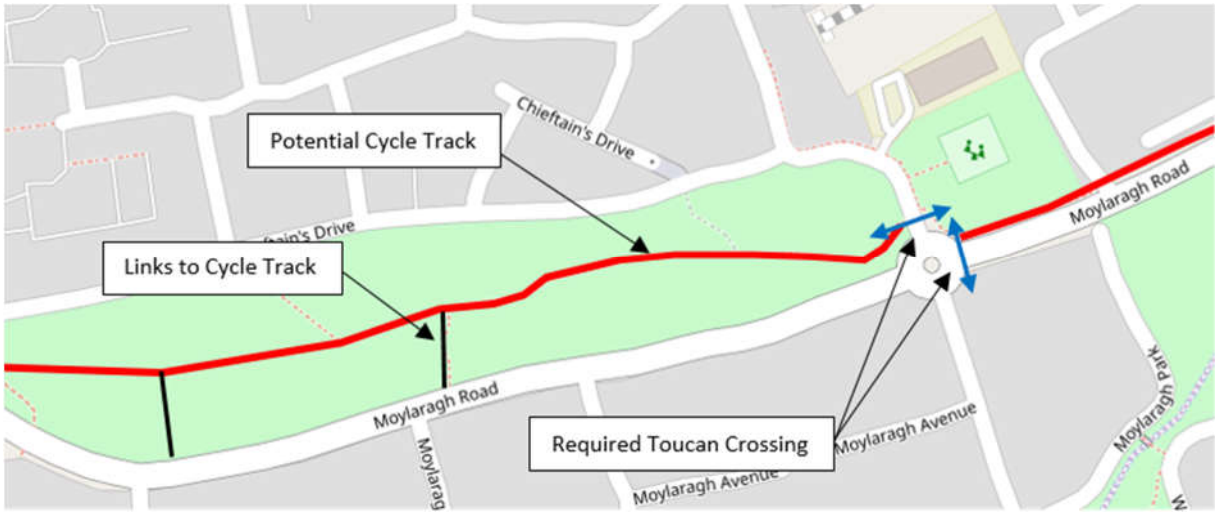


Figure 6-24 Option 5- Two Way Segregated Cycle Track Throughout

6.3.5.6. Link Section 5 – MCA

The Multi Criteria Analysis and comparison between each option for Link Section 4 is summarised in the table below.

Table 6-7 Link Section 5 - MCA Comparison Matrix

Context	Criteria	Option 1	Option 2	Option 3	Option 4	Option 5
Design	Safety*	Does not provide a safe environment for cyclists as they must share the carriageway with vehicular traffic.	Provides a safe environment for pedestrians and cyclists. The channels of travel are well defined.	Provides a safe environment for pedestrians and cyclists. The channels of travel are well defined.	Provides a designated area for cyclists but also uses a shared street which may reduce safety slightly as users must share space with slow moving vehicles.	Provides a safe environment for pedestrians and cyclists. Segregated cycle way and footpath minimises conflicts between cyclists and pedestrians
	Directness	Does not provide opportunity to overtake as environment is shared with vehicular traffic.	Provides as direct a route as possible along the section. Although the connection to the residential areas on the north and south are not direct.	Provides as direct a route as possible along the section.	Provides as direct a route as possible along the section.	Provides as direct a route as possible along the section. Although the connection to the residential areas on the north and south are not direct..
	Coherence	Route does not provide continuity with the rest of the scheme. There is potential for obstructions throughout.	A highly legible route which is well defined. Removal of parking on southern side of Moylaragh Road may result in illegal parking blocking the cycle track.	A highly legible route which is well defined. Removal of parking on southern side of Moylaragh Road may result in illegal parking blocking the cycle track along with possibility of parking outside of residences doing the same.	Route is well defined and clear of obstructions throughout	Route is well defined and clear of obstructions throughout.

Context	Criteria	Option 1	Option 2	Option 3	Option 4	Option 5
	Attractiveness	Option is not attractive to cyclists. Design does not contribute to the urban design.	Route is attractive as it is direct and integrates with the existing layout.	Route is attractive as it is direct and integrates with the existing layout..	Route is attractive as it is direct and integrates with the existing layout..	Route is generally attractive as it is direct but is isolated to the northern side for a short section.
	Comfort	No provision of cyclist own space cyclist may feel uncomfortable interacting with vehicles.	Provides a comfortable facility, suitable for all users. Cyclist progression may be reduced due to necessity of additional crossing points.	Provides a comfortable facility, suitable for all users. Cyclist progression may be reduced due to necessity of additional crossing points.	Provides a comfortable facility, suitable for all users. Cyclist progression is maintained throughout the section with minimal crossing points.	Provides a comfortable facility, suitable for all users. Cyclist progression is maintained throughout the section with minimal crossing points,
	Level of service	Level of service is poor.	Separated cyclist and pedestrian channels of travel allows for level of service A. Conflicts between modes is minimised allowing greater service level.	One way cycle tracks and pedestrian footpaths allow conflicts between modes is minimised. Raised adjacent tracks allowing greater service level as they provide segregation and avoid delays.	Generally provides a high quality of service but is reduced slightly by need to share space with vehicles.	Separated cyclist and pedestrian channels of travel allows for level of service A. Conflicts between modes is minimised allowing greater service level.
Community	Business impact	No business impacts.	No business impacts.	No business impacts.	No business impacts.	No business impacts.
	Residential impact	No residential impact.	Some impact on residents as parking is removed.	Raised adjacent cycle tracks on southern side of Moylaragh Road directly impact	No residential impact.	No residential impact.

Context	Criteria	Option 1	Option 2	Option 3	Option 4	Option 5
				accesses for numerous residences.		
	Operational impact	Some very minor operational impacts possible due to presence of increased cyclists on road with from adjacent new facilities.	Some impact on existing roundabout as it is converted into a full cycle friendly roundabout.	Some impact on existing roundabout as it is converted into a full cycle friendly roundabout	Very minor impact on roundout where new zebra crossing provided.	Very minor impact on roundout where new zebra crossing provided.
	Environmental	No impact to environment.	Construction will require removal of grass verges and will impact on the existing park.	Construction will require removal of grass verges and will impact on the existing park.	Construction will require removal of existing grass verge only.	Construction will require removal of grass verges and will impact on the existing park.
Delivery	Capital cost	No additional costs to scheme.	Costs associated with relocation of kerblines on both sides of Moylaragh Road for short section. Cycle track through park minimises costs in that location.	Significant costs associated with relocation of kerblines and possible carriageway widening along Moylaragh Road.	Construction of two-way cycle track and footpath along Moylaragh Road minimises need for kerb relocation. Use of shared street requires little capital cost.	Construction of two-way cycle track and footpath along Moylaragh Road minimises need for kerb relocation. Cycle track through park minimises costs in that location.
	Programme risks	No risks to programme delivery.	Possible risk of encountering unforeseen utilities in park land.	Construction across residential driveways could cause programme delays. Possibility of encountering utilities with carriageway widening.	Minor risks to programme with construction in existing footpath and verge.	Possible risk of encountering unforeseen utilities in park land.
Ranking		5th	3rd	4th	1st	2st

6.3.5.7. Preferred Option – Two Way Cycle Track With Shared Street on Chieftain's Drive and Permeability Links in Moylaragh

Option 4 is the preferred option for this section of the scheme.

This option would designate Chieftain's Drive as a shared street, given the character of the road with low speeds and volumes. Designation of the shared space could be achieved with the use of minimal road markings and signage.

With Moylargah new permeability links would be provided to connect them to the new cycle provisions along the CastleMill Link Road.

The existing roundabout at Chieftain's Drive would be upgraded with a new zebra crossing on the northern arm to allow access to/from the two-way cycle track. A new shared cycle and pedestrian link would be provided between Chieftain's Drive and Castelmilll Link Road. A 3m wide two way segregated cycle track and 2m wide footpath would be provided on the northern side of Moylaragh Road between Harry Reynolds Road and Chieftain's Drive. This would require removal of the existing grass verge and possible relocation of the existing kerbline to narrow the carriageway width. This option is shown below.

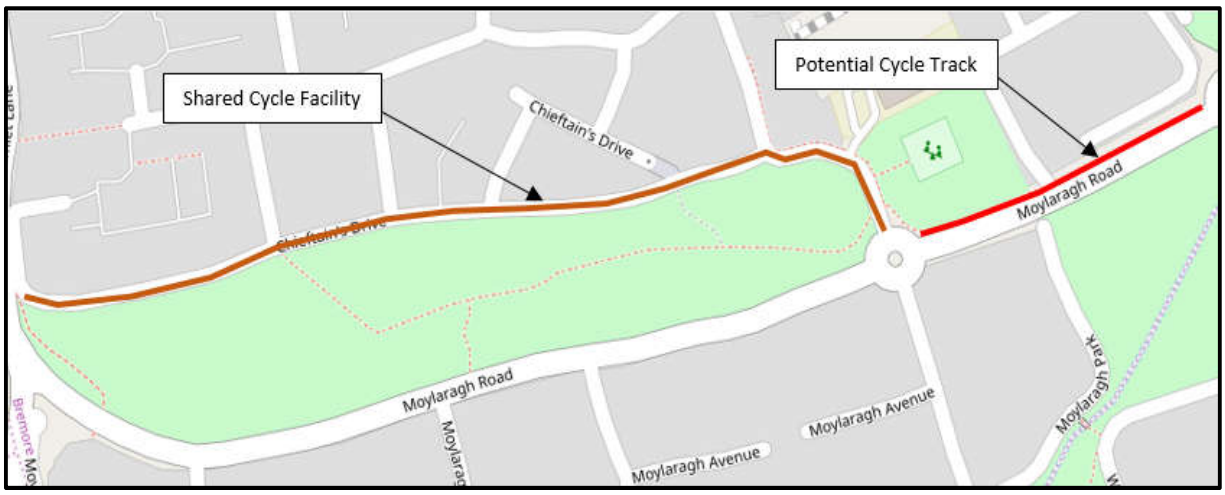


Figure 6-25 Preferred Option Option 4 - Two Way Cycle Track With Shared Street on Chieftain's Drive

6.4. Junction Assessments

Junction assessments were carried out on the two junctions highlighted in the figure below. In their current configuration both junctions operate as roundabouts and they are described in detail in the following sections.

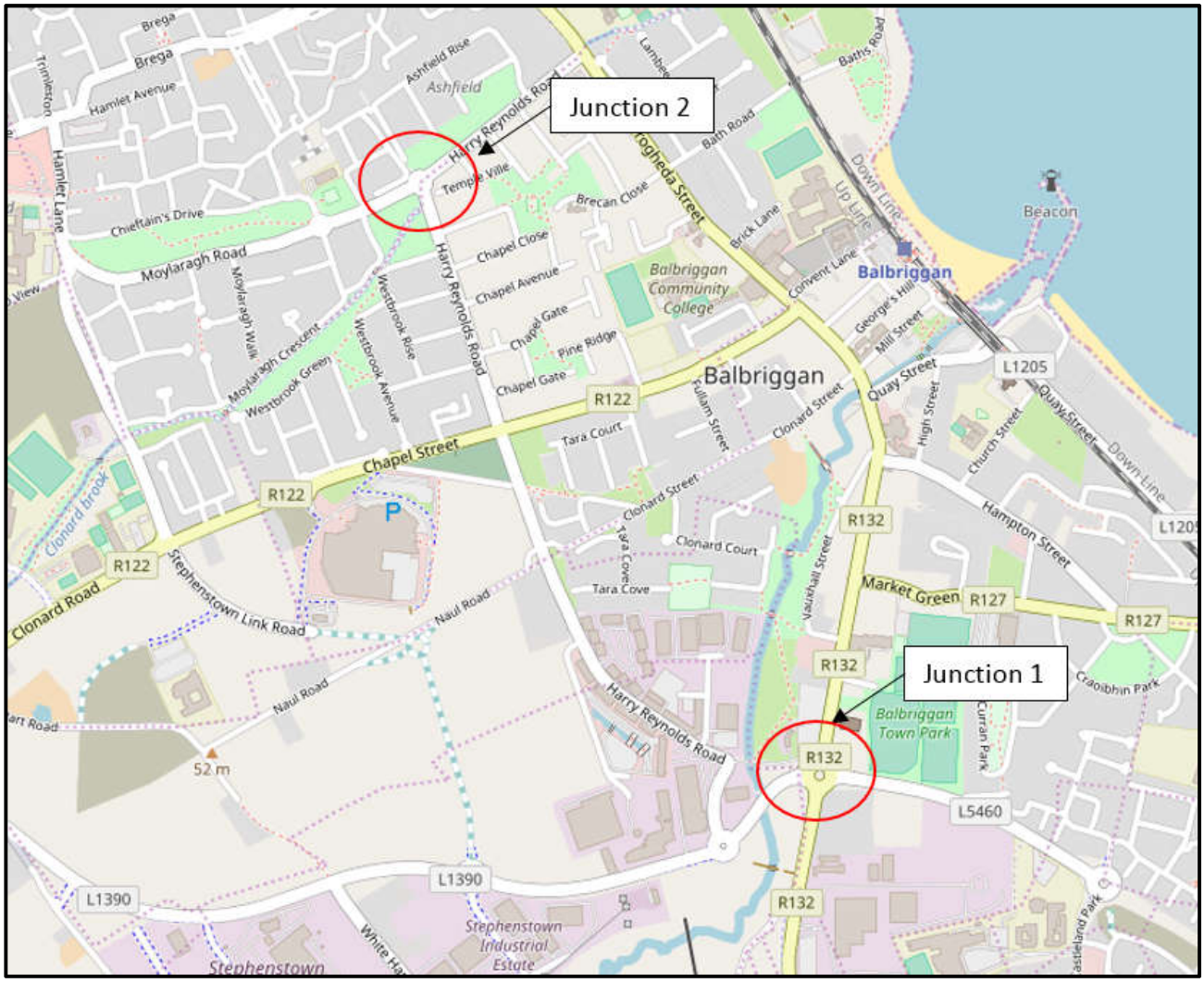


Figure 6-26 Junctions for Assessment

6.4.1. Junction 1

Junction 1 comprises of a four arm roundabout. The L1390 enters the roundabout from the west with two entry lanes. Hamilton Road (L5460) enters the roundabout from the east with two entry lanes. Dublin Street enters the roundabout from both north and south directions. Entries into the roundabout are by way of two entry lanes while all exits from the roundabout are done so using wide single lane exits. Entry and exit widths vary from 6.0-8.0m. The roundabout generally operates as a two lane circulating carriageway. The inscribed circle diameter of the roundabout is approximately 50m.

Cyclists are catered for via one way cycle lanes on the Hamilton Road and L1390 while a two-way facility ends close to the Dublin Street South exit.

There are uncontrolled crossing points at the junction entry/exit on L1390 and Dublin Street South while there is a controlled pedestrian crossing on Hamilton Road. There is a controlled signal crossing for pedestrians on Dublin Street North approximately 60m north of the junction. The figure below shows the existing layout.

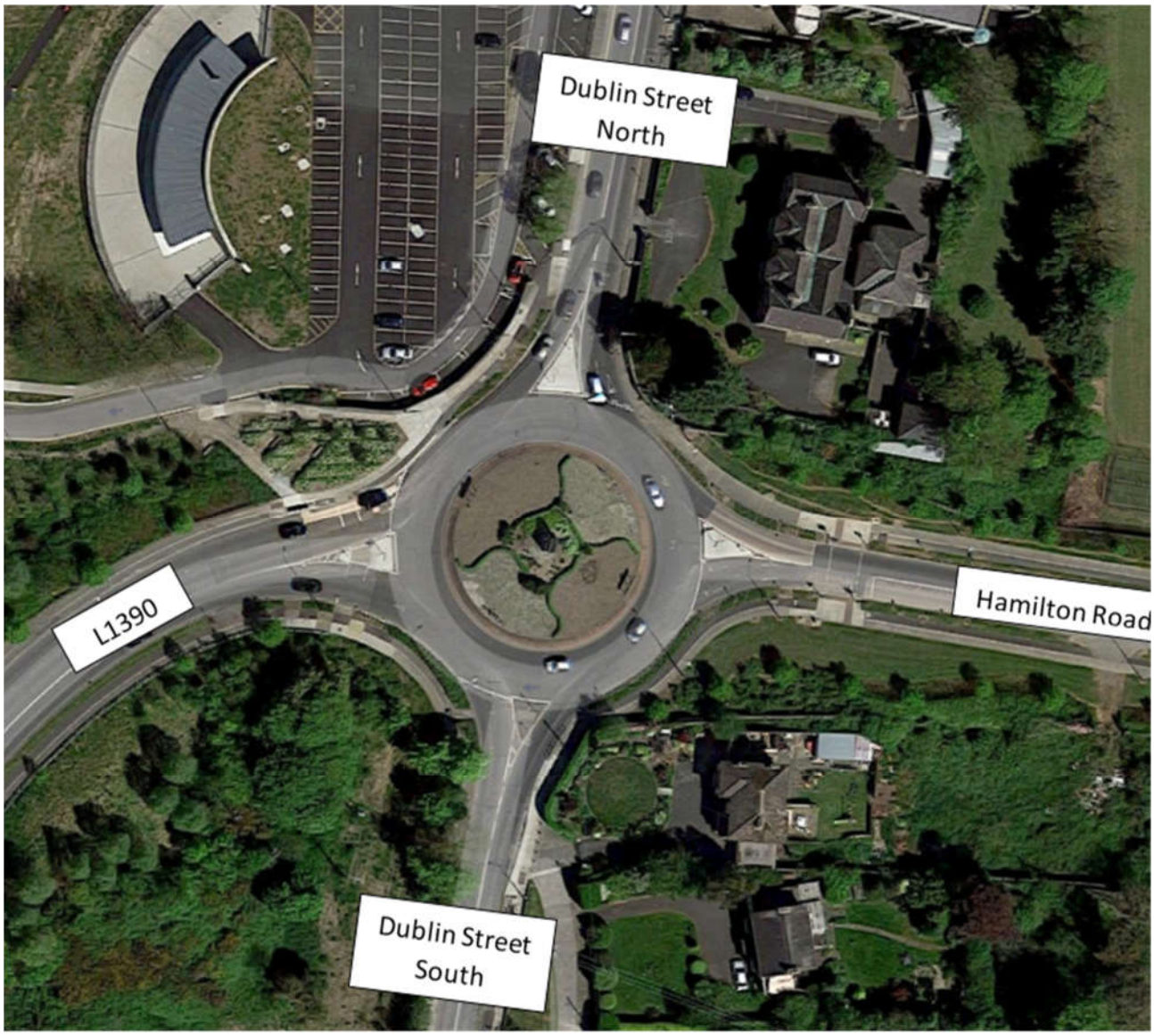


Figure 6-27 Existing Layout of Junction 1

6.4.1.1. Option 1 – Zebra Crossing on Dublin Street North

The current configuration would generally be maintained. A new zebra crossing would be provided close to the entry/exit of Dublin Street North with a 3m segregated two-way cycle track and 2m footpath provided on both sides. This would require the existing geometry of this arm to be modified including relocation of kerbs and reducing of entry/exit widths and radii as shown in the sketch in the below figure.

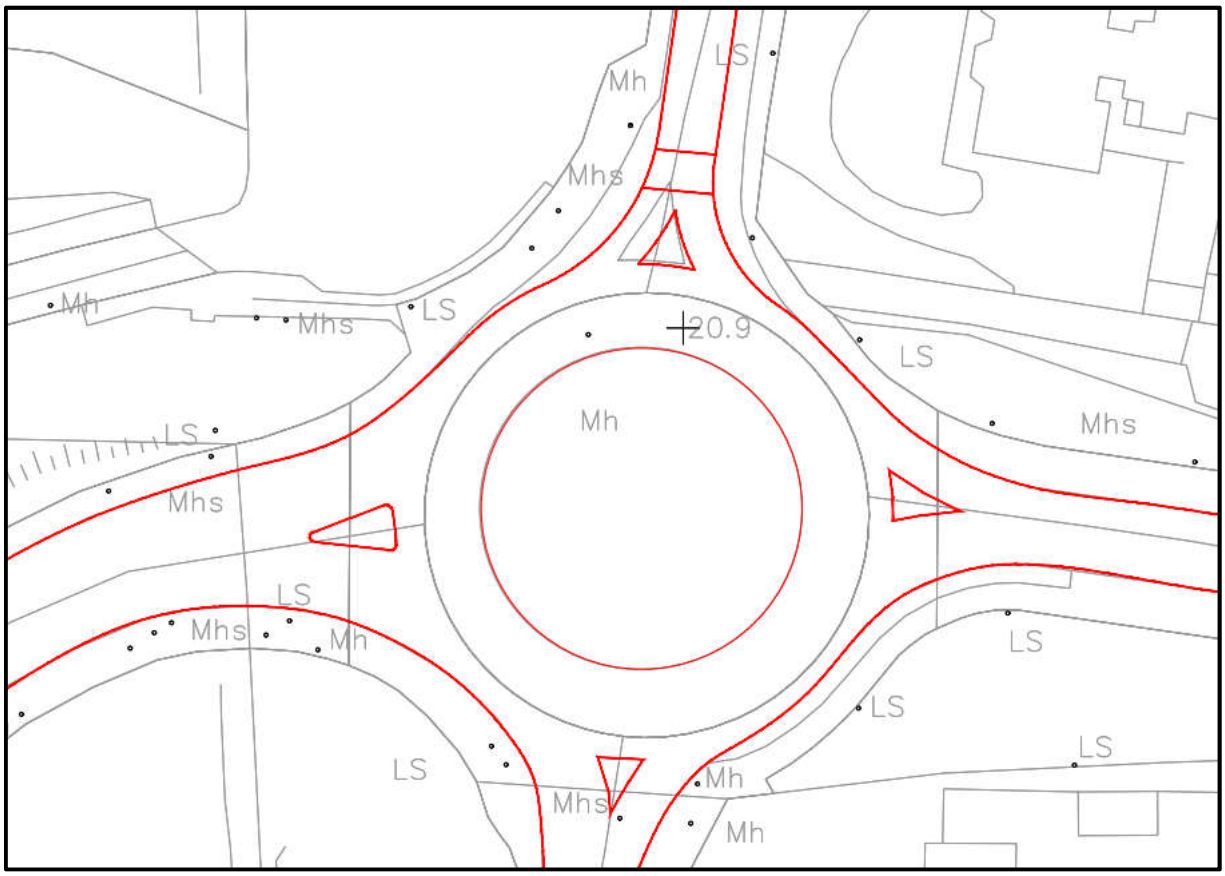


Figure 6-28 Option 1 - Zebra Crossing On Dublin Street North

6.4.1.2. Option 2 – Cycle Friendly Roundabout

The current roundabout layout will be reconfigured to have single lane entry and exits on all arms and entry and exit widths reduced 3.5m in width. The inscribed circle diameter of the roundabout would also be reduced to approximately 30m. This would result in a cycle friendly roundabout in line with the National Cycle Manual. 4m wide zebra crossing facilities would be provided on the Dublin Street North and Hamilton Road arms. The figure below shows the proposed roundabout reconfiguration.

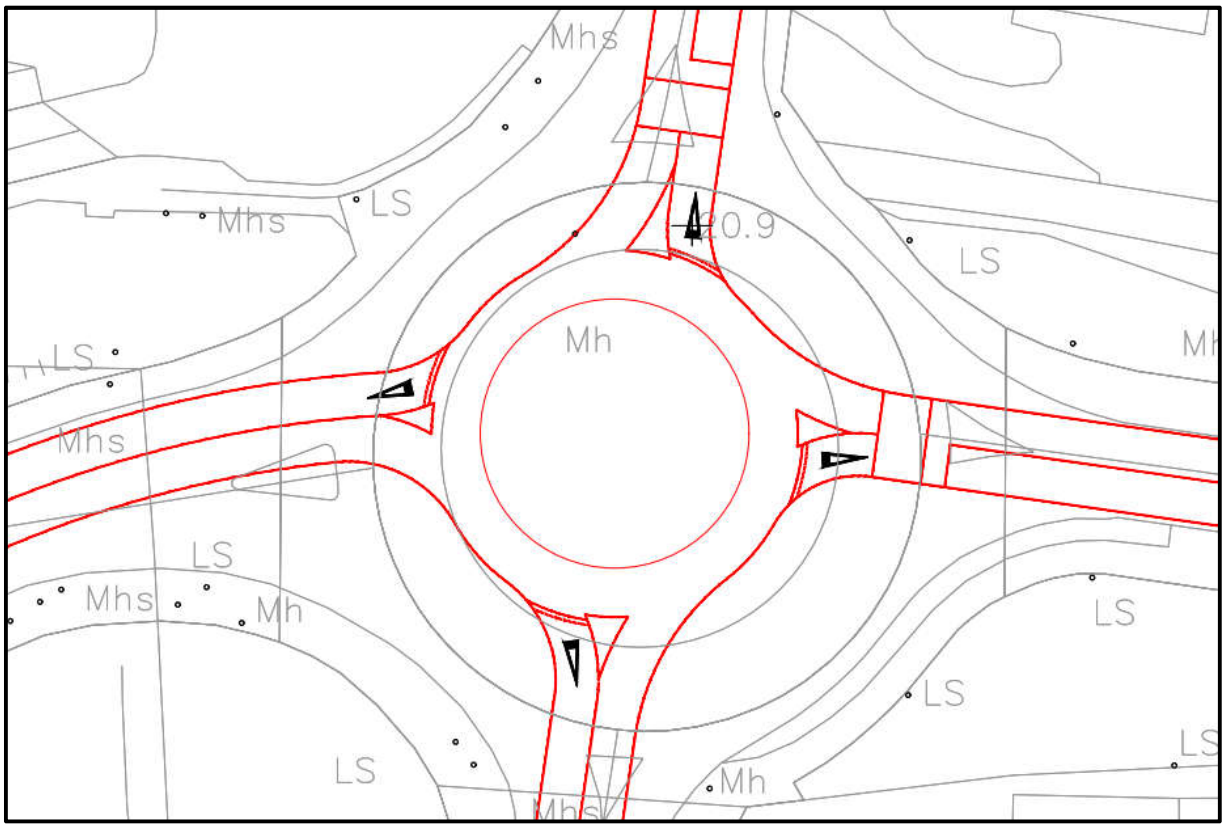


Figure 6-29 Option 2 - Cycle Friendly Roundabout

6.4.1.3. Option 3 – Signalised Junction

The current roundabout layout would be reconfigured to a signalised junction. All entry lanes to the junction are provided by 3.5m wide lanes. All exits from the junction are single exit lanes of 3.5m in width.

Entry to the junction from Dublin Street North will be provided by two lanes, a right turn lane and a straight ahead/left turn lane.

Entry to the junction from Hamilton Road will be provided by three lanes, a right turn, straight ahead and left turn. The left turn lane is provided through the inclusion of a left turn pocket.

Entry to the junction along Dublin Street South is provided through two lanes, a right turn and straight ahead. A left turn slip onto the L1390 is provided in advance of the junction.

Entry to the junction along the L1390 is provided through three lanes, a right turn, straight ahead and left turn lane. The left turn lane is provided through the inclusion of a left turn pocket.

The figure below shows a possible configuration of the signalised junction.

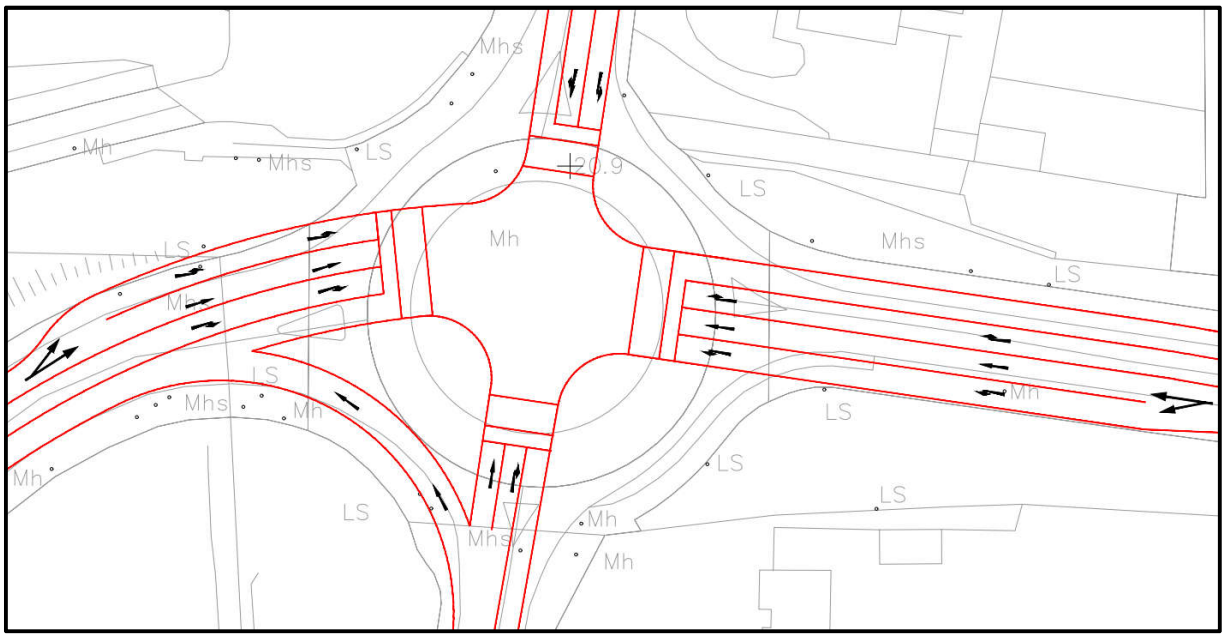


Figure 6-30 Option 3 - Signalised Junction

6.4.1.4. Junction 1 – MCA

The Multi Criteria Analysis and comparison between each option for Junction 1 is summarised in the table below. As part of the analysis, the capacity of each of the junction arrangements was assessed using Junctions 9 and Linsig as appropriate. A summary of the results of this analysis are included in Appendix 1.

Table 6-8 Junction 1 - MCA Comparison Matrix

Context	Criteria	Option 1	Option 2	Option 3
Design	Safety*	Layout provides safe controlled crossing points for vulnerable road users accessing the scheme. Zebra crossings have marginally less control than traffic signals.	Layout provides safe controlled crossing points for vulnerable road users accessing the scheme. Zebra crossings have marginally less control than traffic signals.	Layout provides safe controlled crossing points for vulnerable road users accessing the scheme.
	Directness	Provides a direct route that is very slightly set back from the desire line.	Provides as direct a route as possible across the junction.	Provides as direct a route as possible across the junction.
	Coherence	Layout is legible and continuous with existing and proposed facilities.	Layout is legible and continuous with existing and proposed facilities.	Layout is legible and continuous with existing and proposed facilities.
	Attractiveness	Provision of controlled crossings and segregated cycle and pedestrian facilities makes layout attractive to	Provision of controlled crossings and segregated cycle and pedestrian facilities makes layout attractive to	Provision of controlled crossings and segregated cycle and pedestrian facilities makes layout attractive to

Context	Criteria	Option 1	Option 2	Option 3
		vulnerable road users.	vulnerable road users.	vulnerable road users.
	Comfort	Provision of wide controlled pedestrian crossing points set back from the junction mouth provides good comfort levels.	Provision of wide controlled pedestrian crossing points at the junction mouth provides good comfort levels but may be reduced for some users.	Controlled crossing points and controlled traffic movements makes junction comfortable for all users.
	Level of service	Provides a high quality level of service for cyclists/pedestrians.	Provides a high quality level of service for cyclists/pedestrians.	Provides a high quality level of service for cyclists/pedestrians Some delays possible at signal controlled crossings as opposed to zebras.
Community	Business impact	Minimal impacts to businesses.	Minimal impacts to businesses.	Minimal impacts to businesses.
	Residential impact	Minimal impacts to residents.	Minimal impacts to residents.	Minimal impacts to residents.
	Operational impact	Junction operates similarly to the current arrangement with capacity remaining similar.	Junction capacity is severely reduced due to reduction to single lanes entry arms and general tightening of geometry.	Junction operates just within capacity but gives more control over queues etc.
	Environmental	Some environmental impact associated with removal of grass verges etc.	Some environmental impact associated with removal of grass verges etc.	Some environmental impact associated with removal of grass verges etc.
Delivery	Capitol cost	Relatively small costs associated with minor realignment of 1 arm only and associated zebra crossing works.	Major additional costs to scheme for recongiguration works.	Major additional costs to scheme for recongiguration works.
	Programme risks	Minimal risks to the programme as works are relatively minor.	Programme could suffer due to extent of works required to reconfigure the junction layout.	Programme could suffer due to extent of works required to reconfigure the junction layout.
Ranking		1st	3rd	2nd

6.4.1.5. Junction 1 – Preferred Option

The preferred option for this junction is Option 1. This option would realign Dublin Street North slightly on approach to the roundabout to enable provision of a 3m wide two-way cycle track and 2m footpath on both

sides with a zebra crossing provided across the road. This junction provides a good level of service for vulnerable users while not unduly affecting the capacity of the existing roundabout.

However, it is acknowledged due to forecast increases in traffic flows within Balbriggan and for other traffic management reasons the end solution for this junction will involve upgrading this junction to a signalised junction.

The signalised junction option will be progressed within the next stage of the project and the signalised junction option may be part of the Part 8 scheme.

6.4.2. Junction 2

Junction 2 comprises of a three arm roundabout. Moylaragh Road enters the roundabout from the west with two entry lanes. Harry Reynolds Road enters the roundabout from both east and south directions. All entries and exits of the roundabout are done so using single lanes. Entry and exit widths vary from 4.0-5.0m. The inscribed circle diameter of the roundabout is approximately 32m.

Pedestrians and cyclist are catered for via one way cycle lanes and segregated footpaths along Moylaragh Road. Harry Reynolds Road has no cycle provision, pedestrians are catered for via the existing footpaths on both sides of the carriageway.

Uncontrolled crossing facilities are available on the Moylaragh Road entry and the Harry Reynolds South entry.

The figure below shows the existing junction configuration.

Figure 6-31 Junction 2 - Existing Layout

6.4.2.1. Option 1 – Cycle Friendly Roundabout

This option would alter the existing roundabout geometry to provide a cycle friendly roundabout in accordance with the National Cycle Manual. This would include reducing of entry and exit widths and radii and provision of new cycle and pedestrian facilities around the entire roundabout with zebra crossings provided across each arm. The proposed layout is shown in the figure below.

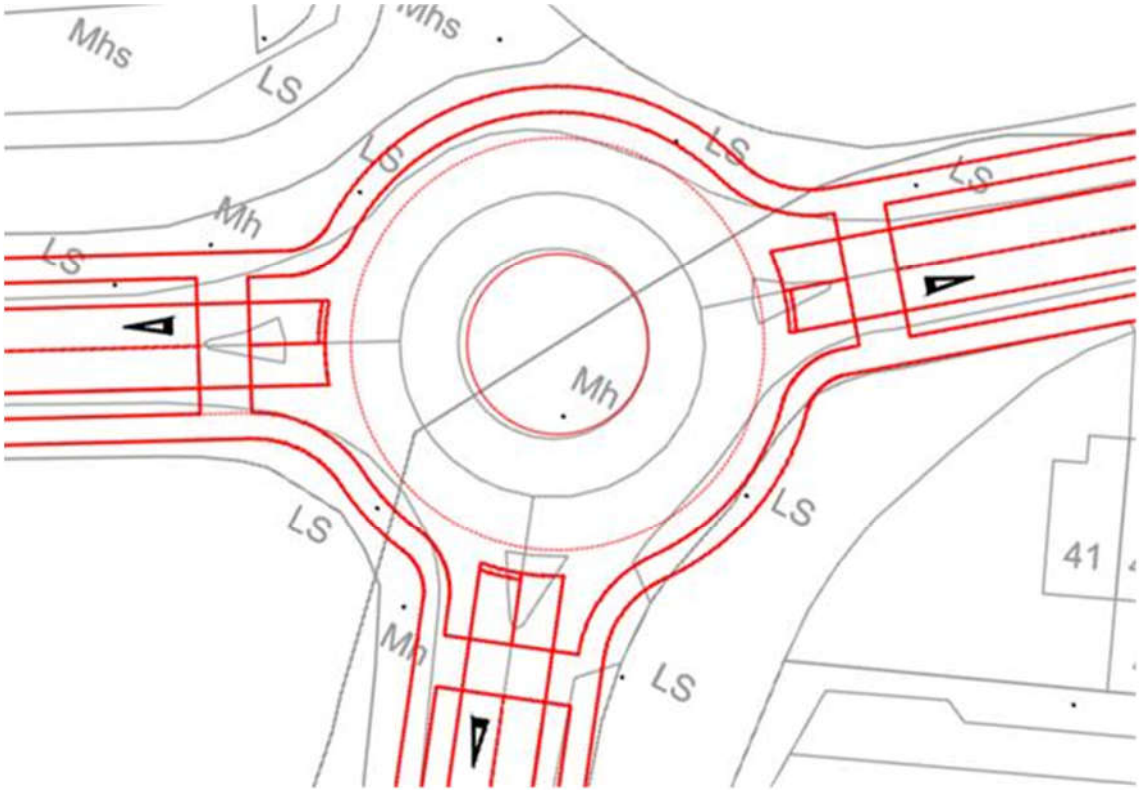


Figure 6-32 Option 1 - Cycle Friendly Roundabout

6.4.2.2. Option 2 – Signal Controlled Junction

The current roundabout layout would be reconfigured to a signalised junction. All entry lanes to the junction will be provided by 3.5m wide lanes while all exits from the junction are single exit lanes of 3.5m in width. Toucan crossings would be provided on all arms of the junction. The figure below shows the proposed layout.

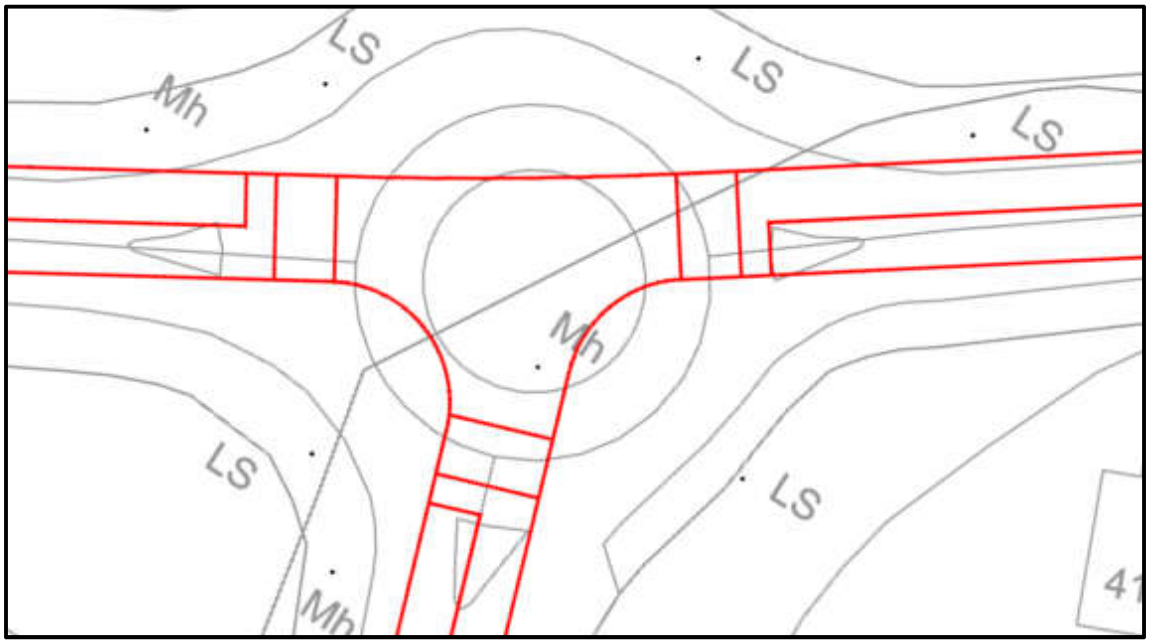


Figure 6-33 Option 2 - Signal Controlled Junction

6.4.2.3. Junction 2 – MCA

The Multi Criteria Analysis and comparison between each option for Junction 2 is summarised in the table below. As part of the analysis, the capacity of each of the junction arrangements was assessed using Junctions 9 and Linsig as appropriate. A summary of the results of this analysis are included in Appendix 1.

Table 1. MCA Performance Matrix

Context	Criteria	Option 1	Option 2
Design	Safety*	Layout provides safe controlled crossing points for vulnerable road users accessing the scheme. Zebra crossings have marginally less control than traffic signals.	Layout provides safe controlled crossing points for vulnerable road users accessing the scheme.
	Directness	Provides as direct a route as possible across the junction.	Provides as direct a route as possible across the junction.
	Coherence	Layout is legible and continuous with proposed facilities.	Layout is legible and continuous with proposed facilities.
	Attractiveness	Provision of controlled crossings and segregated cycle and pedestrian facilities makes layout attractive to vulnerable road users.	Provision of controlled crossings and segregated cycle and pedestrian facilities makes layout attractive to vulnerable road users.
	Comfort	Tighter roundabout geometry and reduced vehicle speeds ensure zebra crossing offer a comfortable and safe crossing point.	Controlled crossing points and controlled traffic movements makes junction comfortable for all users.
	Level of service	Provides a high quality level of service for cyclists/pedestrians.	Provides a high quality level of service for cyclists/pedestrians Some delays possible at signal controlled crossings as opposed to zebras.
Community	Business impact	Minimal impacts to businesses.	Minimal impacts to businesses.
	Residential impact	Minimal impacts to residents.	Minimal impacts to residents.
	Operational impact	Junction operates within capacity without unduly affecting vehicular traffic.	Junction operates within capacity without unduly affecting vehicular traffic.
	Environmental	Some environmental impact associated with removal of grass verges etc.	Some environmental impact associated with removal of grass verges etc.

Context	Criteria	Option 1	Option 2
Delivery	Capitol cost	Additional costs to scheme for reconfiguration works including kerb relocations etc.	Higher additional costs to reconfigure junction and install new traffic signals for entire junction.
	Programme risks	Programme could suffer due to extent of works required to reconfigure the junction layout.	Programme could suffer due to extent of works required to reconfigure the junction layout.
Ranking		1st	2nd

6.4.2.4. Junction 2 – Preferred Option

Option 1 is the preferred option for Junction 2. The reconfiguration of the junction to a cycle friendly roundabout ensures that cyclists and pedestrians have easy, segregated access around the entire roundabout and can cross at zebra crossings without any delay. The junction will still operate within capacity and vehicle users will not be unduly delayed.

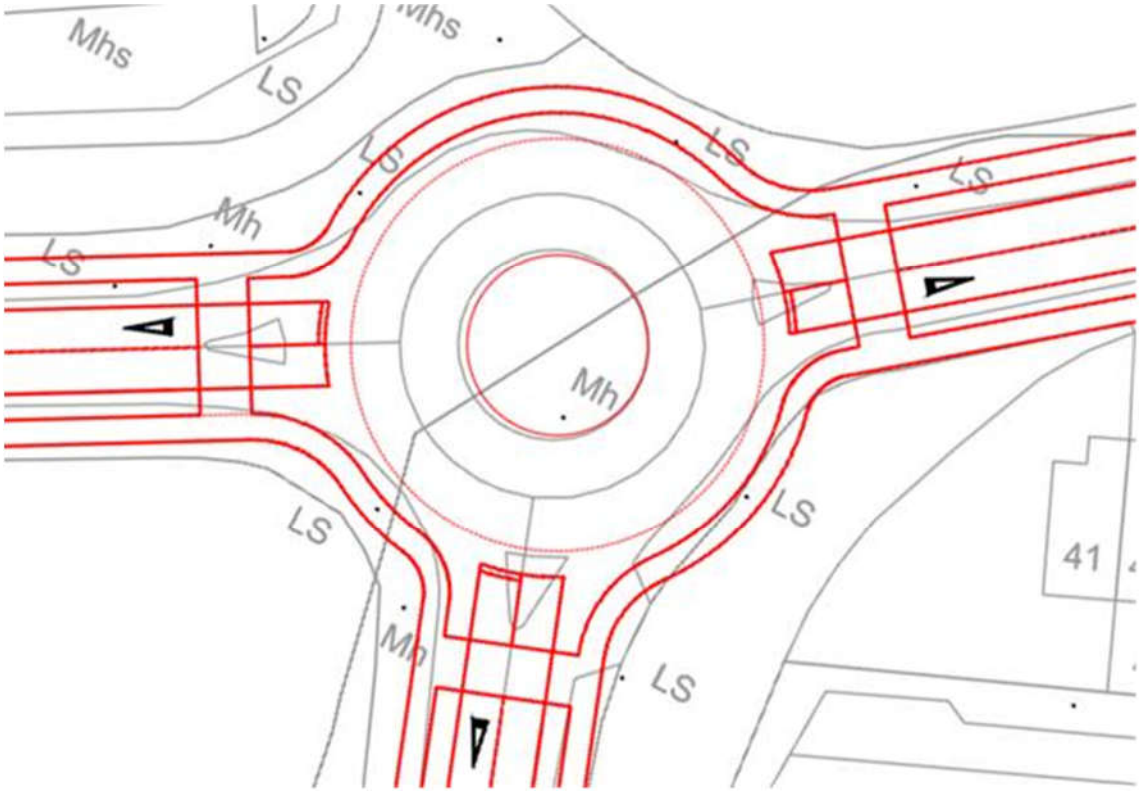


Figure 6-34 Junction 2 - Preferred Option

7. Preferred Route Option

7.1. Description

The Preferred Route for the scheme is shown in the figure below.

Figure 7-1 Preferred Route

It includes:

- Permeability improvements in Moylaragh
- New zebra crossing across Chieftain's Drive at the roundabout
- New two-way cycle track on northern side of Moylaragh Road between Chieftain's Drive and Harry Reynolds Road
- Existing roundabout at Harry Reynolds Road/Moylaragh Road to be reconfigured to cycle friendly roundabout
- New two-way raised cycle track on Harry Reynolds Road between roundabout and Drogheda Street
- New one-way raised adjacent cycle tracks on Harry Reynolds Road between roundabout and Chapel Street junction
- Existing signal controlled junction at Chapel Street to be maintained as is
- New one-way raised adjacent cycle tracks on Harry Reynolds Road between Chapel Street junction to just north of junction with public car park entrance
- New toucan crossing on Harry Reynolds Road at change between one-way and two-way cycle tracks
- New two-way cycle track adjacent to public car park exit road and beside existing car park boundary wall
- New two-way cycle tracks around Dublin Street North arm of roundabout at Dublin Street/L1390/Hamilton Road

- New zebra crossing at Dublin Street North arm (although the signalised junction may be delivered, due to traffic management reasons
- Existing cycle tracks on Hamilton Road to be maintained
- New toucan crossing on Hamilton Road near entrance to Town Park.
- Provision of two way cycle track between the new toucan crossing and the school entrance.
- Environmental Improvements to the laneway to Curran Park and to the schools on Hamilton Road.
- New cycle track to be provided through park along Bracken River – exact route to be determined during preliminary design

The preferred route drawing is shown in Appendix D.

7.2. Preliminary Cost Estimate

A preliminary cost estimate for the scheme has been prepared using the rates from recent urban road schemes. A contingency of 20% has been allocated to the overall cost to allow for any unforeseen items. A breakdown cost estimate of the scheme is shown in Table 7-1. At a feasibility stage, the cost estimate would be in the order of +/- 50%.

The provision of the signalised junction at the junction of Dublin St / Harry Reynolds Road / Hamilton Road would add an additional €1,000,000 to the overall cost estimate.

Table 7-1 Cost estimate per section

Section	Cost Estimate
Section 1	€100,000
Section 2	€35,000
Section 3	€1,000,000
Section 4	€180,000
Section 5	€290,000
Junction 1	€250,000 (Zebra Crossing)
Junction 2	€750,000
Upgrade of Bridges	€100,000
Works within The Park	€200,000
Environmental Improvements and Permeability Links	€80,000
Contingency	€530,000
Total	€3,515,000

The provision of the signalised junction at the junction of Dublin St / Harry Reynolds Road / Hamilton Road would add an additional €1,000,000 to the overall cost estimate.

Appendices

Appendix A. Junction Analysis

Junctions 9

ARCADY 9 - Roundabout Module

Filename: R132 Roundabout with Zebra Crossing on Dublin Street.j9
Path: U:\5165984\7 Calcs\72Model
Report generation date: 17/10/2018 11:05:57

Summary of junction performance

	AM				PM			
	Queue (PCU)	Delay (s)	RFC	LOS	Queue (PCU)	Delay (s)	RFC	LOS
	2018							
Arm 1	2.1	14.15	0.68	B	1.6	10.34	0.62	B
Arm 2	1.1	6.90	0.52	A	0.6	5.30	0.37	A
Arm 3	0.8	5.56	0.46	A	0.8	5.48	0.44	A
Arm 4	0.6	3.43	0.38	A	0.4	2.91	0.31	A

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle.

File summary

File Description

Title	(untitled)
Location	
Site number	
Date	30/04/2018
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ATKINSMCCARTHY\MCollins
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
		0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	2018	AM	ONE HOUR	08:00	09:30	15
D2	2018	PM	ONE HOUR	17:00	18:30	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2018, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.

Junction Network

Junctions

Junction	Name	Junction Type	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	7.32	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description
1	untitled	
2	untitled	
3	untitled	
4	untitled	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1	3.00	5.00	5.0	20.0	51.0	50.0	
2	3.80	7.30	6.5	22.0	51.0	58.0	
3	3.30	7.30	11.5	24.0	51.0	53.0	
4	5.90	7.90	19.5	28.0	51.0	55.0	

Zebra Crossings

Arm	Space between crossing and junction entry (Zebra) (PCU)	Vehicles queueing on exit (Zebra) (PCU)	Central Refuge	Crossing data type	Crossing length (m)	Crossing time (s)
1	1.50	1.50		Distance	6.00	4.29

Pelican/Puffin Crossings

Arm	Space between crossing and junction entry (Signalised) (PCU)	Amber time preceding red (s)	Amber time regarded as green (s)	Time from traffic red start to green man start (s)	Time period green man shown (s)	Clearance Period (s)	Traffic minimum green (s)
2	3.50	3.00	2.90	2.00	6.00	6.00	7.00

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/hr)
1	0.470	1093
2	0.521	1398
3	0.539	1461
4	0.655	2081

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	2018	AM	ONE HOUR	08:00	09:30	15

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		✓	490	100.000
2		✓	511	100.000
3		✓	492	100.000
4		✓	580	100.000

Demand overview (Pedestrians)

Arm	Average pedestrian flow (Ped/hr)
1	100.00
2	20.00
3	
4	

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	2	3	4
From	1	0	115	245	130
	2	139	0	183	189
	3	184	151	0	157
	4	154	305	121	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	2	3	4
From	1	0	0	0	0
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max delay (s)	Max Queue (PCU)	Max LOS
1	0.68	14.15	2.1	B
2	0.52	6.90	1.1	A
3	0.46	5.56	0.8	A
4	0.38	3.43	0.6	A

Main Results for each time segment

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	369	433	75.29	889	0.415	366	0.7	6.852	A
2	385	371	15.06	1170	0.329	383	0.5	4.564	A
3	370	343		1276	0.290	369	0.4	3.960	A
4	437	355		1829	0.239	435	0.3	2.580	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	440	518	89.90	849	0.519	439	1.1	8.760	A
2	459	445	17.98	1132	0.406	459	0.7	5.340	A
3	442	411		1239	0.357	442	0.6	4.510	A
4	521	426		1772	0.294	521	0.4	2.877	A

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	540	634	110.10	794	0.680	536	2.0	13.748	B
2	563	543	22.02	1082	0.520	561	1.1	6.891	A
3	542	502		1190	0.455	541	0.8	5.533	A
4	639	521		1689	0.378	638	0.6	3.424	A

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	540	635	110.10	793	0.680	539	2.1	14.150	B
2	563	546	22.02	1084	0.519	563	1.1	6.899	A
3	542	504		1189	0.456	542	0.8	5.560	A
4	639	522		1688	0.378	639	0.6	3.430	A

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	440	520	89.90	848	0.520	444	1.1	9.007	A
2	459	449	17.98	1135	0.405	461	0.7	5.355	A
3	442	414		1238	0.357	443	0.6	4.539	A
4	521	427		1771	0.294	522	0.4	2.884	A

09:15 - 09:30

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	369	435	75.29	888	0.415	370	0.7	6.975	A
2	385	375	15.06	1173	0.328	385	0.5	4.577	A
3	370	346		1274	0.291	371	0.4	3.986	A
4	437	357		1828	0.239	437	0.3	2.591	A

2018, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm 1 - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm 2 - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.

Junction Network

Junctions

Junction	Name	Junction Type	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	6.09	A

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D2	2018	PM	ONE HOUR	17:00	18:30	15

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		✓	505	100.000
2		✓	366	100.000
3		✓	466	100.000
4		✓	495	100.000

Demand overview (Pedestrians)

Arm	Average pedestrian flow (Ped/hr)
1	0.00
2	0.00
3	
4	

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	2	3	4
From	1	0	75	228	202
	2	99	0	77	190
	3	238	79	0	149
	4	208	167	120	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	2	3	4
From	1	0	0	0	0
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max delay (s)	Max Queue (PCU)	Max LOS
1	0.62	10.34	1.6	B
2	0.37	5.30	0.6	A
3	0.44	5.48	0.8	A
4	0.31	2.91	0.4	A

Main Results for each time segment

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	380	275	0.00	964	0.394	378	0.6	6.112	A
2	276	412	0.00	1184	0.233	274	0.3	3.955	A
3	351	368		1263	0.278	349	0.4	3.935	A
4	373	312		1876	0.199	372	0.2	2.391	A

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	454	329	0.00	939	0.484	453	0.9	7.395	A
2	329	493	0.00	1141	0.288	329	0.4	4.430	A
3	419	441		1223	0.342	418	0.5	4.469	A
4	445	374		1836	0.242	445	0.3	2.587	A

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	556	403	0.00	904	0.615	553	1.6	10.195	B
2	403	603	0.00	1084	0.372	402	0.6	5.277	A
3	513	539		1170	0.438	512	0.8	5.451	A
4	545	457		1781	0.306	545	0.4	2.909	A

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	556	403	0.00	904	0.615	556	1.6	10.342	B
2	403	605	0.00	1083	0.372	403	0.6	5.296	A
3	513	541		1170	0.439	513	0.8	5.483	A
4	545	458		1781	0.306	545	0.4	2.912	A

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	454	329	0.00	938	0.484	456	1.0	7.511	A
2	329	497	0.00	1139	0.289	330	0.4	4.452	A
3	419	443		1222	0.343	420	0.5	4.494	A
4	445	375		1835	0.242	445	0.3	2.592	A

18:15 - 18:30

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	380	276	0.00	964	0.395	381	0.7	6.197	A
2	276	415	0.00	1182	0.233	276	0.3	3.977	A
3	351	370		1261	0.278	351	0.4	3.959	A
4	373	314		1875	0.199	373	0.2	2.398	A

Junctions 9

ARCADY 9 - Roundabout Module

Filename: R132 Reconfigured to Cycle Friendly Roundabout.j9
Path: U:\5165984\7 Calcs\72Model
Report generation date: 17/10/2018 11:04:44

Summary of junction performance

	AM				PM			
	Queue (PCU)	Delay (s)	RFC	LOS	Queue (PCU)	Delay (s)	RFC	LOS
	2018							
Arm 1	9.2	65.34	0.93	F	5.1	34.99	0.85	D
Arm 2	8.5	58.40	0.92	F	2.5	22.76	0.72	C
Arm 3	5.7	40.20	0.87	E	7.2	53.99	0.90	F
Arm 4	24.2	132.97	1.04	F	7.4	52.75	0.91	F

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle.

File summary

File Description

Title	(untitled)
Location	
Site number	
Date	09/05/2018
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ATKINSMCCARTHY\MCollins
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
		0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	2018	AM	ONE HOUR	08:00	09:30	15
D2	2018	PM	ONE HOUR	17:00	18:30	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2018, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Pedestrian Crossing	Arm 1 - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm 2 - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm 3 - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Pedestrian Crossing	Arm 4 - Pedestrian crossing	Pedestrian crossing uses default flow of 0. Is this correct?
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.

Junction Network

Junctions

Junction	Name	Junction Type	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	76.58	F

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description
1	untitled	
2	untitled	
3	untitled	
4	untitled	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1	3.00	3.50	5.0	10.0	35.0	70.0	
2	3.00	3.50	5.0	10.0	35.0	70.0	
3	3.00	3.50	5.0	10.0	35.0	70.0	
4	3.00	3.50	5.0	10.0	35.0	70.0	

Zebra Crossings

Arm	Space between crossing and junction entry (Zebra) (PCU)	Vehicles queueing on exit (Zebra) (PCU)	Central Refuge	Crossing data type	Crossing length (m)	Crossing time (s)
1	1.00	1.00		Distance	6.00	4.29
2	1.00	1.00		Distance	6.00	4.29
3	1.00	1.00		Distance	6.00	4.29
4	1.00	1.00		Distance	6.00	4.29

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/hr)
1	0.418	832
2	0.418	832
3	0.418	832
4	0.418	832

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	2018	AM	ONE HOUR	08:00	09:30	15

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		✓	490	100.000
2		✓	511	100.000
3		✓	492	100.000
4		✓	580	100.000

Demand overview (Pedestrians)

Arm	Average pedestrian flow (Ped/hr)
1	0.00
2	0.00
3	0.00
4	0.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	2	3	4
From	1	0	115	245	130
	2	139	0	183	189
	3	184	151	0	157
	4	154	305	121	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	2	3	4
From	1	0	0	0	0
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max delay (s)	Max Queue (PCU)	Max LOS
1	0.93	65.34	9.2	F
2	0.92	58.40	8.5	F
3	0.87	40.20	5.7	E
4	1.04	132.97	24.2	F

Main Results for each time segment

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	369	428	0.00	653	0.565	364	1.3	12.262	B
2	385	368	0.00	678	0.568	380	1.3	11.883	B
3	370	340	0.00	689	0.537	366	1.1	10.981	B
4	437	352	0.00	684	0.638	430	1.7	13.810	B

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	440	513	0.00	617	0.713	436	2.3	19.410	C
2	459	441	0.00	647	0.710	455	2.3	18.360	C
3	442	408	0.00	661	0.669	439	1.9	15.983	C
4	521	423	0.00	655	0.796	514	3.5	24.409	C

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	540	596	0.00	582	0.926	520	7.3	46.800	E
2	563	521	0.00	614	0.916	544	6.9	43.028	E
3	542	487	0.00	628	0.863	529	5.0	33.016	D
4	639	509	0.00	619	1.032	590	15.5	75.075	F

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	540	609	0.00	577	0.935	532	9.2	65.344	F
2	563	533	0.00	609	0.924	556	8.5	58.395	F
3	542	498	0.00	623	0.869	539	5.7	40.199	E
4	639	518	0.00	615	1.038	604	24.2	132.968	F

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	440	579	0.00	590	0.747	464	3.3	32.544	D
2	459	480	0.00	631	0.728	482	2.9	26.979	D
3	442	432	0.00	651	0.680	456	2.2	19.595	C
4	521	442	0.00	647	0.806	597	5.2	83.069	F

09:15 - 09:30

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	369	446	0.00	645	0.572	376	1.4	13.733	B
2	385	382	0.00	672	0.573	391	1.4	13.062	B
3	370	351	0.00	685	0.541	375	1.2	11.741	B
4	437	361	0.00	681	0.642	450	1.9	16.445	C

2018, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.

Junction Network

Junctions

Junction	Name	Junction Type	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	42.18	E

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D2	2018	PM	ONE HOUR	17:00	18:30	15

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		✓	505	100.000
2		✓	366	100.000
3		✓	466	100.000
4		✓	495	100.000

Demand overview (Pedestrians)

Arm	Average pedestrian flow (Ped/hr)
1	50.00
2	50.00
3	50.00
4	50.00

Origin-Destination Data

Demand (PCU/hr)

		To			
		1	2	3	4
From	1	0	75	228	202
	2	99	0	77	190
	3	238	79	0	149
	4	208	167	120	0

Vehicle Mix

Heavy Vehicle Percentages

		To			
		1	2	3	4
From	1	0	0	0	0
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max delay (s)	Max Queue (PCU)	Max LOS
1	0.85	34.99	5.1	D
2	0.72	22.76	2.5	C
3	0.90	53.99	7.2	F
4	0.91	52.75	7.4	F

Main Results for each time segment

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	380	272	37.64	713	0.533	376	1.1	10.548	B
2	276	409	37.64	652	0.423	273	0.7	9.428	A
3	351	366	37.64	663	0.530	346	1.1	11.240	B
4	373	309	37.64	685	0.544	368	1.2	11.177	B

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	454	326	44.95	688	0.660	451	1.9	15.026	C
2	329	491	44.95	613	0.537	327	1.1	12.525	B
3	419	439	44.95	624	0.672	416	1.9	17.018	C
4	445	371	44.95	650	0.684	441	2.0	16.929	C

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	556	391	55.05	657	0.847	545	4.6	29.690	D
2	403	592	55.05	564	0.714	398	2.3	21.081	C
3	513	533	55.05	572	0.897	497	6.0	41.118	E
4	545	446	55.05	606	0.899	528	6.2	39.889	E

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	556	399	55.05	653	0.852	554	5.1	34.989	D
2	403	603	55.05	559	0.720	402	2.5	22.762	C
3	513	539	55.05	568	0.904	508	7.2	53.994	F
4	545	455	55.05	600	0.908	540	7.4	52.752	F

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	454	344	44.95	679	0.668	466	2.1	17.690	C
2	329	509	44.95	605	0.544	334	1.2	13.532	B
3	419	450	44.95	617	0.679	439	2.2	22.059	C
4	445	389	44.95	640	0.695	465	2.4	22.513	C

18:15 - 18:30

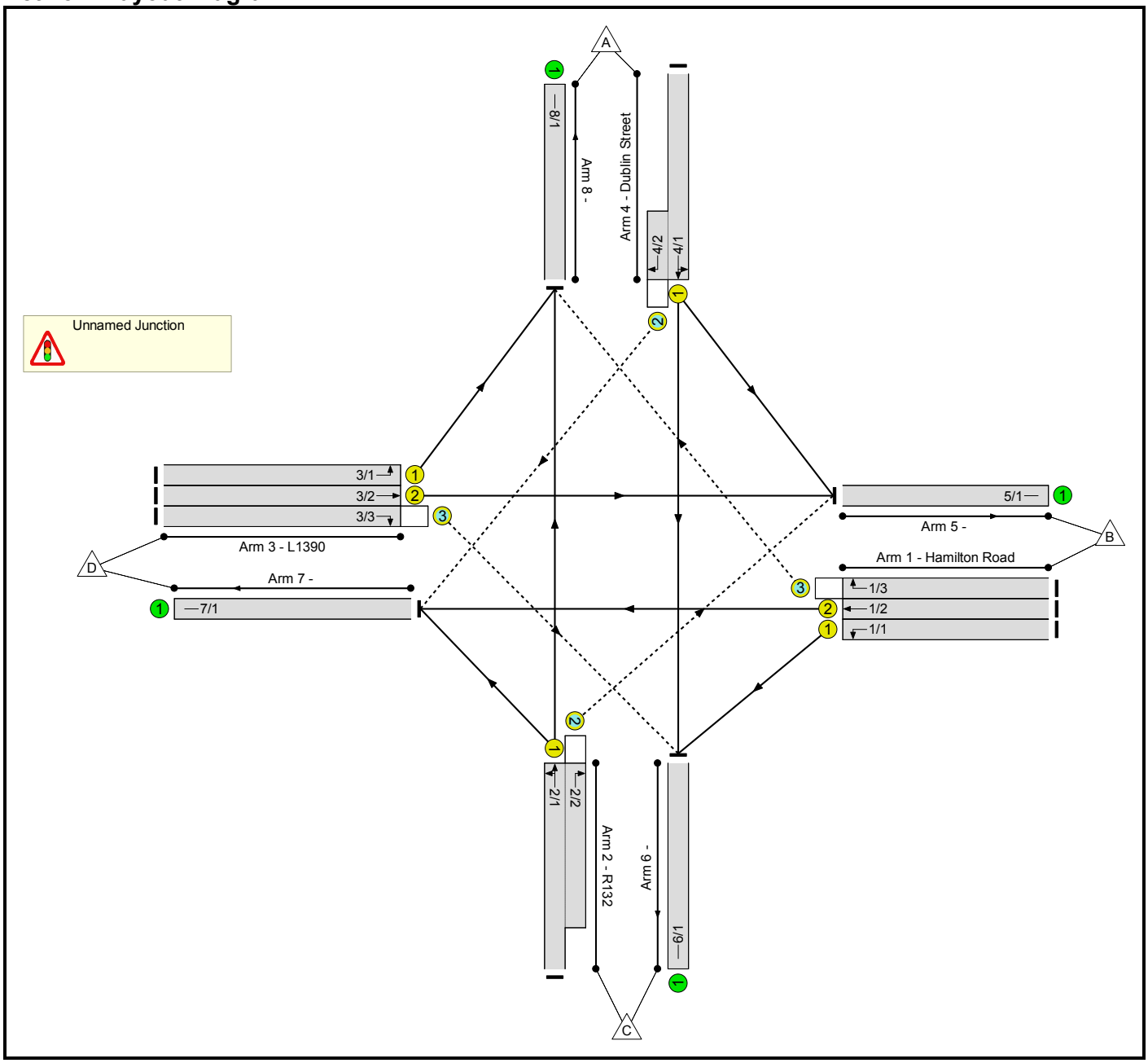
Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	380	279	37.64	710	0.536	384	1.2	11.177	B
2	276	418	37.64	647	0.426	277	0.8	9.780	A
3	351	373	37.64	659	0.532	355	1.2	12.013	B
4	373	317	37.64	681	0.547	377	1.2	12.027	B

Full Input Data And Results

User and Project Details

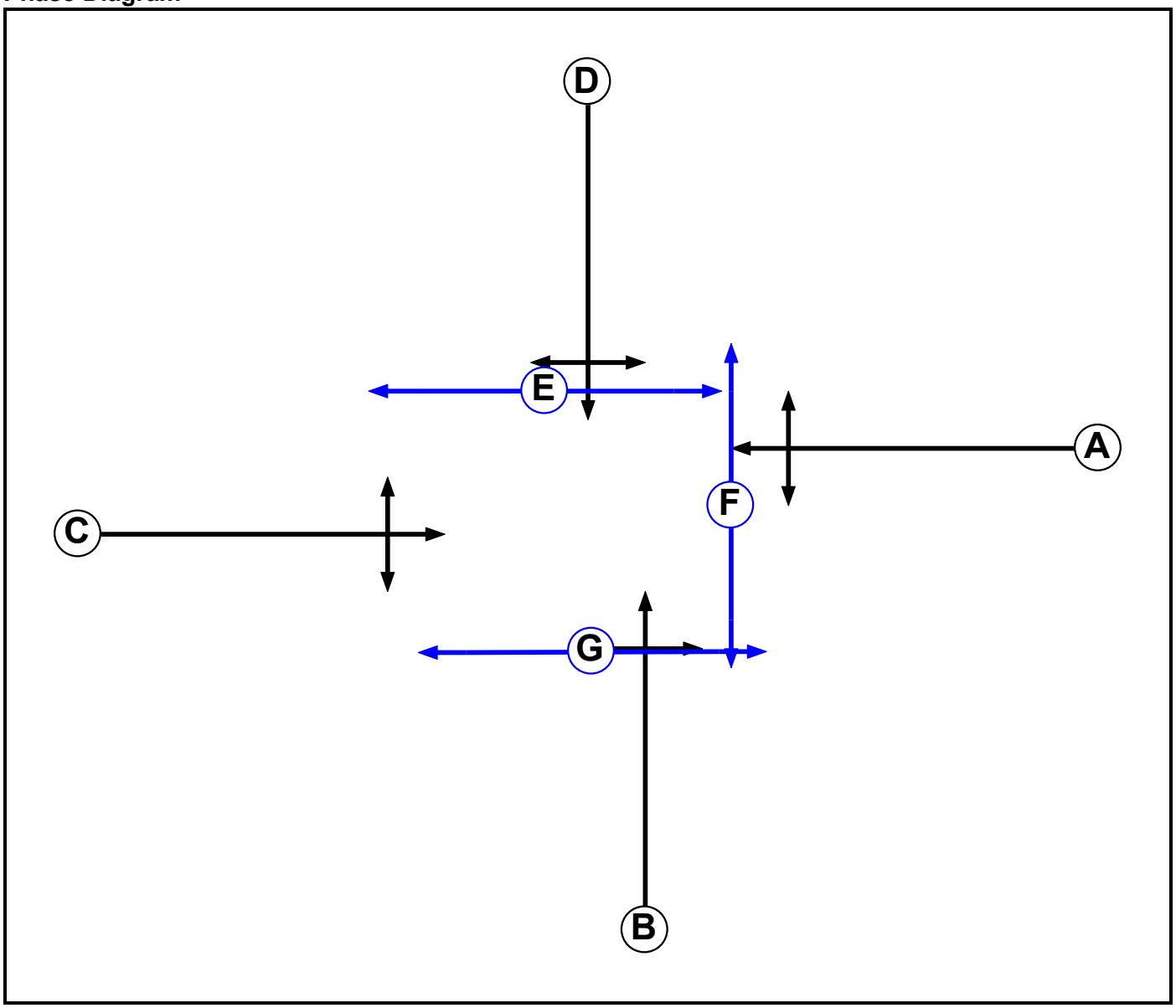
Project:	**R132 Roundabout Reconfiguration to Signalised Junction**
Title:	**Harry Reynolds Road Pedestrian and Cycle Scheme**
Location:	Junction of Hamilton Road, Harry Reynolds Road, Dublin Street
Client:	Fingal County Council
Additional detail:	
File name:	Junction 1.lsg3x
Author:	Ben Holland
Company:	Atkins
Address:	150 Lakeside Drive, Airside Business Park, Swords, Co. Louth

Network Layout Diagram



Full Input Data And Results

Phase Diagram



Phase Input Data

Phase Name	Phase Type	Assoc. Phase	Street Min	Cont Min
A	Traffic		7	7
B	Traffic		7	7
C	Traffic		7	7
D	Traffic		7	7
E	Pedestrian		7	7
F	Pedestrian		7	7
G	Pedestrian		7	7

Full Input Data And Results

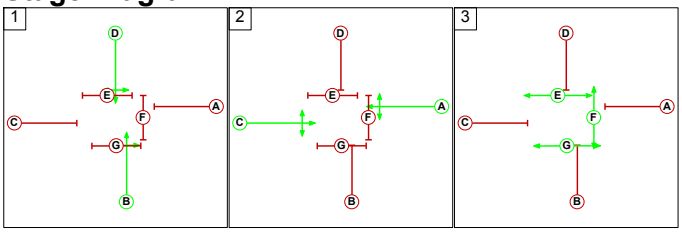
Phase Intergreens Matrix

Terminating Phase \ Starting Phase	A	B	C	D	E	F	G
A		6	-	6	8	8	8
B	6		6	-	8	8	8
C	-	6		8	8	8	8
D	6	-	6		8	8	8
E	8	8	8	8		-	-
F	8	8	8	8	-		-
G	8	8	8	8	-	-	

Phases in Stage

Stage No.	Phases in Stage
1	B D
2	A C
3	E F G

Stage Diagram



Phase Delays

Term. Stage	Start Stage	Phase	Type	Value	Cont value
There are no Phase Delays defined					

Prohibited Stage Change

From Stage \ To Stage	1	2	3
1		6	8
2	8		8
3	8	8	

Full Input Data And Results

Give-Way Lane Input Data

Junction: Unnamed Junction											
Lane	**Movement**	**Max Flow when Giving Way (PCU/Hr)**	**Min Flow when Giving Way (PCU/Hr)**	**Opposing Lane**	**Opp. Lane Coeff.**	**Opp. Mvmnts.**	**Right Turn Storage (PCU)**	**Non-Blocking Storage (PCU)**	**RTF**	**Right Turn Move up (s)**	**Max Turns in Intergreen (PCU)**
1/3 (Hamilton Road)	8/1 (Right)	1439	0	3/2	1.09	All	2.00	-	0.50	2	2.00
2/2 (R132)	5/1 (Right)	1439	0	4/1	1.09	All	2.00	-	0.50	2	2.00
3/3 (L1390)	6/1 (Right)	1439	0	1/2	1.09	All	2.00	-	0.50	2	2.00
4/2 (Dublin Street)	7/1 (Right)	1439	0	2/1	1.09	All	2.00	-	0.50	2	2.00

Full Input Data And Results

Lane Input Data

Junction: Unnamed Junction												
Lane	**Lane Type**	**Phases**	**Start Disp.**	**End Disp.**	**Physical Length (PCU)**	**Sat Flow Type**	**Def User Saturation Flow (PCU/Hr)**	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Turns**	**Turning Radius (m)**
1/1 (Hamilton Road)	U	A	2	3	60.0	Geom	-	3.25	0.00	Y	Arm 6 Left	10.00
1/2 (Hamilton Road)	U	A	2	3	60.0	Geom	-	3.25	0.00	Y	Arm 7 Ahead	10.00
1/3 (Hamilton Road)	O	A	2	3	60.0	Geom	-	3.25	0.00	N	Arm 8 Right	15.00
2/1 (R132)	U	B	2	3	60.0	Geom	-	3.50	0.00	Y	Arm 7 Left	Inf
											Arm 8 Ahead	Inf
2/2 (R132)	O	B	2	3	13.9	Geom	-	3.50	0.00	Y	Arm 5 Right	21.00
3/1 (L1390)	U	C	2	3	60.0	Geom	-	3.25	0.00	Y	Arm 8 Left	10.00
3/2 (L1390)	U	C	2	3	60.0	Geom	-	3.25	0.00	Y	Arm 5 Ahead	Inf
3/3 (L1390)	O	C	2	3	60.0	Geom	-	3.50	0.00	Y	Arm 6 Right	16.50
4/1 (Dublin Street)	U	D	2	3	60.0	Geom	-	3.25	0.00	Y	Arm 5 Left	9.50
											Arm 6 Ahead	Inf
4/2 (Dublin Street)	O	D	2	3	5.0	Geom	-	3.50	0.00	Y	Arm 7 Right	27.00
5/1	U		2	3	60.0	Geom	-	3.50	0.00	Y		
6/1	U		2	3	60.0	Geom	-	3.50	0.00	Y		
7/1	U		2	3	60.0	Inf	-	-	-	-	-	-
8/1	U		2	3	60.0	Inf	-	-	-	-	-	-

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
1: 'AM Peak'	08:00	09:00	01:00	
2: 'PM Peak'	17:00	18:00	01:00	
3: 'AM - 15% growth'	08:00	09:00	01:00	F1*1.15
4: 'AM - 20% growth'	08:00	09:00	01:00	F3*1.2

Scenario 1: 'AM Peak' (FG1: 'AM Peak', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination				
		A	B	C	D	Tot.
Origin	A	0	115	245	130	490
	B	139	0	183	189	511
	C	184	151	0	157	492
	D	154	305	121	0	580
	Tot.	477	571	549	476	2073

Traffic Lane Flows

Lane	Scenario 1: AM Peak
Junction: Unnamed Junction	
1/1	183
1/2	189
1/3	139
2/1 (with short)	492(In) 341(Out)
2/2 (short)	151
3/1	154
3/2	305
3/3	121
4/1 (with short)	490(In) 360(Out)
4/2 (short)	130
5/1	571
6/1	549
7/1	476
8/1	477

Full Input Data And Results

Lane Saturation Flows

Junction: Unnamed Junction								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (Hamilton Road)	3.25	0.00	Y	Arm 6 Left	10.00	100.0 %	1687	1687
1/2 (Hamilton Road)	3.25	0.00	Y	Arm 7 Ahead	10.00	100.0 %	1687	1687
1/3 (Hamilton Road)	3.25	0.00	N	Arm 8 Right	15.00	100.0 %	1891	1891
2/1 (R132)	3.50	0.00	Y	Arm 7 Left	Inf	46.0 %	1965	1965
				Arm 8 Ahead	Inf	54.0 %		
2/2 (R132)	3.50	0.00	Y	Arm 5 Right	21.00	100.0 %	1834	1834
3/1 (L1390)	3.25	0.00	Y	Arm 8 Left	10.00	100.0 %	1687	1687
3/2 (L1390)	3.25	0.00	Y	Arm 5 Ahead	Inf	100.0 %	1940	1940
3/3 (L1390)	3.50	0.00	Y	Arm 6 Right	16.50	100.0 %	1801	1801
4/1 (Dublin Street)	3.25	0.00	Y	Arm 5 Left	9.50	31.9 %	1847	1847
				Arm 6 Ahead	Inf	68.1 %		
4/2 (Dublin Street)	3.50	0.00	Y	Arm 7 Right	27.00	100.0 %	1862	1862
5/1	3.50	0.00	Y				1965	1965
6/1	3.50	0.00	Y				1965	1965
7/1	Infinite Saturation Flow						Inf	Inf
8/1	Infinite Saturation Flow						Inf	Inf

Scenario 2: 'AM Peak with 15% growth' (FG3: 'AM - 15% growth', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination				
		A	B	C	D	Tot.
Origin	A	0	132	282	150	564
	B	160	0	210	217	587
	C	212	174	0	181	567
	D	177	351	139	0	667
	Tot.	549	657	631	548	2385

Full Input Data And Results

Traffic Lane Flows

Lane	Scenario 2: AM Peak with 15% growth
Junction: Unnamed Junction	
1/1	210
1/2	217
1/3	160
2/1 (with short)	567(In) 393(Out)
2/2 (short)	174
3/1	177
3/2	351
3/3	139
4/1 (with short)	564(In) 414(Out)
4/2 (short)	150
5/1	657
6/1	631
7/1	548
8/1	549

Full Input Data And Results

Lane Saturation Flows

Junction: Unnamed Junction								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (Hamilton Road)	3.25	0.00	Y	Arm 6 Left	10.00	100.0 %	1687	1687
1/2 (Hamilton Road)	3.25	0.00	Y	Arm 7 Ahead	10.00	100.0 %	1687	1687
1/3 (Hamilton Road)	3.25	0.00	N	Arm 8 Right	15.00	100.0 %	1891	1891
2/1 (R132)	3.50	0.00	Y	Arm 7 Left	Inf	46.1 %	1965	1965
				Arm 8 Ahead	Inf	53.9 %		
2/2 (R132)	3.50	0.00	Y	Arm 5 Right	21.00	100.0 %	1834	1834
3/1 (L1390)	3.25	0.00	Y	Arm 8 Left	10.00	100.0 %	1687	1687
3/2 (L1390)	3.25	0.00	Y	Arm 5 Ahead	Inf	100.0 %	1940	1940
3/3 (L1390)	3.50	0.00	Y	Arm 6 Right	16.50	100.0 %	1801	1801
4/1 (Dublin Street)	3.25	0.00	Y	Arm 5 Left	9.50	31.9 %	1847	1847
				Arm 6 Ahead	Inf	68.1 %		
4/2 (Dublin Street)	3.50	0.00	Y	Arm 7 Right	27.00	100.0 %	1862	1862
5/1	3.50	0.00	Y				1965	1965
6/1	3.50	0.00	Y				1965	1965
7/1	Infinite Saturation Flow						Inf	Inf
8/1	Infinite Saturation Flow						Inf	Inf

Scenario 3: 'AM Peak with 20% growth' (FG4: 'AM - 20% growth', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination				
		A	B	C	D	Tot.
Origin	A	0	158	338	180	676
	B	192	0	252	260	704
	C	254	209	0	217	680
	D	212	421	167	0	800
	Tot.	658	788	757	657	2860

Full Input Data And Results

Traffic Lane Flows

Lane	Scenario 3: AM Peak with 20% growth
Junction: Unnamed Junction	
1/1	252
1/2	260
1/3	192
2/1 (with short)	680(In) 471(Out)
2/2 (short)	209
3/1	212
3/2	421
3/3	167
4/1 (with short)	676(In) 496(Out)
4/2 (short)	180
5/1	788
6/1	757
7/1	657
8/1	658

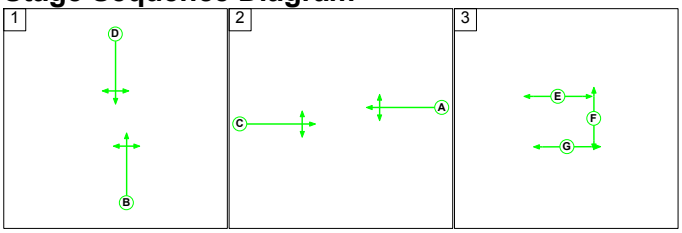
Full Input Data And Results

Lane Saturation Flows

Junction: Unnamed Junction								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (Hamilton Road)	3.25	0.00	Y	Arm 6 Left	10.00	100.0 %	1687	1687
1/2 (Hamilton Road)	3.25	0.00	Y	Arm 7 Ahead	10.00	100.0 %	1687	1687
1/3 (Hamilton Road)	3.25	0.00	N	Arm 8 Right	15.00	100.0 %	1891	1891
2/1 (R132)	3.50	0.00	Y	Arm 7 Left	Inf	46.1 %	1965	1965
				Arm 8 Ahead	Inf	53.9 %		
2/2 (R132)	3.50	0.00	Y	Arm 5 Right	21.00	100.0 %	1834	1834
3/1 (L1390)	3.25	0.00	Y	Arm 8 Left	10.00	100.0 %	1687	1687
3/2 (L1390)	3.25	0.00	Y	Arm 5 Ahead	Inf	100.0 %	1940	1940
3/3 (L1390)	3.50	0.00	Y	Arm 6 Right	16.50	100.0 %	1801	1801
4/1 (Dublin Street)	3.25	0.00	Y	Arm 5 Left	9.50	31.9 %	1847	1847
				Arm 6 Ahead	Inf	68.1 %		
4/2 (Dublin Street)	3.50	0.00	Y	Arm 7 Right	27.00	100.0 %	1862	1862
5/1	3.50	0.00	Y				1965	1965
6/1	3.50	0.00	Y				1965	1965
7/1	Infinite Saturation Flow						Inf	Inf
8/1	Infinite Saturation Flow						Inf	Inf

Scenario 1: 'AM Peak' (FG1: 'AM Peak', Plan 1: 'Network Control Plan 1')

Stage Sequence Diagram

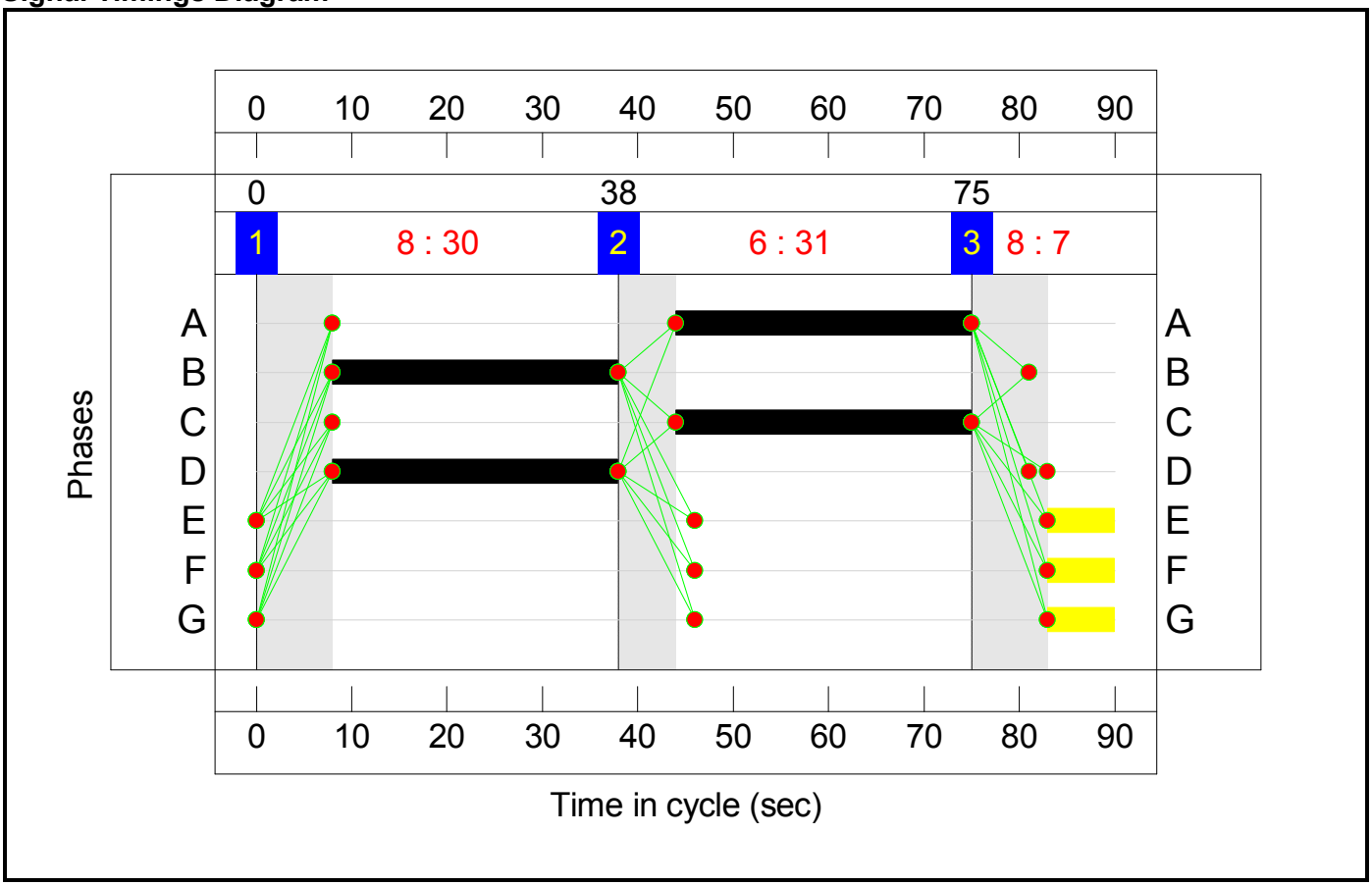


Stage Timings

Stage	1	2	3
Duration	30	31	7
Change Point	0	38	75

Full Input Data And Results

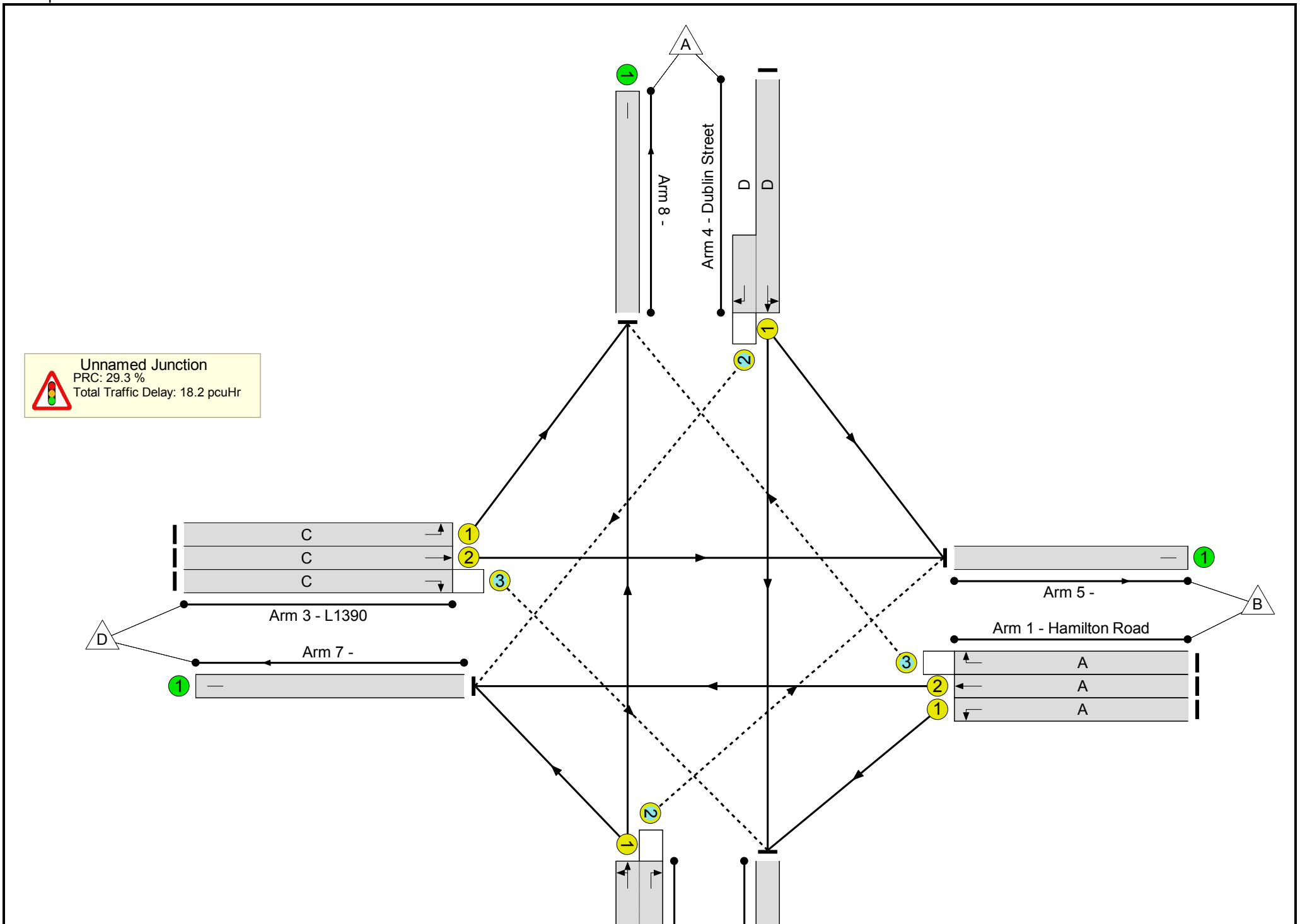
Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram

Full Input Data And Results



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Harry Reynolds Road Pedestrian and Cycle Scheme	-	-	**N/A**	-	-		-	-	-	-	-	-	**69.6%**
Unnamed Junction	-	-	**N/A**	-	-		-	-	-	-	-	-	**69.6%**
1/1	Hamilton Road Left	U	N/A	N/A	A		1	31	-	183	1687	600	30.5%
1/2	Hamilton Road Ahead	U	N/A	N/A	A		1	31	-	189	1687	600	31.5%
1/3	Hamilton Road Right	O	N/A	N/A	A		1	31	-	139	1891	314	44.3%
2/1+2/2	R132 Right Left Ahead	U+O	N/A	N/A	B		1	30	-	492	1965:1834	647+221	52.7 : 68.3%
3/1	L1390 Left	U	N/A	N/A	C		1	31	-	154	1687	600	25.7%
3/2	L1390 Ahead	U	N/A	N/A	C		1	31	-	305	1940	690	44.2%
3/3	L1390 Right	O	N/A	N/A	C		1	31	-	121	1801	389	31.1%
4/1+4/2	Dublin Street Left Ahead Right	U+O	N/A	N/A	D		1	30	-	490	1847:1862	517+187	69.6 : 69.6%
5/1		U	N/A	N/A	-		-	-	-	571	1965	1965	29.1%
6/1		U	N/A	N/A	-		-	-	-	549	1965	1965	27.9%
7/1		U	N/A	N/A	-		-	-	-	476	Inf	Inf	0.0%
8/1		U	N/A	N/A	-		-	-	-	477	Inf	Inf	0.0%

Full Input Data And Results

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Harry Reynolds Road Pedestrian and Cycle Scheme	**-**	**-**	**541**	**0**	**0**	**13.0**	**3.8**	**1.3**	**18.2**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**541**	**0**	**0**	**13.0**	**3.8**	**1.3**	**18.2**	**-**	**-**	**-**	**-**
1/1	183	183	-	-	-	1.1	0.2	-	1.3	25.3	3.3	0.2	3.5
1/2	189	189	-	-	-	1.1	0.2	-	1.3	25.4	3.4	0.2	3.6
1/3	139	139	139	0	0	0.9	0.4	0.3	1.6	40.5	2.9	0.4	3.3
2/1+2/2	492	492	151	0	0	3.3	0.7	0.5	4.4	32.5	6.7	0.7	7.4
3/1	154	154	-	-	-	0.9	0.2	-	1.1	24.6	2.7	0.2	2.9
3/2	305	305	-	-	-	1.9	0.4	-	2.3	26.8	5.8	0.4	6.2
3/3	121	121	121	0	0	0.7	0.2	0.2	1.1	33.1	2.3	0.2	2.5
4/1+4/2	490	490	130	0	0	3.3	1.1	0.3	4.7	34.8	8.4	1.1	9.5
5/1	571	571	-	-	-	0.0	0.2	-	0.2	1.3	0.0	0.2	0.2
6/1	549	549	-	-	-	0.0	0.2	-	0.2	1.3	0.0	0.2	0.2
7/1	476	476	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	477	477	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1

PRC for Signalled Lanes (%): 29.3
PRC Over All Lanes (%): 29.3

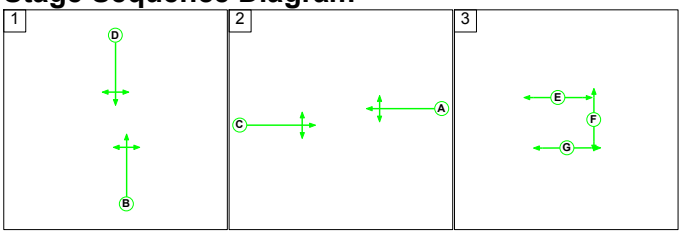
Total Delay for Signalled Lanes (pcuHr): 17.80
Total Delay Over All Lanes(pcuHr): 18.20

Cycle Time (s): 90

Full Input Data And Results

Scenario 2: 'AM Peak with 15% growth' (FG3: 'AM - 15% growth', Plan 1: 'Network Control Plan 1')

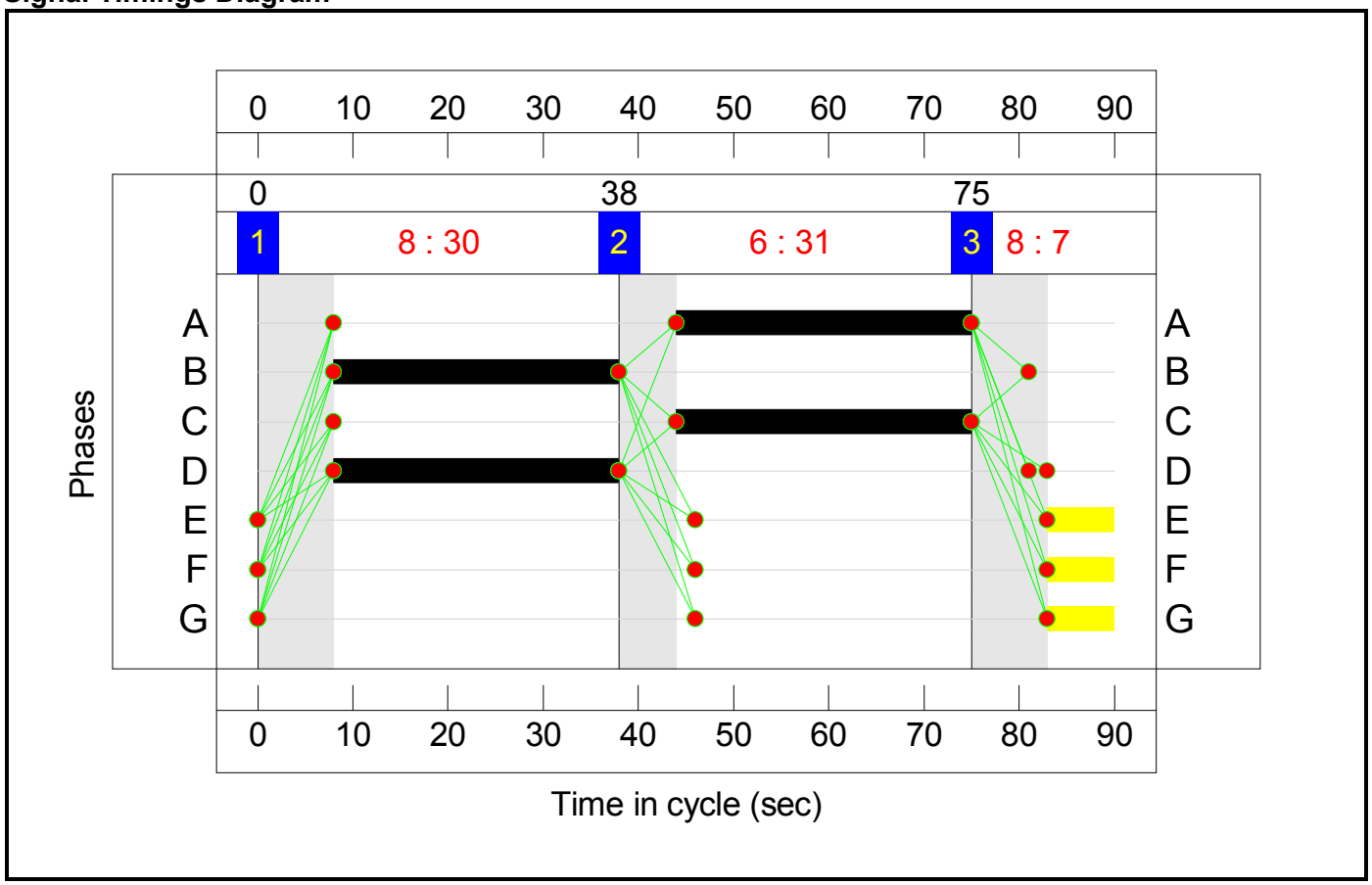
Stage Sequence Diagram



Stage Timings

Stage	1	2	3
Duration	30	31	7
Change Point	0	38	75

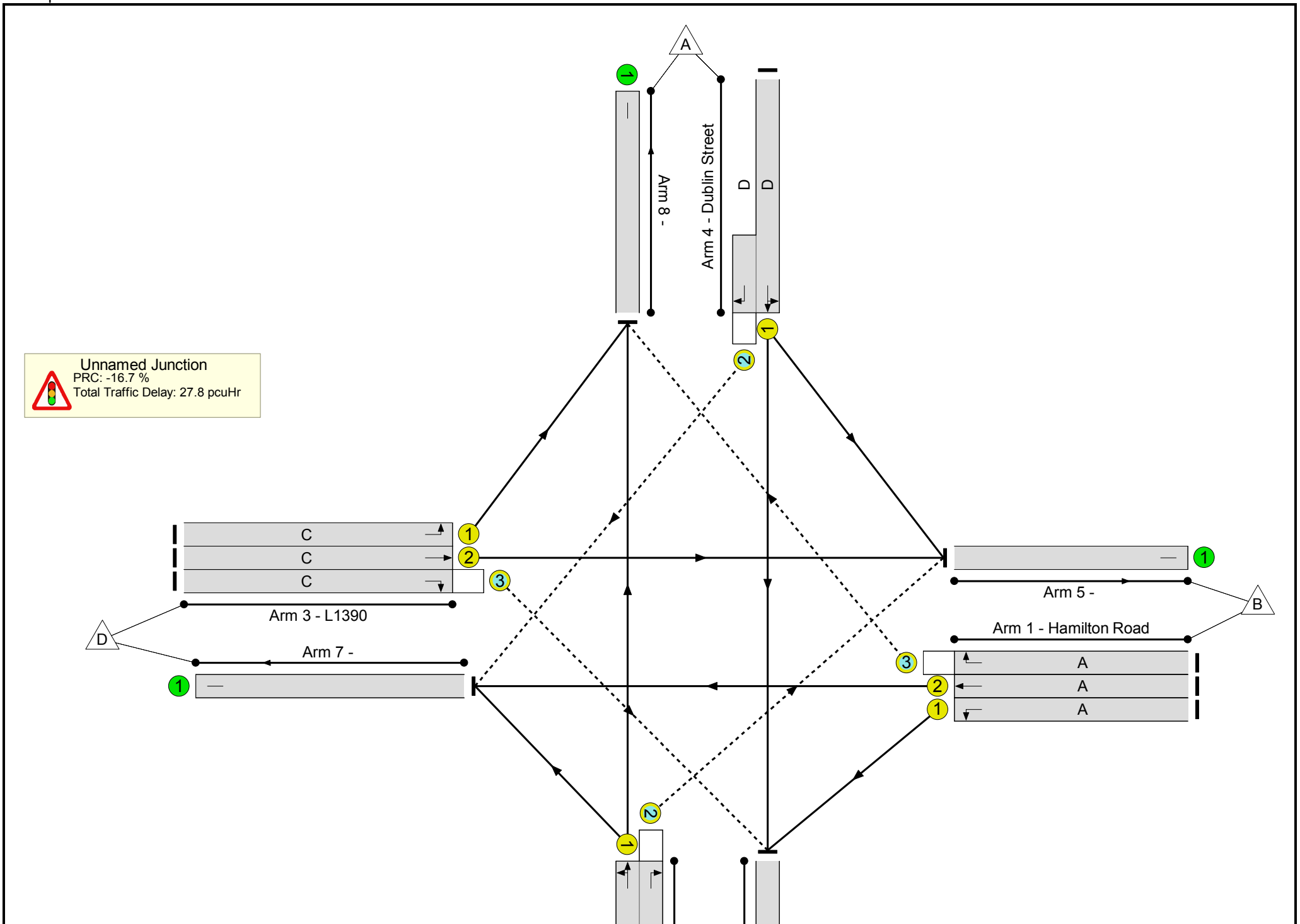
Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram

Full Input Data And Results



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Harry Reynolds Road Pedestrian and Cycle Scheme	-	-	**N/A**	-	-		-	-	-	-	-	-	**105.0%**
Unnamed Junction	-	-	**N/A**	-	-		-	-	-	-	-	-	**105.0%**
1/1	Hamilton Road Left	U	N/A	N/A	A		1	31	-	210	1687	600	35.0%
1/2	Hamilton Road Ahead	U	N/A	N/A	A		1	31	-	217	1687	600	36.2%
1/3	Hamilton Road Right	O	N/A	N/A	A		1	31	-	160	1891	280	57.2%
2/1+2/2	R132 Right Left Ahead	U+O	N/A	N/A	B		1	30	-	567	1965:1834	647+166	60.7 : 105.0%
3/1	L1390 Left	U	N/A	N/A	C		1	31	-	177	1687	600	29.5%
3/2	L1390 Ahead	U	N/A	N/A	C		1	31	-	351	1940	690	50.9%
3/3	L1390 Right	O	N/A	N/A	C		1	31	-	139	1801	364	38.2%
4/1+4/2	Dublin Street Left Ahead Right	U+O	N/A	N/A	D		1	30	-	564	1847:1862	517+187	80.1 : 80.1%
5/1		U	N/A	N/A	-		-	-	-	657	1965	1965	33.0%
6/1		U	N/A	N/A	-		-	-	-	631	1965	1965	32.1%
7/1		U	N/A	N/A	-		-	-	-	548	Inf	Inf	0.0%
8/1		U	N/A	N/A	-		-	-	-	549	Inf	Inf	0.0%

Full Input Data And Results

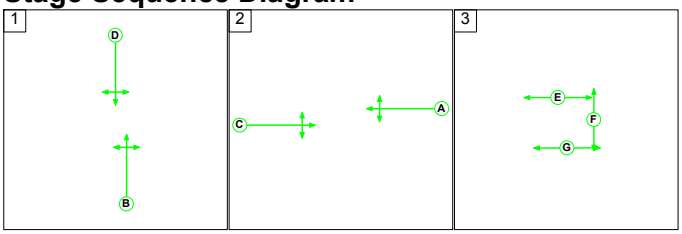
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Harry Reynolds Road Pedestrian and Cycle Scheme	**-**	**-**	**557**	**0**	**58**	**16.1**	**10.0**	**1.7**	**27.8**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**557**	**0**	**58**	**16.1**	**10.0**	**1.7**	**27.8**	**-**	**-**	**-**	**-**
1/1	210	210	-	-	-	1.2	0.3	-	1.5	26.0	3.8	0.3	4.1
1/2	217	217	-	-	-	1.3	0.3	-	1.6	26.2	4.0	0.3	4.3
1/3	160	160	160	0	0	1.1	0.7	0.4	2.1	47.9	3.4	0.7	4.1
2/1+2/2	567	559	108	0	58	4.4	5.3	0.6	10.3	65.5	8.0	5.3	13.3
3/1	177	177	-	-	-	1.0	0.2	-	1.2	25.1	3.1	0.2	3.4
3/2	351	351	-	-	-	2.2	0.5	-	2.7	28.1	6.8	0.5	7.3
3/3	139	139	139	0	0	0.8	0.3	0.2	1.4	36.0	2.7	0.3	3.0
4/1+4/2	564	564	150	0	0	4.0	2.0	0.4	6.4	40.7	10.7	2.0	12.7
5/1	649	649	-	-	-	0.0	0.2	-	0.2	1.4	0.0	0.2	0.2
6/1	631	631	-	-	-	0.0	0.2	-	0.2	1.3	0.0	0.2	0.2
7/1	548	548	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	549	549	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): -16.7 Total Delay for Signalled Lanes (pcuHr): 27.29 Cycle Time (s): 90
PRC Over All Lanes (%): -16.7 Total Delay Over All Lanes(pcuHr): 27.77

Full Input Data And Results

Scenario 3: 'AM Peak with 20% growth' (FG4: 'AM - 20% growth', Plan 1: 'Network Control Plan 1')

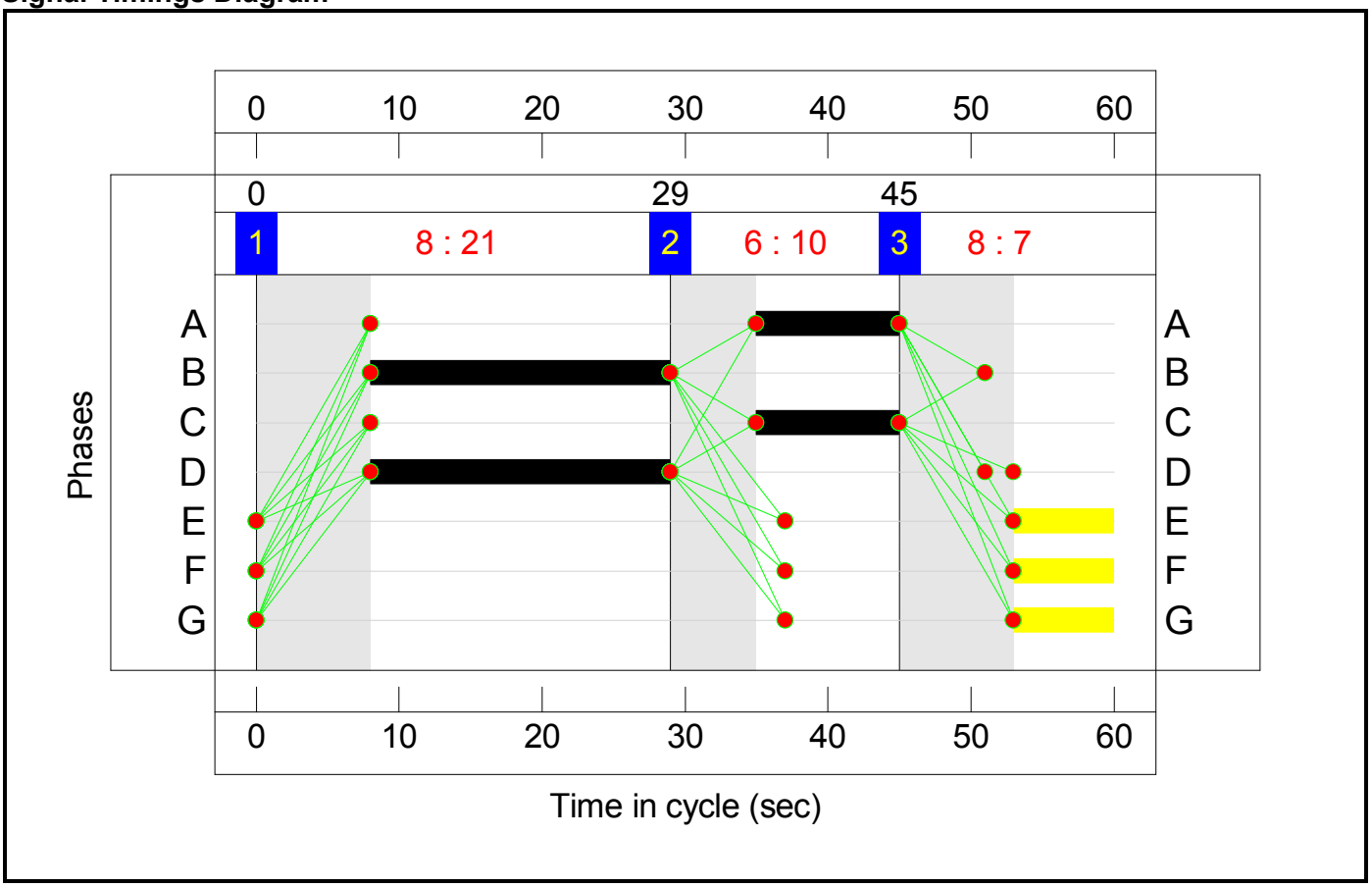
Stage Sequence Diagram



Stage Timings

Stage	1	2	3
Duration	21	10	7
Change Point	0	29	45

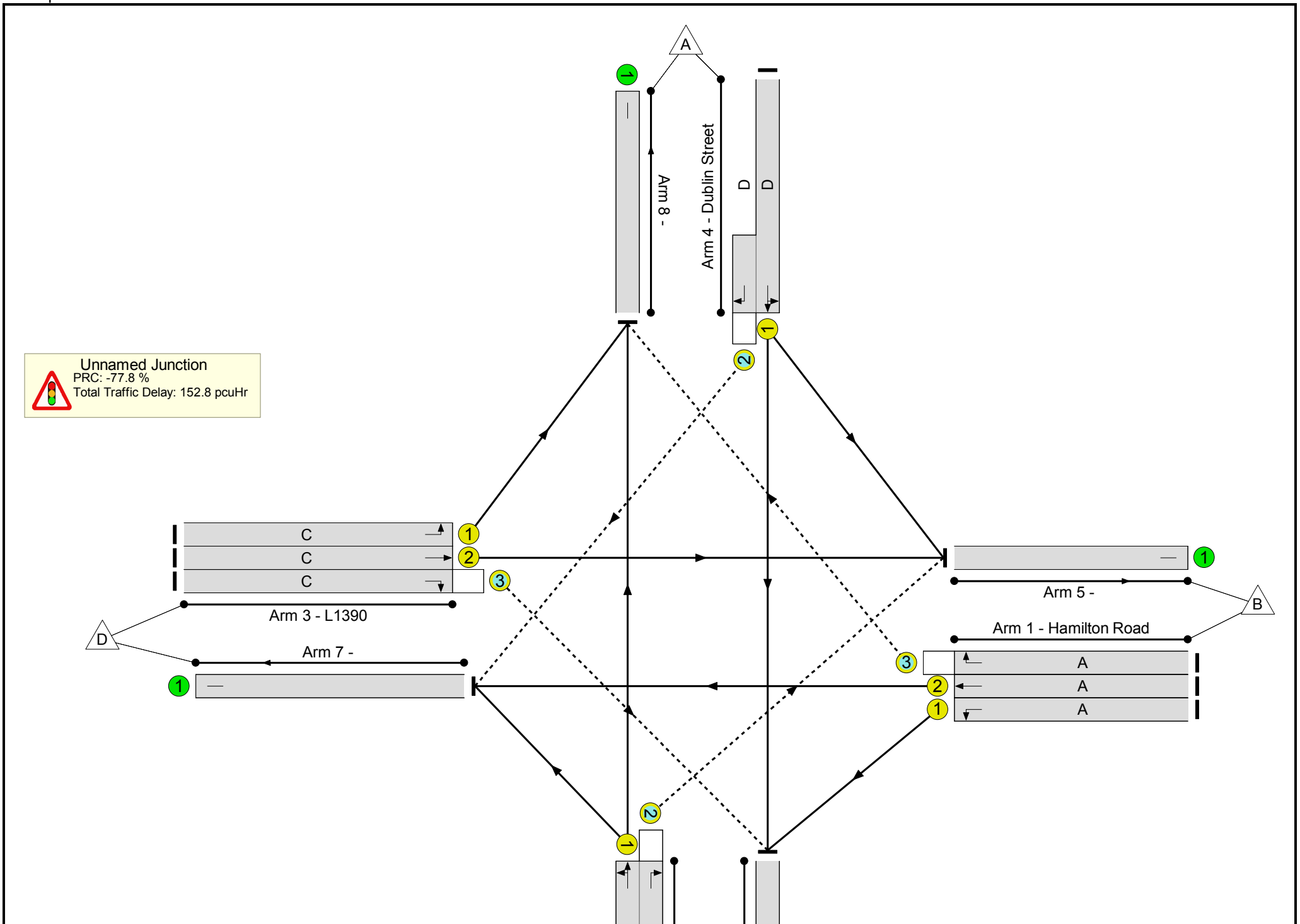
Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram

Full Input Data And Results



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Harry Reynolds Road Pedestrian and Cycle Scheme	-	-	**N/A**	-	-		-	-	-	-	-	-	**160.0%**
Unnamed Junction	-	-	**N/A**	-	-		-	-	-	-	-	-	**160.0%**
1/1	Hamilton Road Left	U	N/A	N/A	A		1	10	-	252	1687	309	81.5%
1/2	Hamilton Road Ahead	U	N/A	N/A	A		1	10	-	260	1687	309	84.1%
1/3	Hamilton Road Right	O	N/A	N/A	A		1	10	-	192	1891	120	160.0%
2/1+2/2	R132 Right Left Ahead	U+O	N/A	N/A	B		1	21	-	680	1965:1834	721+168	65.4 : 124.2%
3/1	L1390 Left	U	N/A	N/A	C		1	10	-	212	1687	309	68.5%
3/2	L1390 Ahead	U	N/A	N/A	C		1	10	-	421	1940	356	118.4%
3/3	L1390 Right	O	N/A	N/A	C		1	10	-	167	1801	120	139.2%
4/1+4/2	Dublin Street Left Ahead Right	U+O	N/A	N/A	D		1	21	-	676	1847:1862	572+207	86.8 : 86.8%
5/1		U	N/A	N/A	-		-	-	-	788	1965	1965	34.7%
6/1		U	N/A	N/A	-		-	-	-	757	1965	1965	36.1%
7/1		U	N/A	N/A	-		-	-	-	657	Inf	Inf	0.0%
8/1		U	N/A	N/A	-		-	-	-	658	Inf	Inf	0.0%

Full Input Data And Results

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Harry Reynolds Road Pedestrian and Cycle Scheme	**-**	**-**	**271**	**0**	**317**	**21.8**	**129.2**	**1.9**	**152.8**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**271**	**0**	**317**	**21.8**	**129.2**	**1.9**	**152.8**	**-**	**-**	**-**	**-**
1/1	252	252	-	-	-	1.6	2.1	-	3.7	52.9	4.0	2.1	6.0
1/2	260	260	-	-	-	1.7	2.4	-	4.1	56.9	4.1	2.4	6.5
1/3	192	120	0	0	120	3.3	37.3	0.4	41.0	768.0	5.0	37.3	42.2
2/1+2/2	680	639	78	0	90	4.1	21.9	0.7	26.7	141.5	6.4	21.9	28.3
3/1	212	212	-	-	-	1.3	1.1	-	2.4	41.0	3.3	1.1	4.4
3/2	421	356	-	-	-	4.3	35.6	-	39.9	341.2	8.1	35.6	43.7
3/3	167	120	39	0	81	2.3	25.2	0.3	27.7	598.1	3.8	25.2	29.0
4/1+4/2	676	676	154	0	26	3.1	3.1	0.5	6.7	35.6	8.3	3.1	11.4
5/1	682	682	-	-	-	0.0	0.3	-	0.3	1.4	0.0	0.3	0.3
6/1	710	710	-	-	-	0.0	0.3	-	0.3	1.4	0.0	0.3	0.3
7/1	657	657	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	586	586	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0

C1 PRC for Signalled Lanes (%): -77.8 Total Delay for Signalled Lanes (pcuHr): 152.25 Cycle Time (s): 60
PRC Over All Lanes (%): -77.8 Total Delay Over All Lanes(pcuHr): 152.80

Junctions 9

ARCADY 9 - Roundabout Module

Filename: Moylaragh Road - Harry Reynolds Road Cycle Friendly Roundabout.j9
Path: U:\5165984\7 Calcs\72Model
Report generation date: 17/10/2018 11:02:28

Summary of junction performance

	AM				PM			
	Queue (PCU)	Delay (s)	RFC	LOS	Queue (PCU)	Delay (s)	RFC	LOS
	2018							
Arm 1	1.8	15.78	0.65	C	0.6	9.42	0.39	A
Arm 2	1.8	19.95	0.65	C	0.8	11.20	0.43	B
Arm 3	0.7	12.14	0.43	B	1.8	19.62	0.65	C

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle.

File summary

File Description

Title	(untitled)
Location	
Site number	
Date	09/05/2018
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	ATKINSMCCARTHY\MCollins
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin

Analysis Options

Calculate Queue Percentiles	Calculate residual capacity	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
		0.85	36.00	20.00

Demand Set Summary

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	2018	AM	ONE HOUR	08:00	09:30	15
D2	2018	PM	ONE HOUR	17:00	18:30	15

Analysis Set Details

ID	Network flow scaling factor (%)
A1	100.000

2018, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.

Junction Network

Junctions

Junction	Name	Junction Type	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	16.38	C

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Arm	Name	Description
1	untitled	
2	untitled	
3	untitled	

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
1	3.00	3.00	0.0	7.3	32.0	74.0	
2	3.00	3.00	0.0	4.2	32.0	69.0	
3	3.00	3.00	0.0	3.6	32.0	80.0	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Final slope	Final intercept (PCU/hr)
1	0.377	693
2	0.337	619
3	0.298	549

The slope and intercept shown above include any corrections and adjustments.

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D1	2018	AM	ONE HOUR	08:00	09:30	15

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		✓	377	100.000
2		✓	306	100.000
3		✓	203	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		1	2	3
From	1	0	101	276
	2	88	0	218
	3	82	121	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		1	2	3
From	1	0	0	0
	2	0	0	0
	3	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max delay (s)	Max Queue (PCU)	Max LOS
1	0.65	15.78	1.8	C
2	0.65	19.95	1.8	C
3	0.43	12.14	0.7	B

Main Results for each time segment

08:00 - 08:15

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	284	90	659	0.431	281	0.7	9.451	A
2	230	206	550	0.419	228	0.7	11.085	B
3	153	65	529	0.289	151	0.4	9.484	A

08:15 - 08:30

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	339	108	652	0.520	338	1.1	11.405	B
2	275	247	536	0.514	274	1.0	13.681	B
3	182	79	525	0.347	182	0.5	10.470	B

08:30 - 08:45

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	415	133	643	0.646	412	1.7	15.425	C
2	337	302	517	0.651	334	1.8	19.326	C
3	224	96	520	0.430	223	0.7	12.064	B

08:45 - 09:00

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	415	133	643	0.646	415	1.8	15.776	C
2	337	304	517	0.652	337	1.8	19.951	C
3	224	97	520	0.430	223	0.7	12.140	B

09:00 - 09:15

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	339	109	652	0.520	342	1.1	11.708	B
2	275	250	535	0.515	278	1.1	14.184	B
3	182	80	525	0.348	183	0.5	10.564	B

09:15 - 09:30

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	284	91	658	0.431	285	0.8	9.681	A
2	230	209	549	0.420	232	0.7	11.418	B
3	153	67	529	0.289	153	0.4	9.599	A

2018, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Vehicle Mix		HV% is zero for all movements / time segments. Vehicle Mix matrix should be completed whether working in PCUs or Vehs.

Junction Network

Junctions

Junction	Name	Junction Type	Junction Delay (s)	Junction LOS
1	untitled	Standard Roundabout	14.13	B

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Traffic Demand

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)
D2	2018	PM	ONE HOUR	17:00	18:30	15

Vehicle mix source	PCU Factor for a HV (PCU)
HV Percentages	2.00

Demand overview (Traffic)

Arm	Linked arm	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
1		✓	224	100.000
2		✓	224	100.000
3		✓	311	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		1	2	3
From	1	0	87	137
	2	72	0	152
	3	156	155	0

Vehicle Mix

Heavy Vehicle Percentages

		To		
		1	2	3
From	1	0	0	0
	2	0	0	0
	3	0	0	0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max delay (s)	Max Queue (PCU)	Max LOS
1	0.39	9.42	0.6	A
2	0.43	11.20	0.8	B
3	0.65	19.62	1.8	C

Main Results for each time segment

17:00 - 17:15

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	169	115	649	0.260	167	0.3	7.444	A
2	169	102	584	0.289	167	0.4	8.595	A
3	234	54	533	0.439	231	0.8	11.818	B

17:15 - 17:30

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	201	139	641	0.314	201	0.5	8.179	A
2	201	123	577	0.349	201	0.5	9.546	A
3	280	65	530	0.528	278	1.1	14.253	B

17:30 - 17:45

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	247	169	629	0.392	246	0.6	9.377	A
2	247	150	568	0.434	246	0.8	11.132	B
3	342	79	525	0.652	340	1.8	19.106	C

17:45 - 18:00

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	247	171	629	0.392	247	0.6	9.422	A
2	247	151	568	0.434	247	0.8	11.199	B
3	342	79	525	0.652	342	1.8	19.625	C

18:00 - 18:15

Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	201	141	640	0.315	202	0.5	8.235	A
2	201	124	577	0.349	202	0.5	9.623	A
3	280	65	529	0.528	282	1.2	14.718	B

18:15 - 18:30

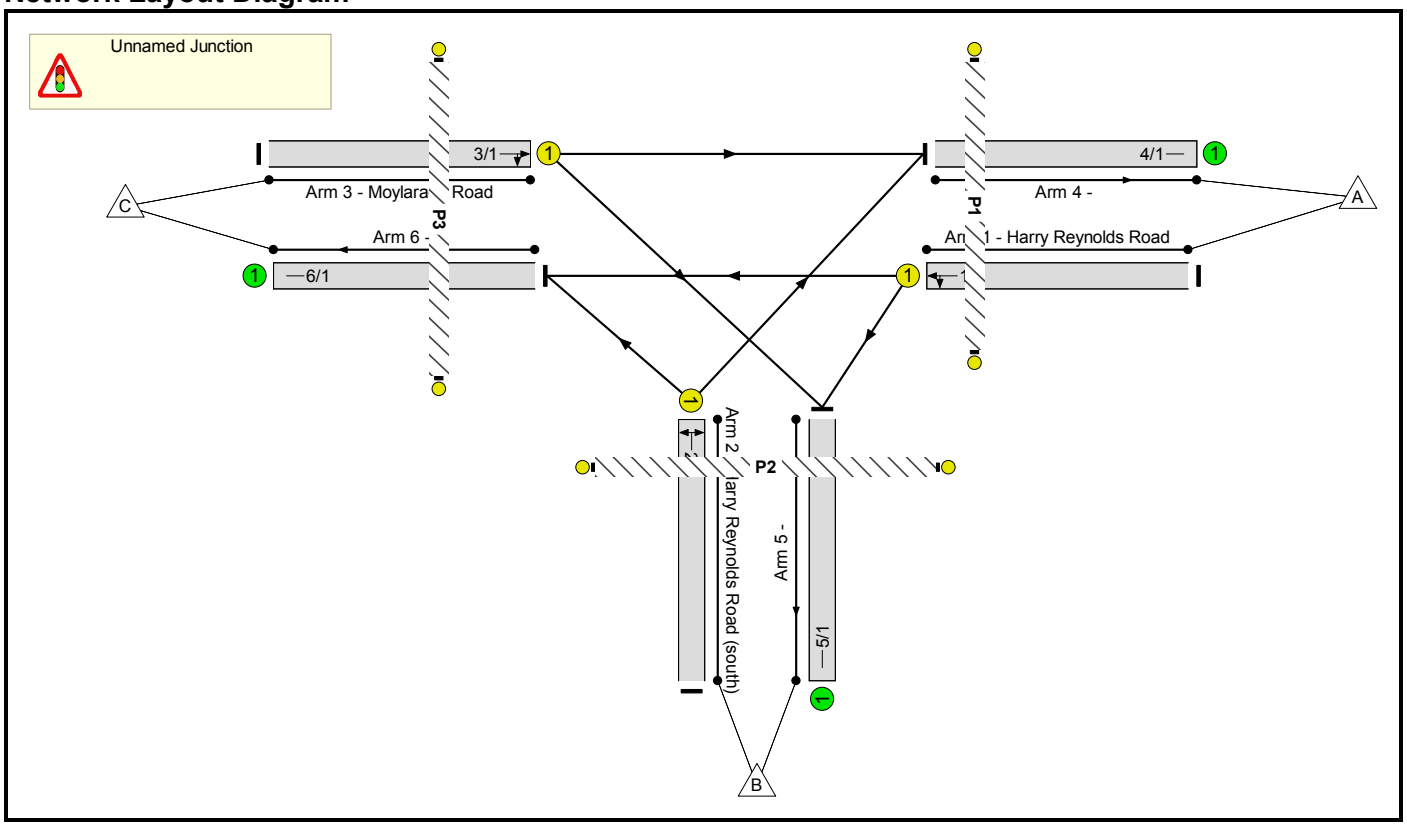
Arm	Total Demand (PCU/hr)	Circulating flow (PCU/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	End queue (PCU)	Delay (s)	LOS
1	169	117	649	0.260	169	0.4	7.512	A
2	169	103	584	0.289	169	0.4	8.689	A
3	234	54	533	0.440	236	0.8	12.177	B

Full Input Data And Results

User and Project Details

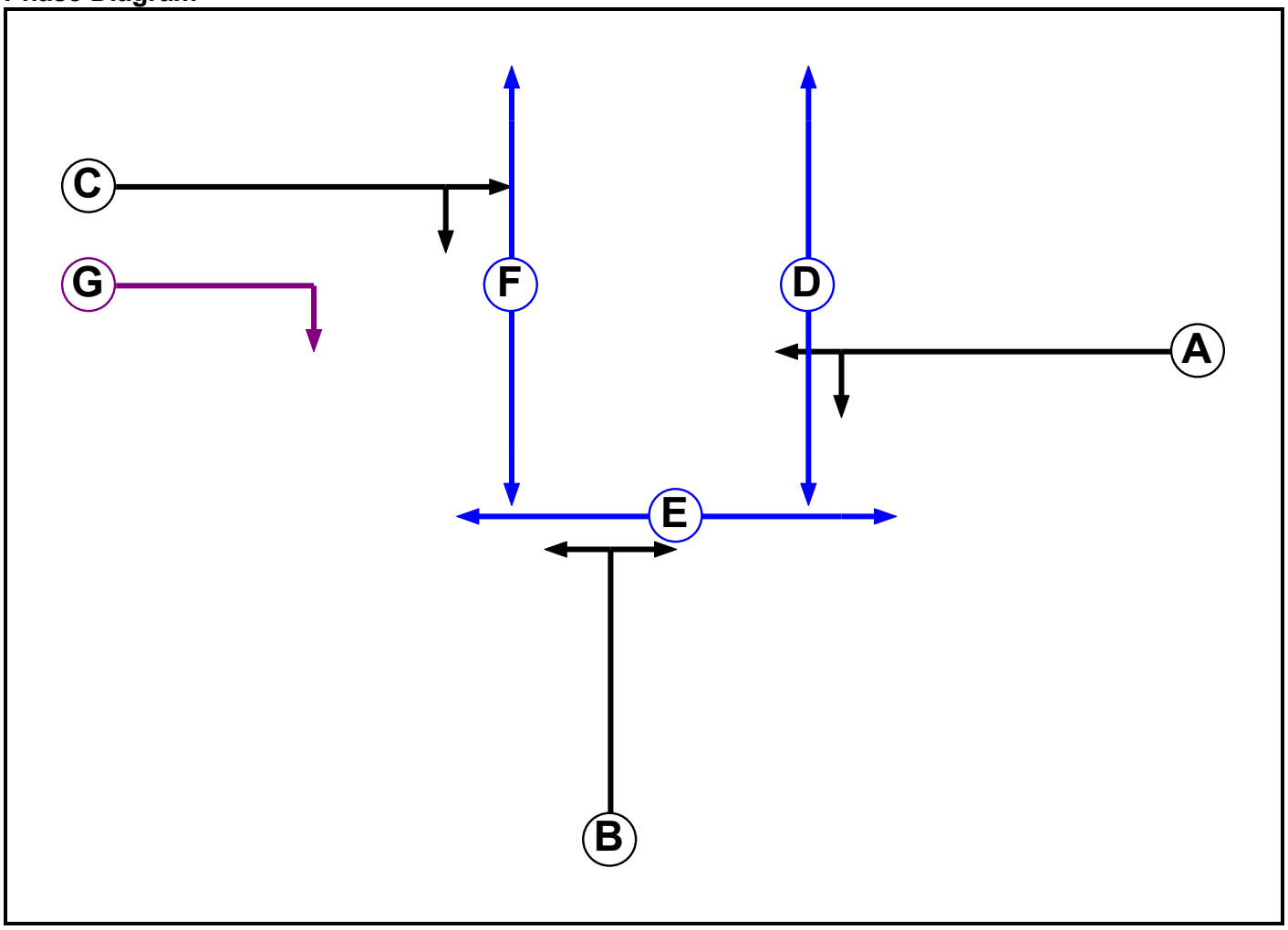
Project:	**Moylaragh Road - Harry Reynolds Road Roundabout Reconfiguration to Signalised Junction**
Title:	**Harry Reynolds Road Pedestrian and Cycle Scheme**
Location:	Moylaragh Road - Harry Reynolds Road Roundabout
Client:	Fingal County Council
Additional detail:	
File name:	Junction 1.lsg3x
Author:	Ben Holland
Company:	Atkins
Address:	150 Lakeside Drive, Airside Business Park, Swords, Co. Dublin

Network Layout Diagram



Full Input Data And Results

Phase Diagram



Phase Input Data

Phase Name	Phase Type	Assoc. Phase	Street Min	Cont Min
A	Traffic		7	7
B	Traffic		7	7
C	Traffic		7	7
D	Pedestrian		5	5
E	Pedestrian		5	5
F	Pedestrian		5	5
G	Ind. Arrow	C	5	5

Full Input Data And Results

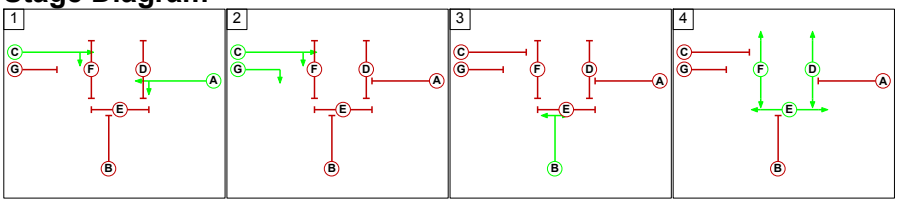
Phase Intergreens Matrix

Terminating Phase	Starting Phase							
		A	B	C	D	E	F	G
	A		5	-	7	7	7	5
	B	5		5	7	7	7	5
	C	-	5		7	7	7	-
	D	8	8	8		-	-	8
	E	8	8	8	-		-	8
	F	8	8	8	-	-		8
	G	5	5	-	7	7	7	

Phases in Stage

Stage No.	Phases in Stage
1	A C
2	C G
3	B
4	D E F

Stage Diagram



Phase Delays

Term. Stage	Start Stage	Phase	Type	Value	Cont value
There are no Phase Delays defined					

Prohibited Stage Change

From Stage	To Stage				
		1	2	3	4
	1		5	5	7
	2	5		5	7
	3	5	5		7
	4	8	8	8	

Full Input Data And Results

Give-Way Lane Input Data

Junction: Unnamed Junction
There are no Opposed Lanes in this Junction

Full Input Data And Results

Lane Input Data

Junction: Unnamed Junction												
Lane	**Lane Type**	**Phases**	**Start Disp.**	**End Disp.**	**Physical Length (PCU)**	**Sat Flow Type**	**Def User Saturation Flow (PCU/Hr)**	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Turns**	**Turning Radius (m)**
1/1 (Harry Reynolds Road)	U	A	2	3	60.0	Geom	-	3.50	0.00	Y	Arm 5 Left	10.00
											Arm 6 Ahead	Inf
2/1 (Harry Reynolds Road (south))	U	B	2	3	60.0	Geom	-	3.50	0.00	Y	Arm 4 Right	13.50
											Arm 6 Left	9.50
3/1 (Moylaragh Road)	U	C G	2	3	60.0	Geom	-	3.50	0.00	Y	Arm 4 Ahead	Inf
											Arm 5 Right	14.00
4/1	U		2	3	60.0	Geom	-	3.50	0.00	Y		
5/1	U		2	3	60.0	Geom	-	3.50	0.00	Y		
6/1	U		2	3	60.0	Geom	-	3.50	0.00	Y		

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
1: '2018 AM'	08:00	09:00	01:00	
2: '2018 PM'	17:00	18:00	01:00	

Scenario 1: 'AM Peak' (FG1: '2018 AM', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	218	88	306
	B	121	0	82	203
	C	101	276	0	377
	Tot.	222	494	170	886

Traffic Lane Flows

Lane	Scenario 1: AM Peak
Junction: Unnamed Junction	
1/1	306
2/1	203
3/1	377
4/1	222
5/1	494
6/1	170

Full Input Data And Results

Lane Saturation Flows

Junction: Unnamed Junction								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (Harry Reynolds Road)	3.50	0.00	Y	Arm 5 Left	10.00	71.2 %	1775	1775
				Arm 6 Ahead	Inf	28.8 %		
2/1 (Harry Reynolds Road (south))	3.50	0.00	Y	Arm 4 Right	13.50	59.6 %	1739	1739
				Arm 6 Left	9.50	40.4 %		
3/1 (Moylaragh Road)	3.50	0.00	Y	Arm 4 Ahead	Inf	26.8 %	1822	1822
				Arm 5 Right	14.00	73.2 %		
4/1	3.50	0.00	Y				1965	1965
5/1	3.50	0.00	Y				1965	1965
6/1	3.50	0.00	Y				1965	1965

Scenario 2: 'PM Peak' (FG2: '2018 PM', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	152	72	224
	B	155	0	156	311
	C	87	137	0	224
	Tot.	242	289	228	759

Traffic Lane Flows

Lane	Scenario 2: PM Peak
Junction: Unnamed Junction	
1/1	224
2/1	311
3/1	224
4/1	242
5/1	289
6/1	228

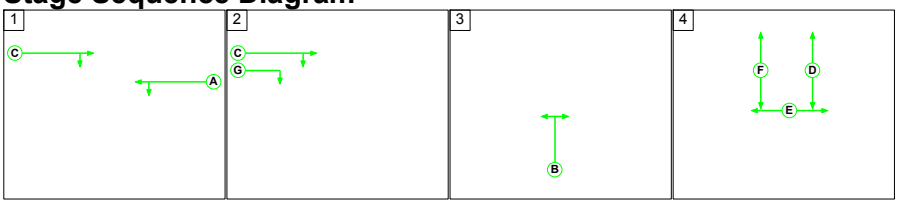
Full Input Data And Results

Lane Saturation Flows

Junction: Unnamed Junction								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (Harry Reynolds Road)	3.50	0.00	Y	Arm 5 Left	10.00	67.9 %	1783	1783
				Arm 6 Ahead	Inf	32.1 %		
2/1 (Harry Reynolds Road (south))	3.50	0.00	Y	Arm 4 Right	13.50	49.8 %	1732	1732
				Arm 6 Left	9.50	50.2 %		
3/1 (Moylaragh Road)	3.50	0.00	Y	Arm 4 Ahead	Inf	38.8 %	1844	1844
				Arm 5 Right	14.00	61.2 %		
4/1	3.50	0.00	Y				1965	1965
5/1	3.50	0.00	Y				1965	1965
6/1	3.50	0.00	Y				1965	1965

Scenario 1: 'AM Peak' (FG1: '2018 AM', Plan 1: 'Network Control Plan 1')

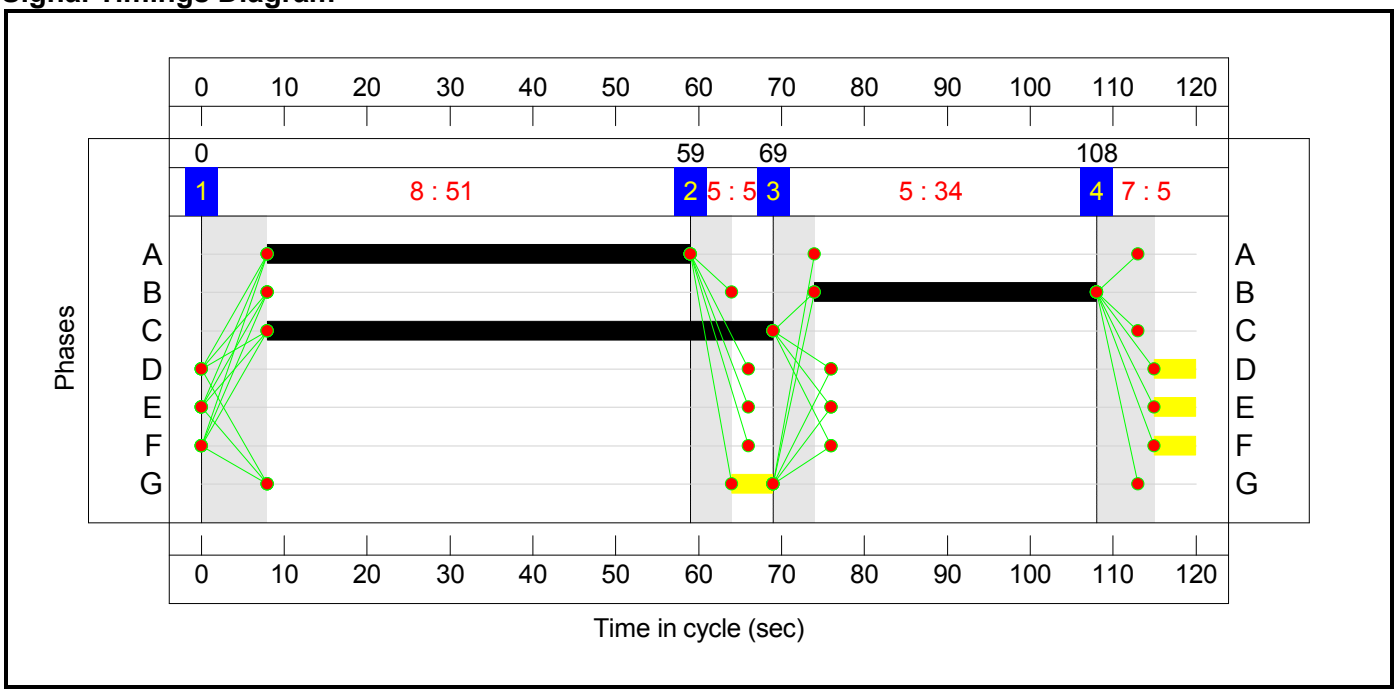
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	51	5	34	5
Change Point	0	59	69	108

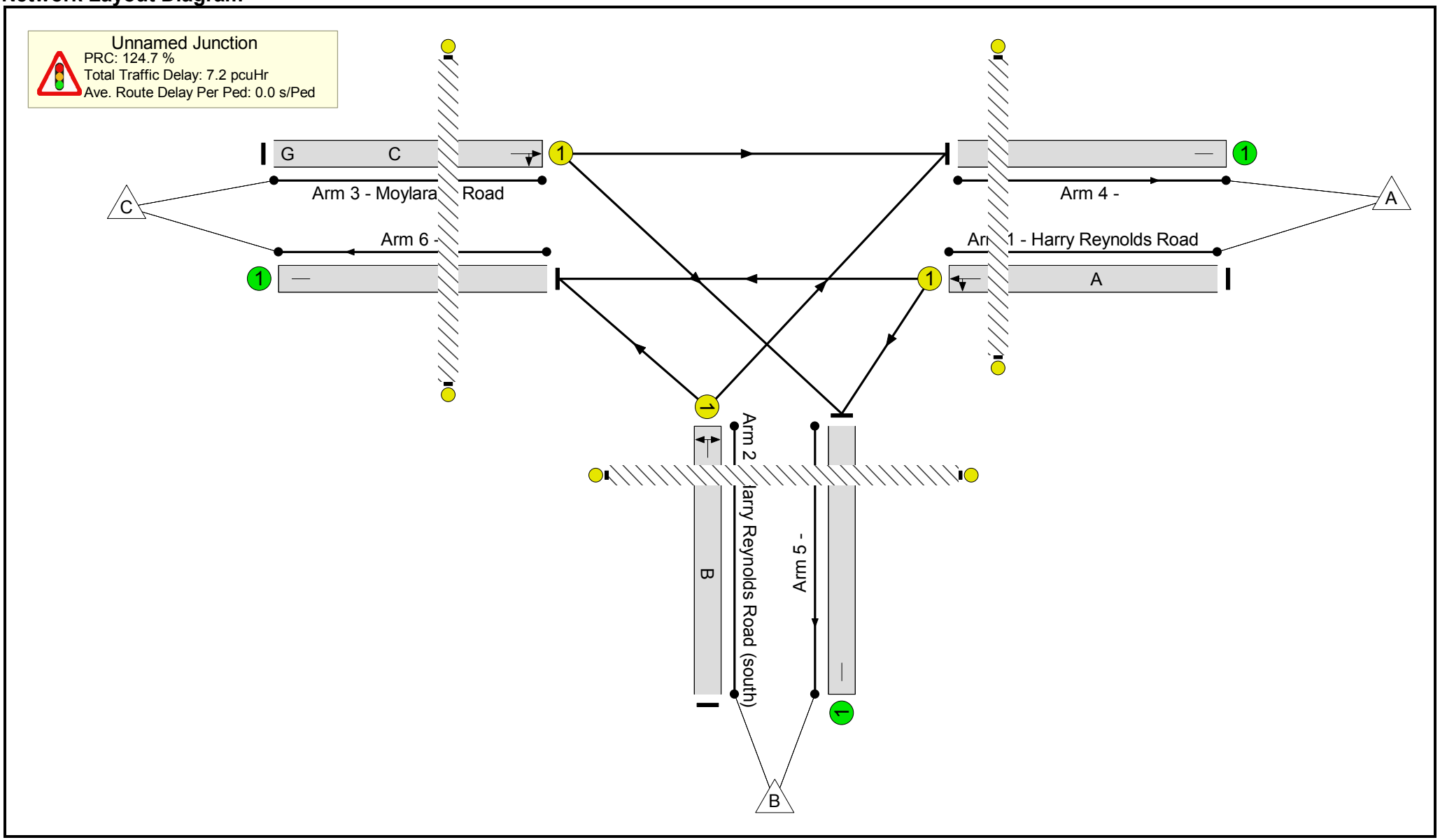
Signal Timings Diagram



Full Input Data And Results

Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Harry Reynolds Road Pedestrian and Cycle Scheme	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**40.0%**
Unnamed Junction	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**40.0%**
1/1	Harry Reynolds Road Left Ahead	U	N/A	N/A	A		1	51	-	306	1775	769	39.8%
2/1	Harry Reynolds Road (south) Right Left	U	N/A	N/A	B		1	34	-	203	1739	507	40.0%
3/1	Moylaragh Road Ahead Right	U	N/A	N/A	C	G	1	61	5	377	1822	941	40.0%
4/1		U	N/A	N/A	-		-	-	-	222	1965	1965	11.3%
5/1		U	N/A	N/A	-		-	-	-	494	1965	1965	25.1%
6/1		U	N/A	N/A	-		-	-	-	170	1965	1965	8.7%
Ped Link: P1	Unnamed Ped Link	-	-	-			0	0	-	0	-	0	0.0%
Ped Link: P2	Unnamed Ped Link	-	-	-			0	0	-	0	-	0	0.0%
Ped Link: P3	Unnamed Ped Link	-	-	-			0	0	-	0	-	0	0.0%

Full Input Data And Results

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Harry Reynolds Road Pedestrian and Cycle Scheme	**-**	**-**	**0**	**0**	**0**	**5.9**	**1.3**	**0.0**	**7.2**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**5.9**	**1.3**	**0.0**	**7.2**	**-**	**-**	**-**	**-**
1/1	306	306	-	-	-	2.0	0.3	-	2.3	27.2	7.0	0.3	7.3
2/1	203	203	-	-	-	1.9	0.3	-	2.3	40.0	5.4	0.3	5.7
3/1	377	377	-	-	-	1.9	0.3	-	2.2	20.9	7.6	0.3	8.0
4/1	222	222	-	-	-	0.0	0.1	-	0.1	1.0	0.0	0.1	0.1
5/1	494	494	-	-	-	0.1	0.2	-	0.3	2.3	10.4	0.2	10.6
6/1	170	170	-	-	-	0.0	0.0	-	0.0	1.0	0.0	0.0	0.0
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf
Ped Link: P2	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf
Ped Link: P3	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1

PRC for Signalled Lanes (%): 124.7
PRC Over All Lanes (%): 124.7

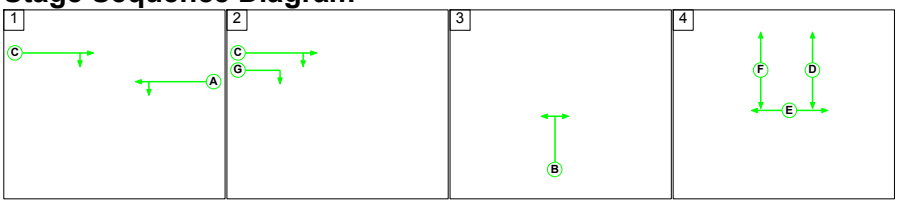
Total Delay for Signalled Lanes (pcuHr): 6.75
Total Delay Over All Lanes(pcuHr): 7.18

Cycle Time (s): 120

Full Input Data And Results

Scenario 2: 'PM Peak' (FG2: '2018 PM', Plan 1: 'Network Control Plan 1')

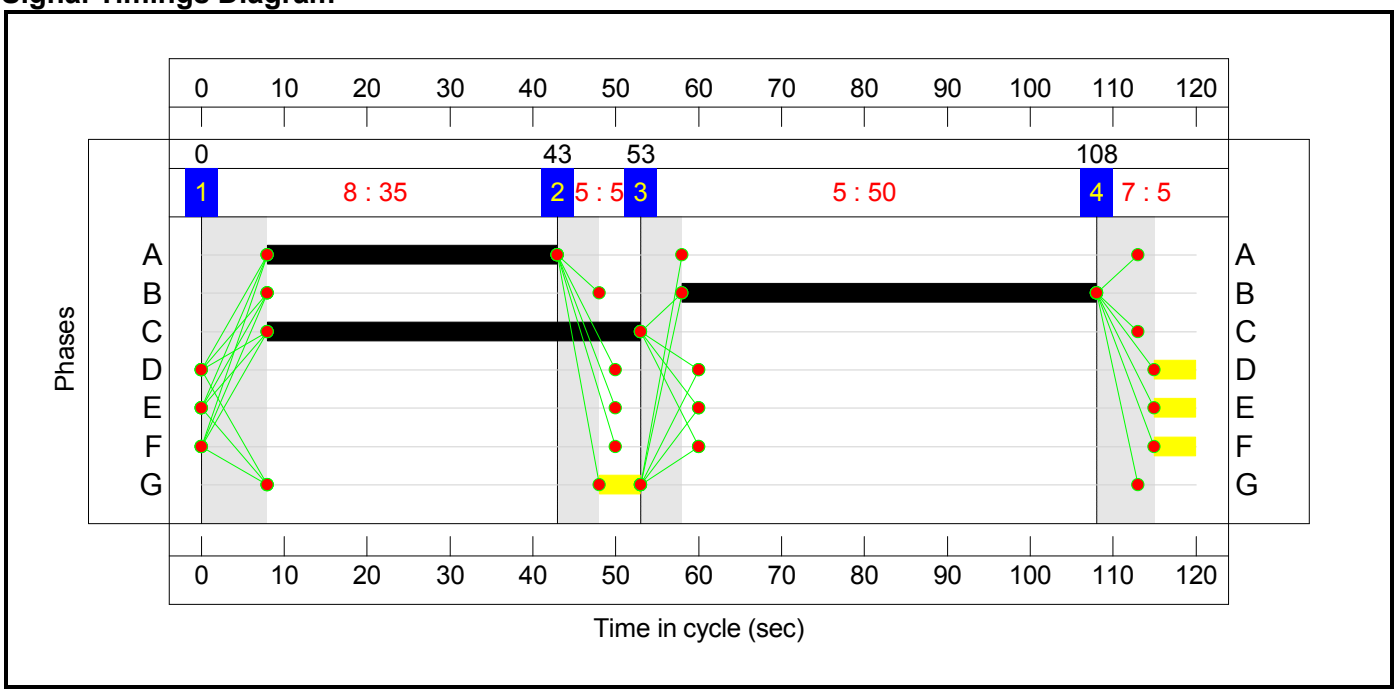
Stage Sequence Diagram



Stage Timings

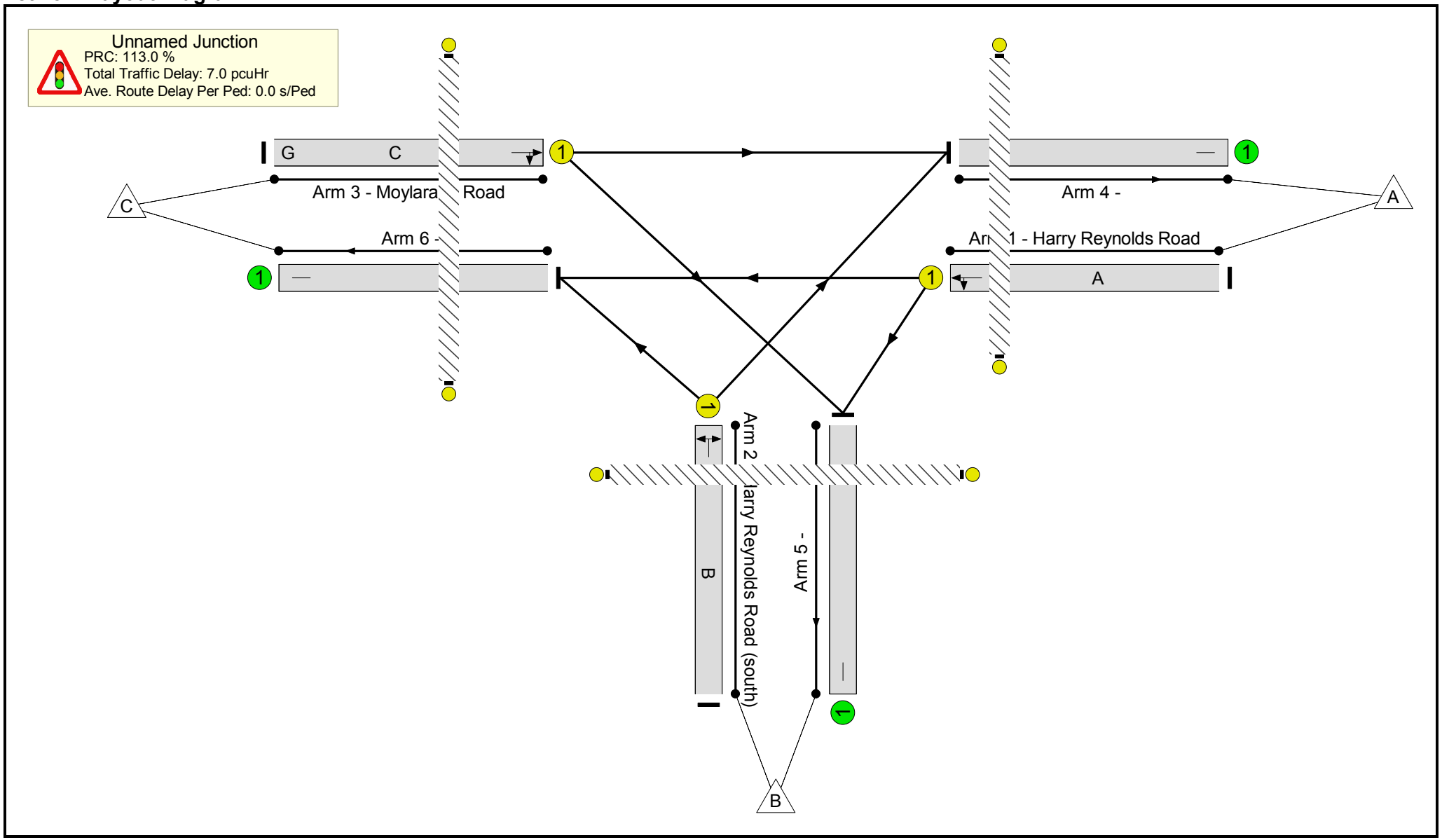
Stage	1	2	3	4
Duration	35	5	50	5
Change Point	0	43	53	108

Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Harry Reynolds Road Pedestrian and Cycle Scheme	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**42.2%**
Unnamed Junction	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**42.2%**
1/1	Harry Reynolds Road Left Ahead	U	N/A	N/A	A		1	35	-	224	1783	535	41.9%
2/1	Harry Reynolds Road (south) Right Left	U	N/A	N/A	B		1	50	-	311	1732	736	42.2%
3/1	Moylaragh Road Ahead Right	U	N/A	N/A	C	G	1	45	5	224	1844	707	31.7%
4/1		U	N/A	N/A	-		-	-	-	242	1965	1965	12.3%
5/1		U	N/A	N/A	-		-	-	-	289	1965	1965	14.7%
6/1		U	N/A	N/A	-		-	-	-	228	1965	1965	11.6%
Ped Link: P1	Unnamed Ped Link	-	-	-			0	0	-	0	-	0	0.0%
Ped Link: P2	Unnamed Ped Link	-	-	-			0	0	-	0	-	0	0.0%
Ped Link: P3	Unnamed Ped Link	-	-	-			0	0	-	0	-	0	0.0%

Full Input Data And Results

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Harry Reynolds Road Pedestrian and Cycle Scheme	**-**	**-**	**0**	**0**	**0**	**5.8**	**1.2**	**0.0**	**7.0**	**-**	**-**	**-**	**-**
Unnamed Junction	**-**	**-**	**0**	**0**	**0**	**5.8**	**1.2**	**0.0**	**7.0**	**-**	**-**	**-**	**-**
1/1	224	224	-	-	-	2.1	0.4	-	2.5	39.4	6.0	0.4	6.3
2/1	311	311	-	-	-	2.1	0.4	-	2.5	28.4	7.3	0.4	7.6
3/1	224	224	-	-	-	1.6	0.2	-	1.8	29.7	5.2	0.2	5.5
4/1	242	242	-	-	-	0.0	0.1	-	0.1	1.0	0.0	0.1	0.1
5/1	289	289	-	-	-	0.0	0.1	-	0.1	1.4	5.7	0.1	5.8
6/1	228	228	-	-	-	0.0	0.1	-	0.1	1.0	0.0	0.1	0.1
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf
Ped Link: P2	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf
Ped Link: P3	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1 PRC for Signalled Lanes (%): 113.0 Total Delay for Signalled Lanes (pcuHr): 6.75 Cycle Time (s): 120
PRC Over All Lanes (%): 113.0 Total Delay Over All Lanes(pcuHr): 7.00

Appendix B. Bridge Options

As part of the wider Harry Reynolds Road scheme it is proposed to upgrade 2 no. footbridges located in the public park to the northeast of Harry Reynolds Road. These structures provide pedestrian access between Vauxhall Street and Clonard Court across the Bracken River. The structures will need to be widened or replaced to accommodate the proposed 4m wide pedestrian & cyclist facilities through the public park as part of the overall scheme.

A third structure is also present to the north of these footbridges. This footbridge provides pedestrian access between Vauxhall Street and Clonard Street. This structure has been omitted from the initial study but may be considered at a later stage.

Description of Existing Structures

The 2no. footbridges are of similar construction, consisting of a reinforced concrete substructure with the superstructure comprising galvanised steel sheeting and transverse beams supported on 2no. longitudinal reinforced concrete beams. The existing parapets are 1.125m high painted steel parapets with a mesh infill. Both structures have a 450mm diameter concrete outfall through the west abutment, discharging drainage water into the watercourse via a concrete apron.

The south structure has a span of 5.82m and an out-to-out width of 2.2m. The central structure has a span of 7.2m and an out-to-out width of 2.2m.

CW from top left: south elevation of the south footbridge, south elevation of the central footbridge, general view of the soffit of the steel decking from below the central footbridge, general view across the south footbridge.

Options Considered

The 3no. options considered to accommodate the upgraded 4m wide pedestrian & cyclist facilities are as follows:

1. Install new cyclist only structures adjacent to the existing structures.
2. Widen the existing structures to meet the required 4m width.
3. Replace the existing structures with new 4m wide structures.

Evaluation of Options

The 3no. options outlined in the section above have been evaluated for numerous criteria including; complexity, construction and whole life costs, environmental impact, buildability, aesthetics, and health and safety.

Option 1 – New cyclist only structures

The existing structures would be retained in their current form for pedestrian use only. 2no. new 2m wide structures would be constructed adjacent to facilitate the passage of cyclists across the watercourse.

The construction of new structures for only cyclist use has the benefit of retaining the use of the existing structure during the construction phase. However, this option would impact the surrounding riverbanks and watercourse, doubling the footprint area of the existing crossings. The cost and duration of the construction phase would be excessive compared to widening the existing structures, with whole life costs also increasing due to the maintenance requirements of the additional structures. Operational issues may occur with both pedestrians and cyclists using a single structure, selecting the shortest route across the Bracken River.

Option 2 – Widen the existing structures

The existing structures would be widened from 2m to 4m in order to facilitate both the pedestrian and cyclist facilities. Due to the modular nature of the superstructure the existing steel decking could be removed and replaced with a wider steel deck, cantilevering 1m either side of the existing reinforced concrete longitudinal beams.

The widening of the existing structures by replacing the steel decking offers a low cost and low complexity solution, subject to the structural capacity of the existing reinforced concrete beams and substructure being capable of supporting the increased deck area. The replacement steel decks would be manufactured off site and lifted into position, limiting works on site and reducing site health and safety risks. The overall cost of the structures would be benefitted by retaining the existing substructures and primary deck elements. Minor land take from the adjacent Balbriggan Enterprise and Training Centre would be required at the south west corner of the structure to accommodate a 4m structure width.

Option 3 – Replacement of the existing structures

The existing structure would be demolished to foundation level and replaced with a new structure to accommodate the 4m wide pedestrian and cyclist facilities.

The replacement of the existing structures would provide the most aesthetic solution but also the most expensive construction cost. The duration of the construction phase would also be increased due to the demolition of the existing structures, restricting public access for a longer period. Whole life costs of the structure would be favourable compared to the other options, as the new construction could be designed for improved durability. The demolition/construction would cause a short term negative impact on the surrounding environment, requiring both the dewatering of the watercourse and the temporary diversion of the outfall pipes through the abutments.

Conclusion & Recommendation

While all 3no. options evaluated are feasible, the proposed option at this initial stage is Option 2 – Widen the existing structures. Option 2 makes best use of the existing structures and therefore has the lowest construction cost and environmental impact. The use of the existing structures is subject to structural assessments confirming the additional capacity required for the widened steel decks. Minor land take from the southeast corner of the Balbriggan Enterprise and Training Centre will also be required to facilitate the widening of the south structure.

Appendix C. Permeability Links


MOYLARAGH PERMEABILITY LINKS
Image 1
Image 2
Image 3
Image 4
Image 5
Image 6
Key Permeability links
Quiet way
Quality cycle route
Shared street

Image 1

Image 2

Image 3

Image 4

Image 5

Image 6

Appendix D. Preferred Route

DO NOT SCALE

Rev	Description	By	Date	Chk'd	Auth
-	FOR INFORMATION	BH	09.10.18	MF	MF

ATKINS
WS Atkins Ireland Ltd. ©

Atkins House, 150-155 Airside
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Fax (+353) 01 810 8001

Unit 2B, 2200 Cork Airport
Business Park, Cork
Tel (+353) 021 429 0300
Fax (+353) 021 429 0360

2nd Floor Technology House
Parkmore Technology Park, Galway
Tel (+353) 091 786 050
Fax (+353) 091 779 830

Client: FINGAL COUNTY COUNCIL

Project: HARRY REYNOLDS ROAD BALBRIGGAN

Purpose: INFORMATION

Title: PREFERRED ROUTE

Original Scale	Design/Drawn	Checked	Authorised
1:1250	BH, Date 09.10.18	MF, Date 09.10.18	MF, Date 09.10.18

Status	Drawing Number	Rev
I	5165984 / HTR / SK / 0040	-

Contact name
Atkins company name
Office address

Email
Telephone
Direct telephone
Fax