Templeogue / Rathfarnham to City Centre Core Bus Corridor Scheme

March 2023

Preliminary Design Report

BUS CONNECTS

SUSTAINABLE TRANSPORT FOR A BETTER CITY.

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List of Acronyms

Acronym	Definition
AC	Asphalt Concrete
AIAR	Arboricultural Impact Assessment Report
ASLs	Advance Stacking Locations
AVL	Automatic Vehicle Location
AP	Attenuation Ponds
AT	Attenuation Tanks
AVLS	Automatic Vehicle Location System
AlluvMIN	Alluvial(mineral)
BCPDGB	BusConnects Preliminary Design Guidance Booklet
BEP	Building Information Modelling (BIM) Execution Plan
BGL	Below Ground Level
BIM	Building Information Modelling
BJTR	Bus Journey Time Report
BminDW	Deep well drained (Mainly basic)
BminPD	Mineral poorly drained (Mainly basic)
CBR	California Bearing Ratio
CBC	Core Bus Corridor
CSC	Characteristic Skid Coefficient
CIRIA	Construction Industry Research and Information Association
CPO	Compulsory Purchase Order
CCTV	Close Circuit Television
DB 32	Design Bulletin 32
DSRC	Dedicated Short Range Communications
DCC	Dublin City Council
DLAM	Dublin Local Area Model
DM	Do Minimum
DMURS	Design Manual for Urban Roads and Streets
DCP	Dynamic Cone Penetrometer
DEHLG	Department of Environment, Heritage and Local Government
DMRB	TII Design Manual for Road and Bridges
DART	Dublin Area Rapid Transit
DTTAS	Department for Transport, Tourism and Sport
DS	Do Something
ESB	Electricity Supply Bord
ED	Engineering Designer

Acronym	Definition
EIAR	Environmental Impact Assessment Report
EPR	Emerging Preferred Route
FTA	Federal Transit Administration
FRA	Flood Risk Assessment
FD	Filter Drains
GNI	Gas Networks Ireland
GSI	Geological Survey of Ireland
GDSDS	Greater Dublin Strategic Drainage Study
GDA	Greater Dublin Area
GDA Transport Strategy	Transport Strategy for the Greater Dublin Area 2022-2042
GI	Ground Investigation
GPR	Ground Penetration Radar
GDRCoP	Greater Dublin Regional Code of Practice
GDSDS	Greater Dublin Strategic Drainage Study
HRA	Hot Rolled Asphalt
HGV	Heavy Goods Vehicle
ILP	Institution of Lighting Professionals
IRI	International Roughness Index
IW	Irish Water
JTC	Junction Turning Count
KFPA	Kerbs, Footways and Paved Areas
LEBM	Low Energy Bound Mixtures
LOD	Level of Detail
LED	Light Emitting Diode
LPV	Longitudinal Profile Variance
MMaRC	Motorway Maintenance and Renewals Contract
msa	Million standard axles
MOVA	Microprocessor Optimise Vehicle Actuation
MPD	Mean Profile Depth
MCA	Multi-Criteria Assessment
MID	Mobility Impaired & Disabled
NCM	National Cycle Manual
NTA	National Transport Authority
NSS	National Spatial Strategy
NCDWC	National Construction and Demolition Waste Council
NPF	National Planning Framework
OPW	Office of Public Works

Acronym	Definition
OSI	Ordnance Survey Ireland
OD	Ordinance Datum
OSP	Oversize pipes
PDR	Preliminary Design Report
PSCI	Pavement Surface Condition Index
PMG	Project Management Guidelines
PMC	People Movement Calculator
RSES	Regional Spatial and Economic Strategies
RC	Rotary Core
RMO	Road Maintenance Office
RSA	Road Safety Audit
RTPI	Real Time Passenger Information
SMA	Stone Mastic Asphalt
SuDS	Sustainable Urban Drainage Systems
SCOOT	Split Cycle Offset Optimisation Technique
SDCC	South Dublin County Council
SCATS	Sydney Coordinated Adaptive Traffic System
SSD	Stopping Sight Distance
TII	Transport Infrastructure Ireland
TSM	Traffic Signs Manual
TP	Trial Pit
VMS	Variable Message Signs

Executive Summary

This Preliminary Design Report has been prepared for the Templeogue / Rathfarnham to City Centre Core Bus Corridor Scheme and builds on the previous Feasibility and Options Reports for two Core Bus Corridors (CBCs) – namely the Rathfarnham to City Centre CBC and the Tallaght to Terenure CBC - and the Preferred Route Options Report for the Templeogue / Rathfarnham to City Centre Core Bus Corridor Scheme.

This report summarises the scheme background and the need for the scheme in the context of National and Local Planning Policy, summarises the existing physical conditions and documents the surveys undertaken in developing the design.

The report also details the preliminary design, sets out traffic management proposals and outlines the traffic modelling undertaken and the outputs from the junction modelling.

The land use and acquisition requirements are summarised in this report, along with details of affected landowners and property owners, and proposed accommodation works.

The report concludes that the design of the Templeogue / Rathfarnham to City Centre Core Bus Corridor Scheme wholly achieves the scheme objectives. In doing so, it fulfils the aim of providing enhanced walking, cycling and bus infrastructure on a key access corridor in the Dublin region, enabling the delivery of efficient, safe, and integrated sustainable transport movement along the corridor.

1 Introduction and Description

1.1 Introduction

BusConnects is the National Transport Authority's (NTA) programme to improve bus and sustainable transport services. It is a key part of the Government's policies to improve public transport and address climate change. The NTA established a dedicated BusConnects Infrastructure team (the BusConnects Infrastructure team) to advance the planning and construction of the Core Bus Corridor (CBC) Infrastructure Works. It comprises an inhouse team including technical and communications resources and external service providers procured from time-to-time to assist the internal team in the planning and design of the twelve Proposed Schemes.

The CBC Infrastructure Works involves the development of continuous bus priority infrastructure and improved pedestrian & cycling facilities on twelve radial core corridors in the Greater Dublin Area (GDA), across the local authority jurisdictions of Dublin City Council (DCC), South Dublin County Council (SDCC), Dún Laoghaire-Rathdown County Council (DLRCC), Fingal County Council (FCC), and Wicklow County Council (WCC). Overall, the CBC Infrastructure Works encompasses the delivery of approximately 230 km of dedicated bus lanes and 200 km of cycle tracks along sixteen of the busiest corridors in Dublin.

The Templeogue / Rathfarnham to City Centre Core Bus Corridor of the CBC Infrastructure Works (herein after called the 'Proposed Scheme') measures approximately 10 km from end to end online with additional offline upgrades and quiet street treatment of approx. 2km and 1.5km respectively.

The Proposed Scheme will be comprised of two main alignments in terms of the route it will follow, namely from Templeogue to Terenure and from Rathfarnham to the City Centre.

The Templeogue to Terenure section of the Proposed Scheme commences on the R137 Tallaght Road, east of the M50 junction 11 interchange and is routed via the R137 along Tallaght Road and Templeogue Road, through Templeogue Village, to Terenure Cross, where it joins the Rathfarnham to City Centre section of the Proposed Scheme.

The Rathfarnham to City Centre section of the Proposed Scheme commences on the R821 Grange Road at the junction with Nutgrove Avenue, and is routed along the R821 Grange Road, the R115 Rathfarnham Road, the R114 Rathfarnham Road, Terenure Road East, Rathgar Road, Rathmines Road Lower, Richmond Street South, Camden Street Upper and Lower, Wexford Street, Redmond's Hill, Aungier Street, and South Great George's Street and terminates at the junction of South Great George's Street and Dame Street. In addition to the above, alternative cycle facilities are provided along Harold's Cross Road / Terenure Road North between Terenure Cross and Parkview Avenue, as well as along Bushy Park Road, Wasdale Park, Wasdale Grove, Zion Road and Orwell Road.

Refer to Figure 1.1 for the overall route of the Proposed Scheme.

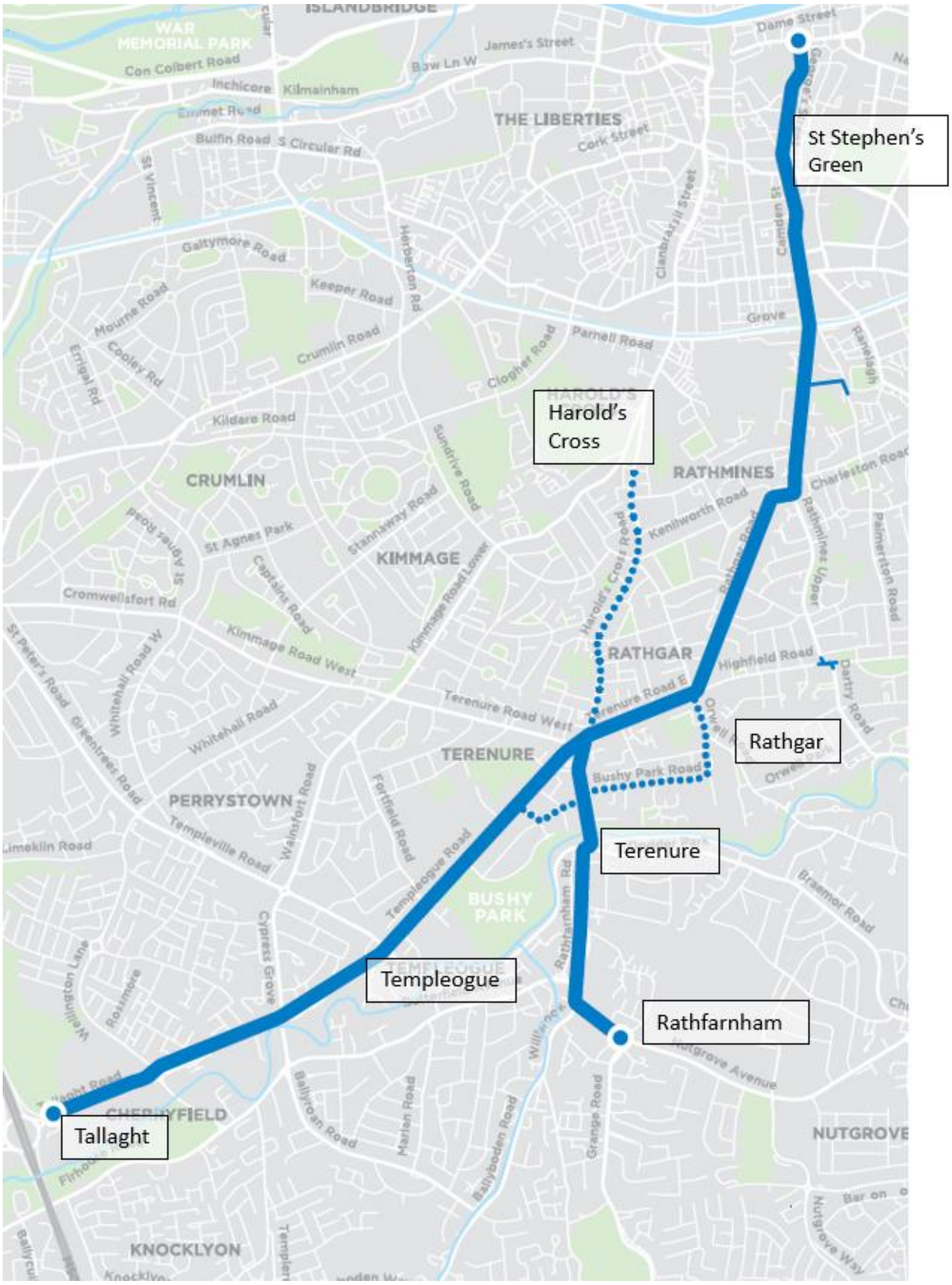


Figure 1.1: Proposed Scheme Route Overview

1.2 Scheme Aims and Objectives

The aim of the Proposed Scheme is to provide enhanced walking, cycling and bus infrastructure on a key access corridor in the Dublin region, which will enable and deliver efficient, safe, and integrated sustainable transport movement along this corridor.

The objectives of the CBC Infrastructure Works are to:

- Enhance the capacity and potential of the public transport system by improving bus speeds, reliability and punctuality through the provision of bus lanes and other measures to provide priority to bus movement over general traffic movements.
- Enhance the potential for cycling by providing safe infrastructure for cycling, segregated from general traffic wherever practicable.
- Support the delivery of an efficient, low carbon and climate resilient public transport service, which supports the achievement of Ireland's emission reduction targets.
- Enable compact growth, regeneration opportunities and more effective use of land in Dublin, for present and future generations, through the provision of safe and efficient sustainable transport networks.
- Improve accessibility to jobs, education and other social and economic opportunities through the provision of improved sustainable connectivity and integration with other public transport services.
- Ensure that the public realm is carefully considered in the design and development of the transport infrastructure and seek to enhance key urban focal points where appropriate and feasible.

1.3 Project Background

The previous Transport Strategy for the Greater Dublin Area 2016 – 2035 set out a network of the bus corridors forming the "Core Bus Network" for the Dublin region. Sixteen indicative radial CBCs were initially identified for redevelopment. This is shown in Figure 1.2 (extract from Transport Strategy for the Greater Dublin Area 2016-2035). It is noted that the current Transport Strategy for the Greater Dublin Area 2022-2042 includes the following objective:

*"**Measure BUS1 – Core Bus Corridor Programme***

Subject to receipt of statutory consents, it is the intention of the NTA to implement the 12 Core Bus Corridors as set out in the BusConnects Dublin programme."

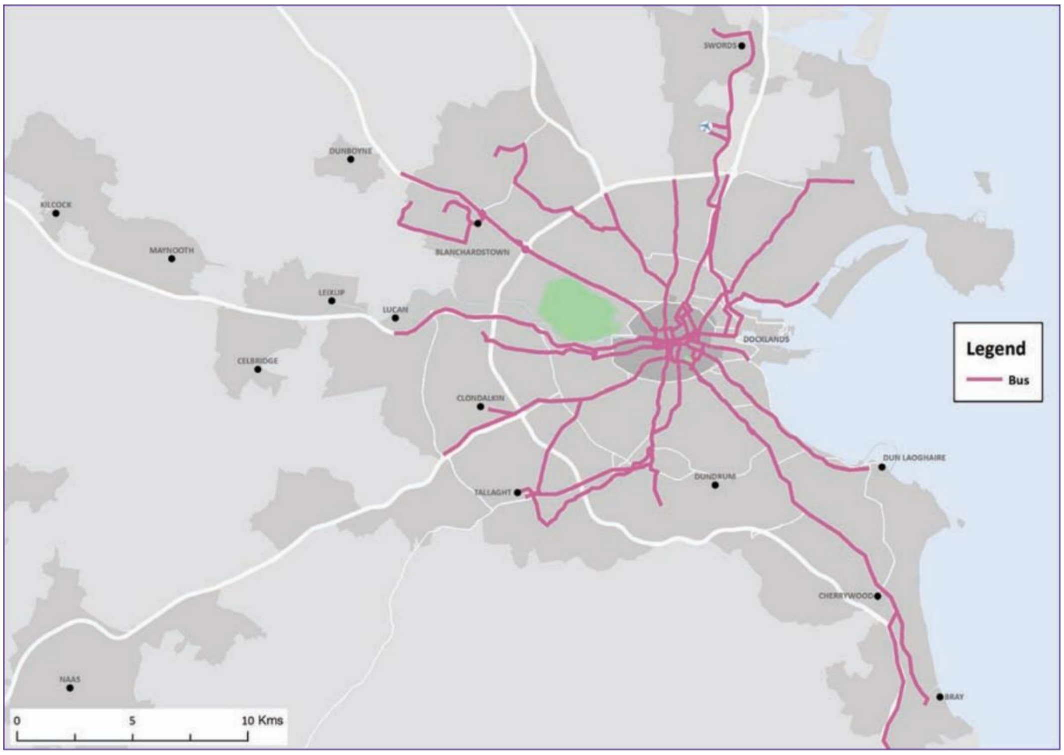


Figure 1.2: 2035 Core Bus Network – Radial Corridors

These corridors currently have dedicated bus lanes along only less than one third of their lengths which means that for most of the journey, buses and cyclists are competing for space with general traffic and are negatively affected by the increasing levels of congestion. This results in delayed buses and unreliable journey times for passengers. Following the completion of feasibility and options studies sixteen radial corridors were taken forward.

In June 2018, the NTA published the Core Bus Corridors Project Report. The report was a discussion document outlining proposals for the delivery of a CBC network across Dublin. The Proposed Scheme is identified in this document as forming part of the Radial Core Bus Network, designated as the Tallaght to Terenure CBC and the Rathfarnham to City Centre CBC.

In the context of the proposed planning applications for the CBC Infrastructure Works, the initial sixteen radial CBCs have been grouped as twelve individual Schemes. The twelve Schemes that will be the subject of separate applications to An Bord Pleanála for approval are listed below:

- Clongriffin to City Centre Core Bus Corridor Scheme;
- Swords to City Centre Core Bus Corridor Scheme;
- Ballymun / Finglas to City Centre Core Bus Corridor Scheme;
- Blanchardstown to City Centre Core Bus Corridor Scheme;
- Lucan to City Centre Core Bus Corridor Scheme;
- Liffey Valley to City Centre Core Bus Corridor Scheme;
- Tallaght / Clondalkin to City Centre Core Bus Corridor Scheme;

- Kimmage to City Centre Core Bus Corridor Scheme;
- Templeogue / Rathfarnham to City Centre Core Bus Corridor Scheme;
- Bray to City Centre Core Bus Corridor Scheme;
- Belfield / Blackrock to City Centre Core Bus Corridor Scheme;
- Ringsend to City Centre Core Bus Corridor Scheme;

The twelve radial routes that form the CBC Infrastructure works are shown in Figure 1.3.

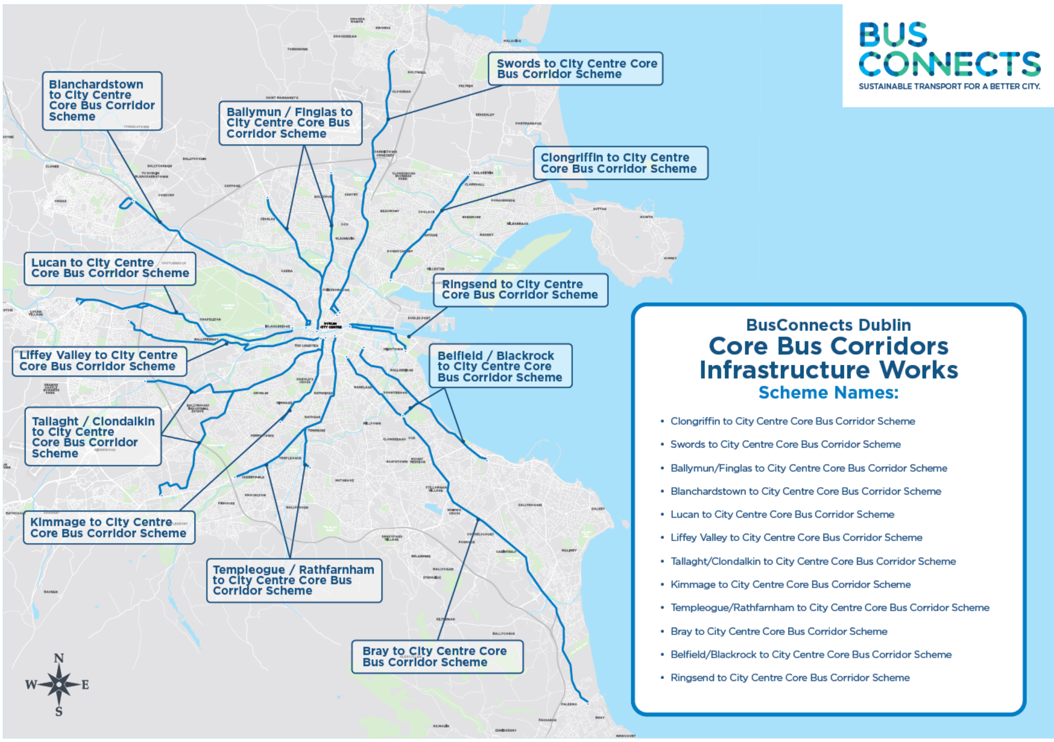


Figure 1.3: BusConnects Radial CBC Network

1.4 Proposed Construction Procurement Method

The Proposed Scheme will proceed on the basis of procurement through a Design-Build tender process.

Consequently, the design information presented in this report ensures that the objectives of the Proposed Scheme are met, in accordance with current design standards and guidance documents. It further ensures that sufficient land will be acquired during the Compulsory Purchase Order process in order to construct a CBC that will fulfil the design requirements.

1.5 Stakeholder Consultation

Three rounds of non-statutory public consultation have taken place over the following dates;

- 23rd January 2019 to 30th April 2019 - Consultation on Emerging Preferred Route;
- 4th March 2020 to 17th April 2020 - Consultation on Preferred Route Option;
- 4th November 2020 to 16th December 2020 - Consultation on Preferred Route Option.

Refer to the Tallaght to Terenure Core Bus Corridor and the Rathfarnham to City Centre Core Bus Corridor Preferred Route Option Second and Third Public Consultation Submissions Summary Reports for information on the non-statutory consultations.

Consultation with the principal project stakeholders (i.e. Dublin City Council (DCC), South Dublin County Council (SDCC), Office of Public Works (OPW) and Utility companies) has taken place to date in order to:

- Inform the scheme development process at particular locations;
- Identify constraints and opportunities within the study area, scheme corridor and route options considered;
- Further refine the scheme objectives;
- Discuss potential mitigation measures and options; and
- Identify planning requirements, conditions and implications with respect to the proposed scheme design measures.

Specific scheme requirements have been discussed and agreed during workshops, with the Local Authorities, and meetings, at Steering Group and Programme level. The BusConnects Infrastructure Team has taken cognisance of any specific requirements and recommendations emerging from this process when exploring feasible scheme options and preparing the preliminary design.

In addition to the principal project stakeholders, consultations have taken place with:

- Representative Groups;
- Chartered Landowners (i.e. owners of lands at any specific locations); and
- Directly Impacted landowners.

1.6 Audit of Existing Situation

A number of audits, surveys and assessments have been carried out, and includes the following:

- Problem Identification Audit;
- Accessibility Audit;

- Route Infrastructure Audit;
- Existing Pavement Inspection Audit;
- Existing Structures Assessment;
- Existing Route Collision Analysis;
- Cellar Survey;
- Private Landings Survey;
- Baseline Tree Survey;
- Cycle Journey Time Survey;
- Pavement condition;
- Phase 1 Utility Survey;
- Bus Stop Survey including boarding and alighting and AVL;
- Traffic Survey (JTC, pedestrian and cyclists counts);
- Parking survey; and
- Bus Journey Time.

These surveys have been supplemented with secondary record data to include utility information, OPW CFRAM Flood Models, IW Drainage Models and existing traffic signal data from DCC.

A number of environmental surveys have also been carried out by the Environmental Impact Assessment (EIA) team. Refer to the Environmental Impact Assessment Report for further information.

1.7 Purpose of the Preliminary Design Report

The Preliminary Design Report sets out the preliminary design of the Proposed Scheme and supports the Compulsory Purchase Order (CPO) documentation and Environmental Impact Assessment Report (EIAR) which form part of the Planning Application to An Bord Pleanála.

During the preparation of the preliminary design, designers' risk assessments were undertaken, details of these are included in Appendix A.

The purpose of the risk assessments is to identify significant design risks and mitigate them as part of the design process.

1.8 Report Structure

The structure for the remainder of this report is set out as follows:

- Chapter 2: Policy Context and Design Standards – This chapter identifies the policies and design standards reviewed and applied to the preliminary design;
- Chapter 3: The Proposed Scheme – This chapter describes the four sections of the Proposed Scheme in more detail;

- Chapter 4: Road Geometry – In this chapter, the geometrical alignment and cross-section of the scheme are described, along with an overview of the operational safety process which has been implemented;
- Chapter 5: Junction Layout – The junction design methodology and modelling process is then set out for the major, moderate and minor junctions along the length of the route in this chapter;
- Chapter 6: Ground Investigation and Ground Condition – This chapter provides an overview of the ground investigation process and ground conditions;
- Chapter 7: Pavement, Kerbs, Footpaths and Paved Areas – This chapter gives an overview of the existing pavement situation and proposed pavement, kerbs, footpaths and paved areas design for the scheme;
- Chapter 8: Structures – In this chapter an overview of the structures strategy is provided, along with a summary of principal and miscellaneous structures, retaining walls and embankments;
- Chapter 9: Drainage, Hydrology and Flood Risk – This chapter is an overview of the drainage strategy includes descriptions of existing watercourses and culverts alongside a summary of the drainage design for each catchment along the scheme, including the consideration of drainage at structures and the maximisation of SuDS features;
- Chapter 10: Services and Utilities – This chapter shows the Utilities design strategy documents surveys undertaken to date, identifies conflicts and recommends a number of diversions;
- Chapter 11: Waste Quantities – This chapter provides an overview of the waste quantities for the Proposed Scheme;
- Chapter 12: Traffic Signs, Lighting and Communications – In this chapter the design strategy for traffic signs, road markings, lighting and communications equipment is outlined, alongside descriptions of how these elements can be maintained and monitored safely and securely;
- Chapter 13: Land Use and Accommodation Works – This chapter outlines land use and acquisition requirements, affected land and property owners, and proposed accommodation works;
- Chapter 14: Landscape and Urban Realm – This chapter is an overview of the landscape and urban realm design strategy focussing on the existing trees and proposed mitigation;
- Chapter 15: How we are achieving the Objectives – This chapter sets out the manner in which the Proposed Scheme achieves its objectives; and
- Appendices – Various appendices and background information as referenced throughout the report.

1.9 Preliminary Design Drawings

A set of preliminary design drawings have been prepared to convey the scheme design principles for each discipline and should be read in conjunction with this Preliminary Design Report. Table 1.1 provides a description of the drawings and relevant design content displayed in each of the series as applicable for the Proposed Scheme. The drawings have been included in Appendix B for reference. The file naming conventions for the Drawing Series and Volume Codes are as set out in the Building Information Modelling (BIM) Execution Plan (BEP) developed for the CBC Infrastructure Works.

Table 1.1: Preliminary Design Drawings

Drawing Series Volume Code	Drawing Series Description/Scale	Design Content
SPW_KP/SPW_ZZ	Site Location Map (1:12500@ A1) & Site Location Plans (1:2500@A1)	Defines the full extent of the works & planning red line boundary. Outlines the scheme chainage structure and provides context for the locality of adjacent Schemes and other notable locations along the route.
SPW_BW	Fencing and Boundary Treatment Plans (1:500@A1)	To be read in conjunction with the GEO_GA General Arrangement series and GEO_CS typical cross-section series. Provides an indication of the locations for the proposed boundary modification works along the route.
GEO_GA	General Arrangement Plans (1:500 @ A1)	Displays information for conveying the overarching scheme design intent, providing information on the proposed pedestrian/cycle/ bus/traffic regime, indicative ultimate tree arrangement (existing trees retained & proposed trees), bus stop/shelter locations, key heritage feature locations, parking and loading arrangements, turn bans, side road treatments in addition to identification of specific items of note to the scheme (structures or significant features which may be further described on other drawing series)
GEO_CS	Typical Cross Sections (1:50 @ A1)	To be read in conjunction with the GEO_GA General Arrangement series. Provides an indication of the proposed cross section works in comparison to the existing road geometry. Indicative pavement/kerbing, boundary treatments and key street furniture are also provided for context.
GEO_HV	Mainline Plan and Profile Drawings (1:500@A1)	To be read in conjunction with the GEO_GA General Arrangement series.

Drawing Series Volume Code	Drawing Series Description/Scale	Design Content
		Provides an indication of the proposed modification works to the mainline vertical alignment with supplementary information on earthworks/retaining walls and other notable structures along the route (as required).
ENV_LA	Landscaping General Arrangement Plans (1:500@A1)	Provides information relating to urban realm and landscaping proposals including identification of trees to be removed resulting from the arborist assessments, proposed tree/planting regime, proposed footpath surface finishes, locations of proposed SuDS features and proposed boundary treatment and key street furniture notes.
DNG_RD	Proposed Surface Water Drainage Plans (1:500@A1)	Displays information for conveying the design intent for the drainage portion of the works including identification of SuDS measures, requirements for allowable discharge rates to the existing networks (attenuation/detention/flow control) where applicable, catchment assessments and outline design for the proposed drainage discharge strategy along the route.
UTL_UC	Combined Existing Utilities Record Plans (1:500@A1)	Displays information regarding existing Statutory Undertakers records along the length of the scheme with the proposed scheme features shown as background information for context.
UTL_UD	IW Foul Sewer Alteration Plans (1:500@A1)	Provides an indication of the existing trunk fowl sewer network and proposed indicative modification/diversion works (where identified) along the route. The existing and proposed kerb lines have been displayed for scheme context.
UTL_UW	IW Potable Water Asset Alteration Plans (1:500@A1)	Provides an indication of the existing trunk potable water network and proposed indicative modification/diversion works (where identified) along the route. The existing and proposed kerb lines have been displayed for scheme context.
UTL_UE	ESB Asset Alteration Plans (1:500@A1)	Provides an indication of the existing trunk electrical network (above and below ground) and proposed indicative modification/diversion works (where identified) along the route. The existing and proposed kerb lines have been displayed for scheme context.

Drawing Series Volume Code	Drawing Series Description/Scale	Design Content
UTL_UL	Telecommunications Asset Alteration Plans (1:500@A1)	Provides an indication of the existing trunk telecommunications network and proposed indicative modification/diversion works (where identified) along the route. The existing and proposed kerb lines have been displayed for scheme context.
UTL_UG	GNI Asset Alteration Plans (1:500@A1)	Provides an indication of the existing trunk gas network and proposed indicative modification/diversion works (where identified) along the route. The existing and proposed kerb lines have been displayed for scheme context.
LHT_RL	Street Lighting Plans (1:500@A1)	Provides an indication of the proposed modification works to the existing street lighting infrastructure along the route in addition to identification of any key heritage light column features.
TSM_SJ	Junction System Design Plans (1:250@A1)	Provides a more detailed overview of the proposed junction arrangements for pedestrians, cyclists, buses and general traffic with an indication of the proposed junction staging and associated signal head arrangements for key signalised junctions/signalised crossings along the route.
TSM_GA	Traffic Signs and Road Markings Plans (1:500@A1)	Provides an indication of the proposed key signage (information/directional/regulatory) design requirements and the design intent for the proposed lane marking arrangements along the route.
PAV_PV	Pavement Treatment Plans (1:500@A1)	Provides an indication of the proposed pavement treatment works along the length of the route

The planning red line boundary has been displayed on the Site Location Plans in drawing series SPW_ZZ as designated by the solid red line ‘SITE EXTENTS’. For clarity the various discipline general arrangement drawing series have been displayed with the permanent extent of works boundary line as designated by the solid red line ‘SITE BOUNDARY LINE’. Where construction access or accommodation works are required to facilitate the permanent works this has been displayed by the dashed red line ‘TEMPORARY LAND ACQUISITION’. Construction site compounds outside the ‘SITE BOUNDARY LINE’ are also captured within the dashed red line ‘TEMPORARY LAND ACQUISITION’.

Full details of the compulsory land acquisition required to construct the Proposed Scheme are provided on the various Deposit Maps, Server Maps and associated CPO schedules/documentation for the Proposed Scheme as part of the statutory application documentation.

2 Policy Context & Design Standards

2.1 Policy Context

The following national, regional and local policies have been reviewed and considered in the development of the Proposed Scheme:

- Project Ireland 2040;
- Department of Transport: Statement of Strategy (2021 - 2023);
- Smarter Travel: A Sustainable Transport Future (2009 – 2020);
- National Cycle Policy Framework (2009);
- Road Safety Strategy (2021 – 2030);
- Building on Recovery: Infrastructure and Capital Investment Plan (2016-2021);
- The Sustainable Development Goals National Implementation Plan (2022-2024);
- Climate Action Plan (2023);
- Eastern & Midland Regional Assembly, Regional Spatial & Economic Strategy (2019-2031);
- Greater Dublin Area Cycle Network Plan;
- Transport Strategy for the Greater Dublin Area (2022-2042);
- Dublin City Council Development Plan (2022-2028);
- South Dublin County Council Development Plan (2022–2028); and
- Dún Laoghaire-Rathdown County Council Development Plan (2022 – 2028).

For further information on how the Proposed Scheme meets the policies outlined above, refer to Templeogue / Rathfarnham to City Centre Core Bus Corridor Planning Compliance Report. (Document No. BCIDC-JAC-ENV_ZZ-1012-XX-00-RP-ES-0003).

2.2 Design Standards

Design standards applied on the Proposed Scheme are stated within the applicable chapters of this report. In addition to national design standards, the CBC Infrastructure Works has developed the BusConnects Preliminary Design Guidance Booklet (BCPDGB) – included in Appendix O; its purpose is to provide guidance for the various design teams involved in CBC Infrastructure Works, to ensure a consistent design approach across the twelve Proposed Schemes.

The BCPDGB complements existing guidance documents relating to the design of urban streets, bus facilities, cycle facilities and urban realm. A non-exhaustive list of these guidelines is as follows:

- The Design Manual for Urban Roads and Streets (DMURS);
- The National Cycle Manual (NCM);
- TII Publications;
- The Traffic Signs Manual (TSM);
- Guidance on the use of Tactile Paving;
- Building for Everyone: A Universal Design Approach, and
- Greater Dublin Strategic Drainage Study (GDSDS).

The BCPDGB focuses on the engineering geometry and Proposed Scheme operation. It is recognised that the Proposed Scheme has been planned and designed within the context of an existing city, with known constraints.

The BCPDGB provides guidance; however, a more flexible approach to the design of the Proposed Scheme, utilising engineering judgement, may be necessary in some locations due to these constraints.

Where it has been necessary to deviate from the parameters set out in the relevant national design standards or design guidance, these deviations have been noted within Section 4.17.

3 The Proposed Scheme

3.1 Proposed Scheme Description

The Proposed Scheme is approximately 10 km long and consists of two main alignments - Templeogue to Terenure and Rathfarnham to City Centre. The General Arrangement drawings within Appendix B show the extent of the infrastructure proposed to deliver the Proposed Scheme. The Proposed Scheme Description has been broken into four sections and the works contained within them are described accordingly.

3.1.1 Section 1 - Tallaght Road to Rathfarnham Road

Section 1 of the Proposed Scheme will commence on the R137 Tallaght Road adjacent to D'Arcy McGee's, east of the M50 interchange. It is proposed to retain the existing bus and traffic lane configuration on the R137. Between the M50 interchange and the Spawell Roundabout junction it is proposed to relocate the existing two-way cycle track to the carriageway side of the footpath to better tie in with proposals at the Spawell Roundabout junction. It is proposed to convert the Spawell Roundabout to a signalised junction with kerb protection for cyclists. The design of this junction has been coordinated with design proposals under the Wellington Lane Walking and Cycling Scheme and the Dodder Greenway.

Between the Spawell Roundabout and Cypress Grove Road junction, it is proposed to retain the existing bus and traffic lane configuration on the R137. The existing cycle track on the northern side of the carriageway will be relocated to the carriageway side of the footpath, and a new cycle track provided on the southern side of the carriageway between Cheeverstown and the Spawell Roundabout junction. At the Cypress Grove Road junction, general through traffic may divert to Old Bridge Road for access to the City Centre via the R114. Significantly enhanced cycle facilities will also be provided at this junction with the introduction of kerb protection.

Within this section the existing free-standing stone arch adjacent to the R137 Templeogue Road will be cleared of the overgrown vegetation which currently covers it and conserved in its existing location. The existing fencing around the arch will be removed and the arch opened up to the public realm. It is proposed to install high quality stone paving, decorative lighting and soft landscaping elements around the arch as well as to construct a new footpath running behind the arch.

Between the Cypress Grove Road junction and the Ashfield Place development it is proposed to provide bus lanes and traffic lanes in each direction. A limited amount of land take will be required from a number of residential properties on the northern side of the carriageway to achieve this cross section. Dedicated cycle facilities are provided on the approach to the Cypress Grove Road junction, however these will terminate approximately 100m from the junction where cyclists will share the bus lane in an inbound direction and the general traffic lane in an outbound direction.

To improve safety for cyclists, it is proposed to introduce a 30kph speed limit between Cypress Grove Road and Templeogue Village. Outside the Ashfield Place Development, there is insufficient space for a bus lane and a general traffic lane in each direction. Therefore, it is proposed to stop the outbound bus lane for a distance of approximately 170m and use signal-controlled priority along this section.

Within this section, the existing service/access road serving 250 to 258 Templeogue Road will be converted to provide a shared surface for vehicles and pedestrians. This will facilitate the provision of an outbound bus lane to the stop line at the Cypress Grove Road junction, while minimising land acquisition from properties on the northern side of Templeogue Road.

Between Ashfield Place and the Templeogue Tennis Club, it is proposed to provide a bus lane and a general traffic lane in each direction. It is proposed to utilise a limited amount of land-take within this section to achieve the desired cross-section.

Within Templeogue Village, between Templeogue Tennis Club and the Templeville Road junction, it is proposed to manage bus priority through the use of signal-controlled priority and tie into South Dublin County Council's Templeogue Village Initiative Scheme.

North of Templeogue Village, a cross section consisting of a general traffic lane, and bus lane and a cycle track in each direction is resumed. Between the village and the Springfield Avenue junction, the width of the proposed cycle tracks is reduced locally to minimise the impact on existing mature trees in this section.

At the junction with Templeville Road, general inbound through traffic may divert to the R112 and further to the R114 through the reintroduction of the right turn onto Springfield Avenue. It is proposed to introduce kerb protection at this junction which will improve cycle facilities and cyclist safety.

Between the Templeville Road junction and Fortfield Road it is proposed to provide one bus lane, one general traffic lane and cycle tracks in each direction. 1.5m wide cycle tracks are proposed along this section to minimise impacts on mature trees tree on the eastern side of the road. It is proposed to upgrade the Fortfield Road junction to provide a protected cycle crossing for inbound cyclists to a proposed two-way cycle facility on the eastern side of Templeogue Road north of the junction.

Between Fortfield Road and Terenure Road West, the Templeogue Road width is heavily constrained. Within this section of the Proposed Scheme, it is proposed to maintain one outbound bus lane, one outbound general traffic lane and one inbound general traffic lane. A segregated two-way cycle track and footpath is proposed on the southern side of the carriageway within Bushy Park along the alignment of the existing shared path.

This cycle track will link to a quiet street treatment on Rathdown Drive. The existing dirt path through the green space adjacent to Rathdown Drive will be formalised as a footpath, using shallow dig construction methods to minimise impacts on the existing trees within this area.

It is proposed to provide an inbound Bus Gate at the junction of Olney Grove, which will restrict northbound general traffic on Templeogue Road from accessing Terenure Road West or Terenure Place during the hours of operation of the Bus Gate (06:00 – 20:00, 7 days a week). A right turn ban is proposed from Fergus Road to Templeogue Road, and a left turn ban from Olney Grove to Templeogue Road.

Right turn bans are also proposed from Templeogue Road to Rathdown Park and to Rathdown Avenue and from Fortfield Road to Greenlea Road and to Lavarna Grove in order to prevent through traffic diverting inappropriately. A quiet street treatment to Rathdown Crescent and Rathdown Park is proposed which will link to Section 2 of the Proposed Scheme at the junction of Rathdown Park and Rathfarnham Road.

3.1.2 Section 2 - Nutgrove Avenue to Terenure Road North – Grange Road, Rathfarnham Road

Section 2 of the Proposed Scheme will commence at the junction of Grange Road and Nutgrove Avenue, where it will tie into the Grange Road Cycle scheme. It is proposed to upgrade this junction through the provision of kerb protection for cyclists. This will require a limited amount of land take from the entrance to the Rathfarnham Wood development. It is also proposed to reconfigure the existing car park adjacent to this junction to facilitate the revised road arrangement and to install a new island bus stop layout in this location.

Between this junction and the Castleside Drive junction it is proposed to provide a single bus lane alongside general traffic lanes and cycle tracks in both directions. To accommodate the road layout, it is proposed to utilise limited land-take from adjacent properties, including setting back the existing boundary wall to Rathfarnham Castle Park. The existing boundary wall of Rathfarnham Castle will be set back and reconstructed with a round capping roughcast render.

It is proposed to upgrade the junctions of Rathfarnham Road and Willbrook Road, Rathfarnham Road and Butterfield Avenue, and Rathfarnham Road and Castleside Drive through the provision of kerb protection for cyclists. The upgrade of the Rathfarnham Road and Butterfield Avenue junction will require the removal of general traffic lanes on the Butterfield Avenue arm of this junction.

On the section of Rathfarnham Road between Castleside Drive and Dodder Park Road, it is proposed to provide an inbound bus lane, two general traffic lanes and a 1.5m wide outbound cycle track, with outbound bus priority provided through signal-controlled priority. Due to construction related constraints, the inbound cycle track will be curtailed over approximately 270m, with cyclists utilising the bus lane over this short section. A section of inbound cycle track will be provided at either end of this section, on approach to junctions. It is proposed to introduce a 30 kph speed limit on Rathfarnham Road at this point due to the fact that inbound cyclists will be sharing the bus lane through this section. This 30 kph speed limit will continue from here to the City Centre, due to the presence of multiple urban villages along the route, as well as other sections where cyclists share the bus lane. This consistent speed limit is proposed to ensure legibility for road users along the route and to avoid frequent increases and decreases in speed limits.

To accommodate the new configuration on Rathfarnham Road between Castleside Drive and Dodder Park Road, it is proposed to utilise land-take from adjacent properties on the western side of the road, south of Brookvale Road.

To maintain bus priority through the Dodder Park Road and Rathfarnham Road junction, it is intended to provide signal-controlled priority on the southern and northern approaches to the junction. It is proposed to upgrade this junction through the provision of kerb protection for cyclists, which will tie into the proposed Dodder Greenway on Dodder View Road and Dodder Road Lower.

Between Dodder Park Road and Rathdown Park, it is proposed to provide bus priority through a combination of signal-controlled priority and partial bus lanes, with 1.5m wide cycle tracks provided. To accommodate the new configuration within this section it is proposed to utilise land-take from adjacent properties on the western side of the road.

Between Rathdown Park and Bushy Park Road, no bus lanes are proposed. It is proposed to maintain bus priority by providing signal-controlled priority in both directions and managing traffic queues in this area.

From Bushy Park Road to Terenure Road North it is proposed to provide 1.5m wide cycle tracks, bus lanes and traffic lanes in both directions. To accommodate these new bus lanes on this section of Rathfarnham Road, it is proposed to acquire land from adjacent properties on the eastern side of Rathfarnham Road.

At the Terenure Road North junction it is intended to extend the existing bus lane and proposed cycle track as far as the junction stop line. Bus movements through this junction will be managed with signal-controlled priority. A number of existing parking spaces on the approach to Terenure Village will be removed to facilitate the proposed cross section.

3.1.3 Section 3 - Terenure Road North to Charleville Road – Terenure Road East, Rathgar Road

On Terenure Road East, between the Terenure Road North junction and St. Joseph’s Church, due to the proximity of existing built form to the carriageway, it is proposed to provide a single general traffic lane in each direction. Bus priority will be provided through this section by signal-controlled priority. It is also proposed to widen the footpaths within this section and to provide a high-quality urban realm within Terenure Village, including new pedestrian crossings constructed with high quality paving setts.

Between St. Joseph’s Church and the Rathgar Avenue junction it is intended to provide a bus lane and general traffic lane in both directions. To accommodate the proposed cross section, it is proposed to acquire land from adjacent properties on both sides of Terenure Road East. A new Toucan crossing is proposed on Terenure Road East, west of Brighton Road.

It is also proposed to provide an alternative cycle facility consisting of cycle tracks in each direction along Terenure Road North and Harold’s Cross Road, connecting to the Kimmage to City Centre Core Bus Corridor Scheme at Harold’s Cross.

An additional alternative cycle facility is proposed along Bushy Park Road, Wasdale Park, Wasdale Grove, Victoria Road, Zion Road and Orwell Road to provide a secondary east-west route for cyclists travelling between Rathfarnham Road and Rathgar Road.

At Rathgar Avenue, it is proposed to maintain bus priority through the junction with signal-controlled priority. The junction of Highfield Road and Rathgar Road will be signalised, with new toucan crossings provided on the Highfield Road arm and the Rathgar Road arm of this junction.

Along Rathgar Road it is proposed to provide bus lanes and 1.5m wide cycle tracks in each direction and a one-way inbound general traffic lane only. Local access for residents on Rathgar Road and adjoining streets will be maintained through the surrounding road network via Rathgar Avenue or Rathmines Road Upper including Frankfort Avenue, Leicester Avenue, Garville Avenue, Garville Road, and Highfield Road.

A new toucan crossing is proposed on Rathgar Road, south of Wesley Road. It is proposed to upgrade the junction of Rathgar Road and Grosvenor Road through the provision of kerb protection for cyclists.

It is proposed to remove the current right turn ban from Rathmines Road Upper to Highfield Road as well as the right turn ban from Highfield Road onto Rathgar Road to facilitate outbound general traffic movements.

3.1.4 Section 4 – Charleville Road to Dame Street

On Rathgar Road and Rathmines Road Lower between Charleville Road and Castlewood Avenue it is proposed to provide an inbound bus lane, an inbound and outbound traffic lane and cycle tracks in each direction. Outbound bus priority will be provided through signal-controlled priority. It is proposed to upgrade the junction of Rathmines Road Upper with Rathmines Road Lower/Rathgar Road through the provision of kerb protection for cyclists. An upgraded public realm will be provided at this junction through the reallocation of road space.

Between Castlewood Avenue and Grove Road, a general traffic lane and a cycle track in each direction are proposed, with the provision of a Bus Gate between Richmond Hill and Lissenfield which will restrict general traffic movements during the hours of operation of the Bus Gate (06:00 – 20:00, 7 days a week). This proposal also allows for some increase to footpath widths through Rathmines and the provision of 2m wide cycle tracks in each direction through the village.

It is proposed to reverse the existing one-way traffic regime on Williams Park to facilitate traffic to turn off of the main CBC route at Military Road in advance of the Bus Gate and return via Williams Park. It is proposed to provide a mini roundabout outside of St Mary’s College to facilitate school drop off.

It is proposed to restrict movements on Mountpleasant Street Lower, north of the junction with Richmond Hill to pedestrians and cyclists only through the introduction of planted build-outs.

It is also proposed to reintroduce the right turn from Richmond Hill to Mountpleasant Avenue Upper, to facilitate general traffic to turn off of the main CBC route at Richmond Hill in advance of the Bus Gate and return via Mountpleasant Avenue Upper. Due to the restricted road with at this location, a traffic light shuttle system is proposed to safely manage these traffic movements.

At La Touche Bridge it is proposed to provide an inbound bus lane and an outbound general traffic lane along with a high-quality segregated cycling facility, to facilitate connectivity with the Grand Canal cycleway. Inbound general traffic will be required to turn left onto Grove Road at this point. Outbound bus priority across the bridge will be provided through signal-controlled priority from a proposed traffic signal on Richmond Street South approximately 70m north of the bridge.

On Richmond Street South, it is proposed to maintain the outbound traffic lane with a bus lane and cycle tracks in both directions. Immediately south of the junction of Harrington Street/Harcourt Road/Richmond Street South, the outbound bus lane will be curtailed due to space constraints.

It is proposed to restrict movements into and out of Lennox Street to pedestrians and cyclists only through the introduction of planted build-outs. It is also proposed to upgrade the junction of Richmond Street South and Harrington Street through the provision of kerb protection for cyclists.

On Camden Street Upper between Harcourt Road and Charlotte Way, one bus lane in each direction and one inbound general traffic lane is proposed, with a cycle track provided in each direction.

Between Charlotte Way and Cuffe Street it is proposed to provide bus lanes in each direction and a single outbound general traffic lane on Camden Street/Wexford Street. The outbound bus lane will not commence until just south of Montague Street due to the proximity of existing built form to the carriageway. Bus priority will be achieved by signal-controlled priority over this section. Under this proposal, inbound traffic will reroute to Harcourt Street to access Cuffe Street and beyond. 1.5m wide cycle tracks are proposed in this section in order to provide sufficient footpath space in this area of significant pedestrian activity.

Between Cuffe Street and Dame Street it is proposed to provide one general traffic lane and one cycle track in each direction. No bus lanes will be provided on this section of the route. Where practicable, on-street parking bays and loading bays will be retained. The Proposed Scheme ties into the existing road network on Dame Street.

Turning restrictions are proposed at a number of locations off the immediate CBC route to prevent through traffic diverting inappropriately. These locations are summarised below:

- Proposed right turn ban from Kimmage Road Lower onto Aideen Avenue;
- Proposed right turn ban from Grand Parade onto Dartmouth Place;
- Proposed right turn ban from Cullenswood Road onto Ranelagh Road;
- Proposed right turn ban from Ashfield Road onto Ranelagh Road;

- Proposed left turn bans from Chelmsford Lane and Sallymount Avenue onto Ranelagh Road; and
- Proposed right turn ban from Merton Drive onto Sandford Road.

3.2 Associated Infrastructure Projects and Developments

The Proposed Scheme will interface with the following under construction or proposed developments and as such the design has accounted for appropriate tie in with these schemes.

3.2.1 Grange Road Walking and Cycling Scheme

This scheme, which was completed in 2022, involved the provision of walking and cycling facilities on Grange Road between St. Enda's Drive and Nutgrove Avenue. The Proposed Scheme has been coordinated with this scheme.

3.2.2 Wellington Lane Walking and Cycling Scheme

This scheme involves the provision of walking and cycling facilities on Wellington Lane between Spawell Roundabout and Kimmage Road West. The Proposed Scheme has been coordinated with the proposals.

3.2.3 Dodder Greenway Scheme

This scheme involves the provision of cycle facilities adjacent to Dodder Park Road as well as the provision of cycle facilities on Spawell Road. The Proposed Scheme has been coordinated with the proposals.

3.2.4 Templeogue Village Initiative Scheme

This scheme, which was completed in 2022, involved upgrade and enhancement of the public realm within Templeogue Village by SDCC. The Proposed Scheme integrates with this scheme at either end of Templeogue Village.

3.3 Integration

As part of the Preliminary Design of the Proposed Scheme, consideration has been given to the potential coordination required in relation to other schemes within the BusConnects CBC Infrastructure Works. This section outlines potential interactions of the Proposed Scheme with adjacent scheme(s) and identifies any procedures within the construction strategies that may be required in order to account for various sequencing scenarios in the construction of the schemes.

The closest such scheme to the Proposed Scheme is the Kimmage to City Centre CBC Scheme, with which the Proposed Scheme interacts at the signalised junction of Harold's Cross Road / Rathgar Avenue / Kenilworth Square / Kenilworth Park and the junction of Harold's Cross Road and Parkview Avenue.

The BCID Infrastructure Team has coordinated the design tie-ins to ensure a holistic design has been achieved, so that each scheme can be implemented, and integrated, regardless of the sequencing of their construction.

The Proposed Scheme intends to improve the subject junction through the provision of cycle tracks on approach to the northern and southern arms of the junction, as well as the provision of toucan crossings on all arms of the junction to facilitate turning cyclists. It is proposed to remove the right turn lanes on Harold's Cross Road to facilitate these improve cycle facilities. Figure 3.1 shows an extract of the preliminary design of the Proposed Scheme at the subject junction.

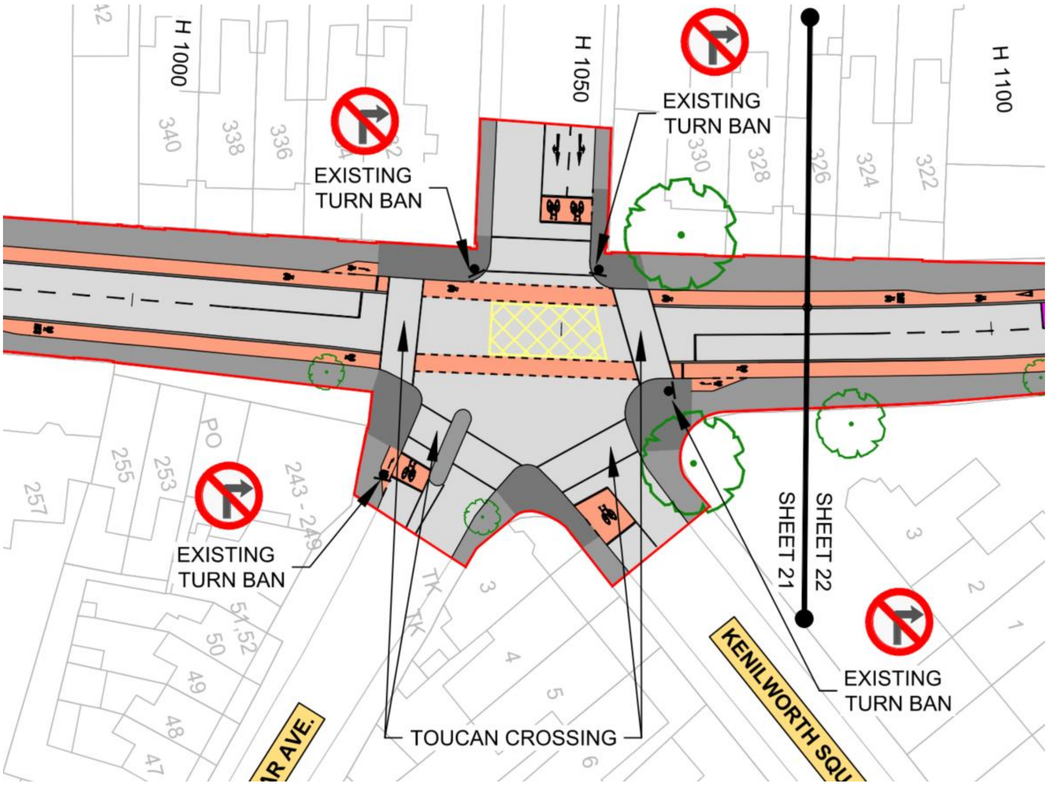


Figure 3.1: Preliminary design of the Proposed Scheme at the tie-in location with the Kimmage to City Centre Core Bus Corridor Scheme

The Kimmage to City Centre CBC Scheme proposes significant amendments to the existing junction to bring it in line with the BCPDGB and to meet the needs of the Kimmage to City Centre CBC Scheme, i.e. protected junction for cyclist principles, restricted turning movements for general traffic, Bus gate on Kenilworth Square North etc. Figure 3.2 shows an extract of the design of the Kimmage to City Centre CBC Scheme at the subject junction.

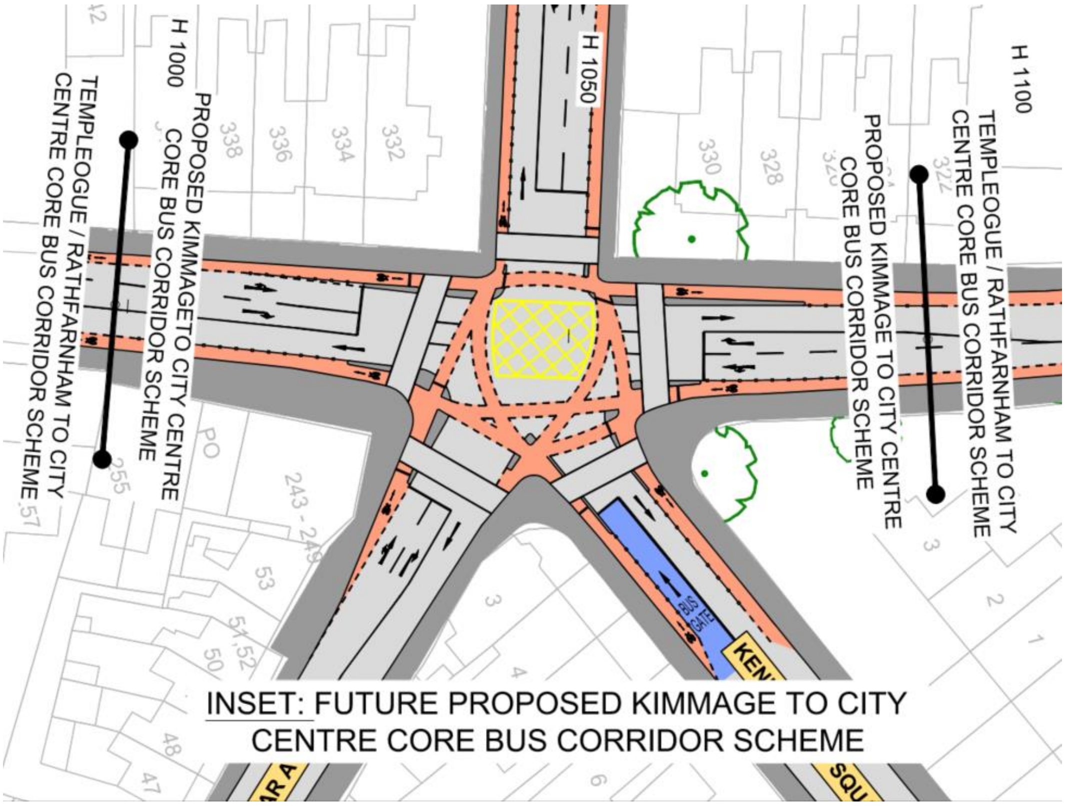


Figure 3.2: Preliminary design of the Kimmage to City Centre Core Bus Corridor Scheme at the subject junction

The Kimmage to City Centre CBC Scheme is subject to a separate planning process, the timing of which is largely independent of that of the Proposed Scheme, and as such no exact sequencing of construction works can be determined at this stage. Table 3.1 presents a matrix of potential interactions and impacts associated with various potential sequencing scenarios in relation to construction and operation of both schemes.

Table 3.1: Matrix of potential interactions and impacts associated with different sequencing scenarios

Scenario	Kimmage to City Centre Core Bus Corridor Scheme: Not Yet Commenced	Kimmage to City Centre Core Bus Corridor Scheme: Under Construction	Kimmage to City Centre Core Bus Corridor Scheme: Completed
Proposed Scheme: **Not Yet Commenced**	N/A	Construction of the proposed Kimmage to City Centre Core Bus Corridor Scheme shall be carried out in accordance with the Construction Strategy within that scheme's planning application, without any potential interaction with works associated with the Proposed Scheme. The works shall take place within the Red Line Boundary of same and tie-in with the existing environment on Harold's Cross Road.	The Kimmage to City Centre CBC Scheme shall be in full operation, designed in accordance with its planning application. Harold's Cross Road shall remain unchanged, in terms of physical infrastructure, outside of the Kimmage to City Centre CBC Scheme's Red Line Boundary.
Proposed Scheme: Under Construction	Construction of the Proposed Scheme will be carried out in accordance with the Construction Strategy within its planning application, without any potential interaction with works associated with the Kimmage to City Centre Core Bus Corridor Scheme. The works shall take place within the Red Line Boundary of same and tie-in with the existing environment at the subject junction.	It is not envisaged that both schemes will be under construction at the same time at this location.	The Kimmage to City Centre CBC Scheme will have been completed including the proposed upgrade of the subject junction. Common tie-in points have been determined approximately 35m from the existing stop line on the southern arm of the junction, and approximately 60m from the existing stop line on the northern arm of the junction outside of which the Proposed Scheme works will be constructed as per the proposed design shown in Figure 3.2.In this scenario it is not envisaged that any significant abortive works will be required, aside from minor works associated with footpath, cycle track, and pavement tie-ins.

Scenario	Kimmage to City Centre Core Bus Corridor Scheme: Not Yet Commenced	Kimmage to City Centre Core Bus Corridor Scheme: Under Construction	Kimmage to City Centre Core Bus Corridor Scheme: Completed
Proposed Scheme: Completed	The Proposed Scheme shall be in full operation, designed in accordance with its planning application. The subject junction shall remain unchanged, in terms of physical infrastructure, outside of the Rathfarnham to City Centre CBC Scheme's Red Line Boundary.	The Proposed Scheme will have been completed up to and including the interventions at the subject junction. As noted previously, the Kimmage to City Centre CBC Scheme proposes significant interventions at the subject junction, and as such any works carried out by the Proposed Scheme within the confines of the junction will be considered abortive and will be removed as part of the construction work on the Kimmage to City Centre CBC Scheme. Common tie-in points have been determined approximately 35m from the existing stop line on the southern arm of the junction, and approximately 60m from the existing stop line on the northern arm of the junction inside which the Kimmage to City Centre CBC Scheme works will be constructed as per the proposed design shown in Figure 3.2.	Both schemes shall be in full operation in accordance with each planning application and the arrangement will reflect the design shown in Figure 3.2.

4 Road Geometry

The following chapter outlines the process by which the geometrical design of the Proposed Scheme was undertaken. This chapter discusses the design speed, cross-section, horizontal and vertical alignment design, stopping sight distance, alignment modelling, active travel provision and corner radii and swept path of the Proposed Scheme.

4.1 Principal Geometric Parameters

The BCPDGB in Appendix O has been used to form the basis of design. Section 2.2 of this PDR lists the standards referenced within the BCPDGB.

The road geometry design of the Proposed Scheme was undertaken in accordance with the Design Manual for Urban Roads and Streets (DMURS) as published by the Department for Transport, Tourism and Sport (DTTAS).

For urban roads with a proposed speed limit equal to or greater than 60 km/h the design was undertaken in accordance with the Transport Infrastructure Ireland (TII) current design publications. In particular, adherence to the following standards is the basis of the Design:

- DN-GEO-03031 – Rural Road Link Design
- DN-GEO-03036 – Cross-sections and Headroom
- DN-GEO-03060 – Geometric Design of Junctions (priority junctions, direct accesses, roundabouts, grade separated and compact grade separated junctions)
- DN-GEO-03044 – 2009 TII addendum to UK DMRB TD 50/04 - Geometric Layout of Signal Controlled Junctions and Signalised Roundabouts

The BCPDGB has also been used to form the basis of the design.

The Proposed Scheme requires the reconfiguration of the existing carriageway and where practicable the existing geometry has been maintained to respect the existing site constraints. Where the existing road geometry does not meet the above design standards this has been highlighted within Section 4.17.

Table 4.1 summarises the key geometric design parameters applicable to all urban roads designed in accordance with DMURS contained within the Proposed Scheme.

Table 4.1: Geometric Design Parameters for Urban Roads designed to DMURS

Road Type	Design Speed (km/h)	Minimum Curve Radius (m) without Superelevation	Minimum Curve Radius (m) with 2.5% Superelevation	Minimum Longitudinal Gradient (%)	Maximum Gradient (%)	Minimum Sag Curve Value (K)	Minimum Crest Curve Value (K)
Urban Road with 30 km/h Speed Limit	30	26	-	0.5	5	2.3	N/A
Urban Road with 50 km/h Speed Limit	50	104	82	0.5	5	6.4	4.7
Urban Road with 60 km/h Speed Limit	60	187	136	0.5	5	9.2	8.2

4.2 Accessibility for Mobility Impaired Users

The Proposed Scheme will include the provision of enhanced walking and cycling infrastructure along the route.

The design process has included an Accessibility Audit of the existing road corridor environment, which is enclosed in Appendix I. The audit provided a description of the key accessibility features and potential barriers to mobility impaired people based on good practice, and identified the following issues to be addressed in the design process:

- Accessible Parking - On-street Disabled Parking Space layout should be to the appropriate standard, with dropped kerb access between the parking space and footpath;
- Access Routes on Footpaths - Width of footpaths should be clear of clutter, such as street furniture, and allow unimpeded access for the mobility impaired, and in doing so, meet the minimum standards for widths;
- Drainage - All footpaths should have sufficient cross-fall for drainage purposes but without affecting the ability of mobility-impaired people to move safely along the corridor;
- Guardrails - Guardrails should be located only where needed for safety purposes – and care should be taken not to create narrow spaces which create difficulties for movement;
- Pedestrian Crossing Points - Pedestrian crossing points should be laid out in accordance with standards and make it convenient and safe for mobility impaired users to negotiate crossing of carriageways;
- Controlled and Uncontrolled Crossings - Controlled and Uncontrolled Crossings should have tactile paving laid out correctly to provide tactile and visual assistance to mobility-impaired users approaching crossing points;
- Changes in Level - Any changes in level should be addressed in the design process to ensure that all changes in level, where practicable, comply with standards;
- Shared pedestrian/cyclist areas - Shared pedestrian/cyclist areas should be well laid out, with clear visual and tactile elements included, to ensure that these areas are safe for mobility-impaired users, pedestrians and cyclists;
- Surface Material - Footpath materials should be selected to ensure surfaces are free of undulations, with no trip hazards where there is a transition between surface materials – or where the Proposed Scheme ties into the existing infrastructure; and
- Street Furniture - All poles for signs and street lighting should be carefully located to minimise the effect on the safe and convenient passage of pedestrians and cyclists, with due cognisance to the safe movement of mobility impaired users.

The assessment of the existing street infrastructure and its ability to support access for disabled users have been based mainly on the Irish Wheelchair Association [IWA] '*Best Practice Guidelines, Designing Accessible Environments*' and The National Disability Authority's [NDA] '*Building for Everyone: A Universal Design Approach*'.

4.3 Mainline Cross-section (Lane Widths)

4.3.1 Design Guidance and Requirements

All the roads contained within the Proposed Scheme are urban in location and setting. The proposed road cross-sections were developed based on the guidance outlined in DMURS and DN-GEO-03036. For roads with a design speed of 60 km/h or less, traffic lane widths follow the guidance outlined in DMURS, with the preferred minimum width of traffic lanes on Proposed Scheme being:

- 3.0m in areas with a posted speed limit ≤ 60 km/h; and
- Traffic lane widths of 2.75m are permissible in DMURS but are not desirable. Reduced lane widths have only been applied on straight road sections with very low HGV traffic and where all desirable minimum widths for footpaths, cycle tracks, parking, and bus lanes are not achievable without impact on third-party land.

For roads designed to DMURS, bus lanes widths are a minimum of 3m as detailed in the BCPDGB.

Figure 4.1 summarises the optimum road cross-section, while Table 4.2 presents the geometric cross section requirements for road design to the BCPDGB.

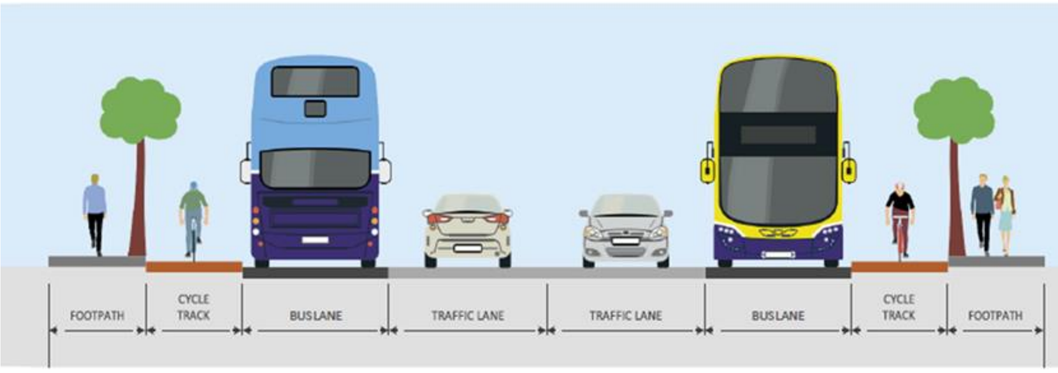


Figure 4.1: Optimum CBC Infrastructure Works Cross Section for this section comprising of a traffic lane, bus lane, cycle track and footpath in each direction

The National Cycle Manual (NCM) indicates the desirable minimum width for a single-direction, with-flow, raised-adjacent cycle track is 2.0m which includes a 0.25m kerb. This arrangement allows for two-abreast cycling. Based on the NCM Width Calculator this allows for overtaking within the cycle track. The minimum width is 1.5m, which, based on the NCM Width Calculator, allows for single file cycling. Localised narrowing of the cycle track below 1.5m may be necessary over very short distances to cater for local constraints (e.g. mature trees).

The desirable minimum width for a two-way cycle track is 3.25m. In addition to this, a desirable minimum buffer of 0.5m, with an absolute minimum of 0.3m, should be provided between the two-way cycle track and the carriageway. Using the NCM width calculator, reduction of these desirable minimum widths can be considered on a case-by-case basis, with due cognisance of the volume of cyclists anticipated to use the route as well as the level of service required.

The preferred arrangement for a two-way cycle track is for cyclists to ‘cycle on the left’. This is contrary to the current guidance provided in the National Cycle Manual, which recommends that the with-flow cyclist be placed closest to traffic to reduce relative speeds (i.e. a ‘cycle on the right’ regime). Notwithstanding this, a ‘cycle on the left’ regime is considered best practice in terms of legibility and has been successfully implemented on a number of projects in Ireland to date (e.g. Grand Canal Cycleway, Royal Canal Cycleway and S2S at Clontarf). This arrangement has been implemented on the Proposed Scheme. Refer to Table 4.2 for cycle track widths recommended by DMURS.

DMURS indicates a 2m wide footpath as the recommended limit / desirable minimum width. This width should be increased in areas catering for significant pedestrian volumes where space permits. DMURS defines the absolute minimum footway width for road sections as 1.8m based on the width required for two wheelchairs to pass each other. At specific pinch points, Building for Everyone: A Universal Design Approach, defines acceptable minimum footpath widths as being 1.2m wide over a 2m length of path (Figure 4.2). This minimum of 1.2m allows one wheelchair to pass. Refer to Table 4.2 for footpath widths recommended by DMURS.

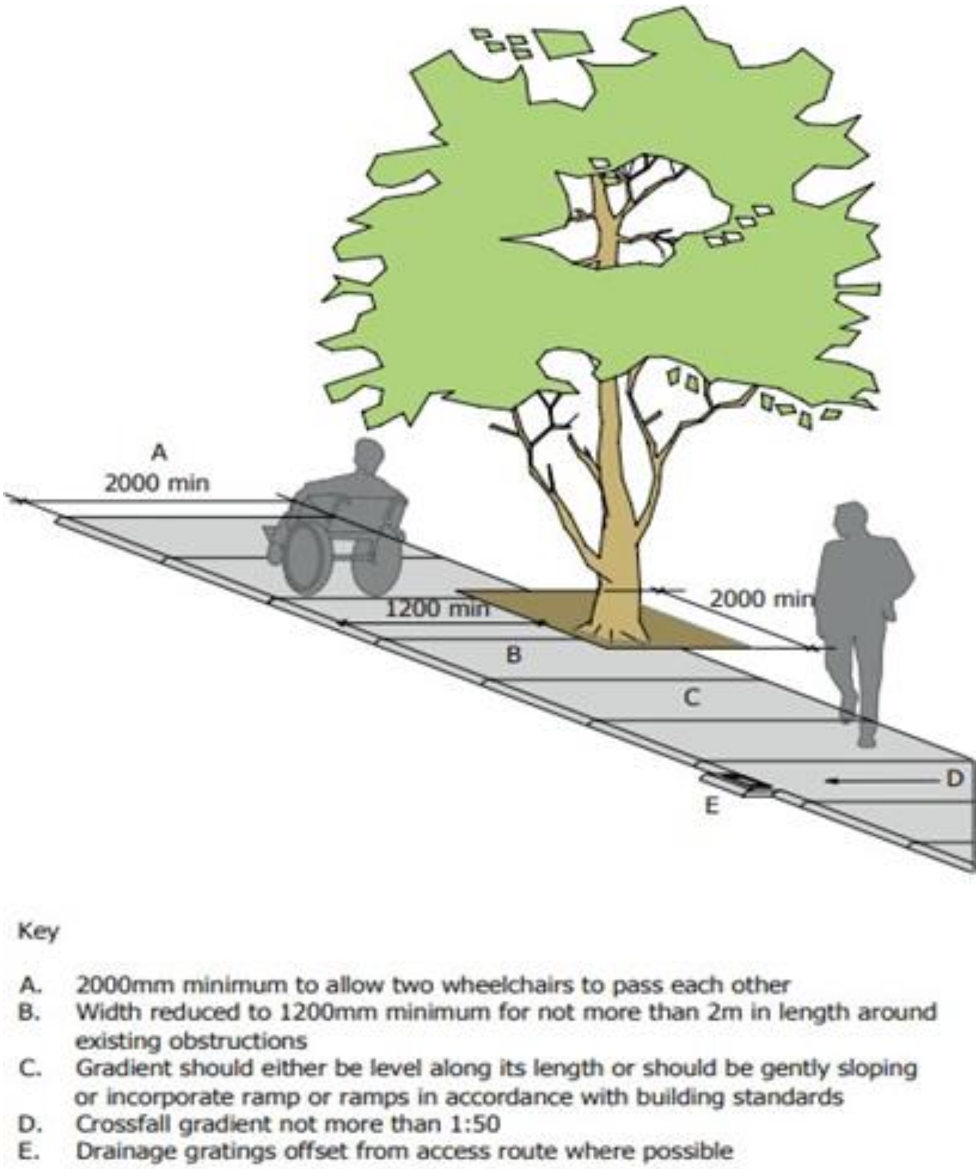


Figure 4.2: Recommended absolute minimum footpath widths allowable over a short section

Table 4.2: BCPDGB Cross-Sectional Design Parameters

Design Element	Desirable Minimum	Absolute Minimum	Permitted Reductions at Constraints
Footpath	2.0m	1.8m	1.2m over a 2m length of path (2)
Cycle Track (one-way)	2.0m	1.50m	Local narrowing below 1.5m may be necessary over short distances to cater for local constraints

Design Element	Desirable Minimum	Absolute Minimum	Permitted Reductions at Constraints
Cycle Track (two-way)	3.25m+ 0.5m (buffer)	Refer National Cycle Manual width calculator. 0.3m (buffer)	
Bus Lane	3.0m	N/A	N/A
Traffic Lane	Preferred Width: 3.0m where speed ≤ 60 km/h 3.25m where speed limit > 60 km/h	2.75m (3)	Matches

1. Deviations from the desirable minimum parameters in the table have been tabulated in Appendix C.
2. Building for everyone: A Universal Design Approach.
3. Traffic lane widths of 2.75m are permissible but not desirable and should only be permitted on straight road sections with very low HGV percentage and where all desirable minimum widths for footpaths, cycle tracks, parking, and bus lanes are not achievable without impacting on third-party lands.

4.3.2 Proposed Design

The geometric design of the Proposed Scheme has been sub-divided into Alignments A, J and H to account for the Rathfarnham to the City Centre alignment string (Alignment A), the Templeogue to Terenure alignment string (Alignment J) and Terenure Road North/Harold’s Cross Road alignment string (Alignment H).

Section 1: Tallaght Road to Rathfarnham Road (Alignment J)

The section of carriageway between CH J0100 and CH J0515 will match existing with minor realignments to the two-way cycle track which is to be provided in the northern verge. From CH J0515 to CH J0650 the inbound carriageway will be widened by up to 3m on the north to facilitate the upgrade of the Spawell Roundabout to a signalised junction. The grassed median will also be reduced on approach to the junction to a width of 3.45m to facilitate the junction upgrades. A 3m wide footpath is proposed in the inbound verge only, from CH J0100 to CH J0575.

Similar to the west, on the east of the Spawell Roundabout the central median will be reduced to a width of 3.4m to allow for the additional lanes needed for the proposed signalised junction. It is also proposed to convert sections of the existing roundabout carriageway into grassed verge and cycle tracks as part of the junction upgrades.

From CH J0700 to CH J1550 cycle tracks and footpaths are proposed in both directions with minimum widths of 2m proposed for both. The main alignment from the Spawell junction to Cypress Grove Road is to remain unchanged for the majority with all accesses along the mainline to be retained.

At the Cypress Grove Road junction, the corner radii are proposed to be tightened providing improved facilities and therefore enhanced safety for cyclists.

On the eastern arm of the junction, in the outbound direction, (CH J1150 and CH J1550) road widening is proposed, and the existing bus stop will be relocated to facilitate a bus lane and to accommodate existing access to properties.

On approach to Terenure Village, CH J1550 to CH J1840, land take is proposed from the adjacent properties on the northern side of the road to allow for a bus lane in the inbound direction. Cycle tracks are not proposed through this section to minimise the land take required. Bus lanes are proposed in both directions between CH J1730 and CH J1840.

East of Terenure Village, between CH J2000 and CH J2450 the existing cross section will be largely maintained. Cycle tracks, footpaths and bus lanes are proposed in both directions with a minimum of 1.5m, 1.6m and 3m respectively. A 0.25m buffer is proposed between the inbound cycle track and the bus lane through this section. At the Templeville Road Junction corner radii are again proposed to be tightened to improve cyclist facilities.

No on road cycle tracks are proposed from the Fortfield Road Junction to Rathdown Avenue. Instead, a 2.5m wide two-way cycle track will be introduced parallel to the mainline in the grass verge to the south. Footpaths of a minimum 1.5m are proposed in both directions. A bus lane is proposed in the outbound direction only from CH J2500 to CH J3240, and a 3m wide traffic lane in both directions.

Cycle facilities are proposed through quiet street treatment on Rathdown Drive from CH J2800 to CH J3270. From CH J3270 to CH J3650 a 2m cycle track is proposed in the outbound direction only. Two 3m shared traffic lanes are also proposed through this section with 1.6m minimum footpaths in both directions.

Section 2: Nutgrove Avenue to Terenure Road North – Grange Road, Rathfarnham Road (Alignment A)

This section of the Proposed Scheme begins at the junction of Grange Road and Nutgrove Avenue. Proposed upgrades to this junction include widening of the carriageway into the grassed verge to provide better cycle facilities through the junction. Land take will be required on the northern side of the junction as a result.

To the west of the junction, CH A0050 to CH A0120, carriageway widening of up to 7m will be necessary to provide bus lanes, cycle tracks and footpaths in both directions. From CH A0120 to CH A0550 the proposed cross section will be achieved through further widening and land take from the properties to the north. Traffic lanes are proposed to be removed on the Butterfield Avenue arm of the Rathfarnham Road and Butterfield Avenue junction to provide cycle facilities on this arm of the junction.

Further reductions and realignments to the central median are proposed from CH A0550 to CH A0700 to allow for 3m bus lanes, cycle tracks (1.5m min) and footpaths (2m min) in both directions.

The Castleside Drive junction will be upgraded to provide kerb protection for cyclists and reduced corner radii to provide safe cyclist movements through the junction.

To the north of the junction a bus lane will only be provided in the inbound direction, cycle tracks (1.5m min) and footpaths (1.8m min) are proposed in both directions. This cross section will continue from CH A0840 to CH A1110. Limited land take will be required from properties to the west of Rathfarnham Road between CH A0840 and CH A0925. On all approaches to the Dodder Park Road junction carriageway widening is proposed to maintain the desired cross section. North of the junction, due the existing width constraints on Pearse Bridge, a bus lane is only proposed in the outbound direction and cycle tracks are reduced to 1.5m in both directions.

North of Pearse Bridge, land take is proposed from the residential properties to the west between CH A1350 and CH A1500. This will allow for a single inbound bus lane (3m), cycle tracks (1.5m min) and footpaths (2m) in both directions.

3m bus lanes will again be introduced in both directions from Bushy Park Road to Beechlawn Way. Land take will be required from properties to the east to facilitate this and also provide cycle tracks (1.5m min) and footpaths (2m min) in both directions. A single inbound bus lane is proposed from Beechlawn Way to Terenure Road.

Section 3: Terenure Road North to Charleville Road – Terenure Road East, Rathgar Road, Harold’s Cross Road (Alignment A & H)

It is proposed to maintain the existing cross-section from CH A1860 to CH A2000. From CH A2000 to CH A2250 land take is proposed from properties on both sides of Terenure Road East to achieve a cross section with bus lanes and general traffic lanes in both directions. From CH A2250 to CH A2500 the same cross section is proposed by utilising the existing carriageway width with minor narrowing of footpaths (2m min). No cycle tracks are proposed on Terenure Road East.

Minor adjustments are proposed to the Highfield Road junction, including minor narrowing of footpaths and adjustments to corner radii, which would allow cycle tracks to be re-introduced from CH A2500 onwards.

From Highfield Road to Grosvenor Road (CH A2550 to CH A3650) a single general traffic lane is proposed in the inbound direction only. This would facilitate bus lanes (3m), cycle tracks (1.5m min) and footpaths (1.8m min) in both directions while not affecting adjacent properties. Adjustments to footpaths and corner radii are proposed at the Grosvenor Road Junction while the footpath at the Rathmines Road junction will be widened from 6.33m to 15.5m to provide a larger public realm.

A bus lane is only proposed in the inbound direction between Grosvenor Road and Castlewood Avenue, with cycle tracks (1.5m min), footpaths (2m) and general traffic lanes proposed in both directions.

From Terenure Cross to Parkview Avenue (CH H0000 to CH H1548) the proposed cross section will involve minor amendments to the existing to provide new cycle tracks to improve cyclist safety. Shared traffic lanes are proposed in both directions.

Section 4: Charleville Road to Dame Street (Alignment A)

From Castlewood Avenue to La Touche Bridge (CH A3860 to CHA 4660) shared traffic lanes, cycle tracks (2m) and footpaths (2.7m min) are proposed in both directions. A bus gate is proposed at CH A4400 to prevent general traffic from utilising this route to access the city during its hours of operation.

From Richmond Row to Lennox Street very minor adjustments are proposed to the kerb line to facilitate the proposed cycle tracks (2m min) in both directions. A single outbound traffic lane is proposed with bus lanes and footpaths (1.7m min) in both directions. From Lennox Street to Harrington Street a bus lane is proposed in the inbound direction only and a shared traffic lane outbound. Cycle tracks (2m) and footpaths (1.8m min) are proposed in both directions.

The overall width of Camden Street to Dame Street is not proposed to change due to the congested nature of this section. There are minor changes proposed to the alignment of cycle tracks and widths of footpaths.

Bus lanes are proposed in both directions from CH A5000 to CH A5080 and a single inbound traffic lane. Footpaths through this section will be a minimum of 2.7m wide.

From Charlotte Way to Montague Street (CH A5080 to CH A5400) Bus lanes, cycle tracks, and footpaths are proposed in both directions with a single outbound general traffic lane. No outbound bus lane will be provided from Montague Street to Cuffe Street. At the Cuffe Street junction adjustments to footpath and corner radii are proposed to improve cycle movement through the junction.

From the Cuffe Street junction to Dame Street (CH A5550 to CH A6285) shared traffic lanes, cycle tracks and footpaths are proposed in both directions. Adjustments to corner radii and footpath width are proposed through these chainages to achieve the desired cross section.

Table 4.3: Proposed Scheme vs Existing Nominal Cross-section Widths

Chainage Reference	Existing Inbound Carriageway Proposed Inbound Carriageway				Existing Outbound Carriageway Proposed Outbound Carriageway				Existing Conditions Notes Proposed Scheme Notes
	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	
(Alignment J) Dennings to Kennedy's Field - Tallaght Road									
CH J100 to CH J250	**1.5m**	**2.5m Two-way Cycle Track**	**N/A**	**3 x 3-3.6m lanes**	**3m**	**N/A**	**N/A**	**3 x 3.3-3.6m lanes**	No inbound / outbound bus lane in the existing conditions. Two-way offline cycle track on inbound side. Central Median of 7.3m.
	3m	3m Two-way Cycle Track	N/A	3 x 3-3.6m lanes	3m	N/A	N/A	3 x 3.3-3.6m lanes	No inbound / outbound bus lane. Two-way offline cycle track on inbound side. Central Median of 7.3m.
(Alignment J) Kennedy's Field to Wheelie Bin Storage Ireland - Tallaght Road									
CH J250 to CH J650	**1.3m**	**2.5m Two-way Cycle Track**	**3.3m**	**2 x 3-3.6m lanes**	**N/A**	**N/A**	**3m**	**2 x 3.3-3.6m lanes**	Inbound bus lane, with a two-way offline cycle track on the inbound side. No outbound bus lane in the existing conditions.
	3m	3m Two-way Cycle Track	3.3m	2 x 3-3.6m lanes	N/A	N/A	3m	2 x 3.3-3.6m lanes	Bus lane in each direction. Two-way offline cycle track on the inbound side.

Chainage Reference	**Existing Inbound Carriageway** **Proposed Inbound Carriageway**				**Existing Outbound Carriageway** **Proposed Outbound Carriageway**				**Existing Conditions Notes** **Proposed Scheme Notes**
	Footway width (m)	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	**Footway width (m)**	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	
(Alignment J) Spawell Junction to Cheeverstown - Templeogue Road									
CH J650 to CH J1050	**1.5m**	**2.25m Two-way Cycle Track**	**3m**	**2 x 3.3-3.6m lanes**	**1.05-1.8m**	**N/A**	**N/A**	**3 x 3.3-3.6m lanes**	Inbound bus lane, with a two-way offline cycle track on the inbound side. No outbound bus lane in the existing conditions.
	2m	2m	3.3m	2 x 3.6m lanes	2m	2m	3m	2 x 3.6m lanes	Bus lane in each direction. Segregated Cycle Tracks in each direction.
(Alignment J) Cheeverstown to Cypress Grove Road - Templeogue Road									
CH J1050 to CH J1425	**1.2-1.8m**	**1.5m**	**3m**	**3 x 3.6-4m lanes**	**1.1-1.7m**	**1.8m**	**N/A**	**3 x 3.5-3.7m lanes**	Segregated cycle tracks in each direction, with an inbound bus lane in the existing conditions. No outbound bus lane.
	2m	2m	3m	2 x 3.4m lanes	2m	2m	3.1m	2 x 3.3m lanes	Bus lane in each direction. Segregated Cycle Tracks in each direction.

Chainage Reference	**Existing Inbound Carriageway** **Proposed Inbound Carriageway**				**Existing Outbound Carriageway** **Proposed Outbound Carriageway**				**Existing Conditions Notes** **Proposed Scheme Notes**
	Footway width (m)	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	**Footway width (m)**	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	
(Alignment J) Cypress Grove Road to Templeogue Road (Access/Service Road) - Templeogue Road									
CH J1425 to CH J1570	**3-3.5m**	**1.5m**	**N/A**	**1 x 2.8 - 4.2m lane**	**1.8-2m**	**N/A**	**N/A**	**3 x 2.8-3.6m lanes**	No inbound / outbound bus lane in the existing conditions, with an on-road cycle lane on the inbound side (white line segregated). No cycle facilities in the outbound direction.
	3.9m	2m	3m	1 x 3m lane	2m	2m	3m	2 x 3m lanes	Bus lane in each direction. Segregated Cycle Tracks in each direction. Entrance to residential properties 248-258 on Templeogue Road upgraded with a raised entry treatment to promote slower driving speeds and enhance cycling facilities.
(Alignment J) Templeogue Road (Access/Service Road) to Ashfield Place - Templeogue Road									
CH J1570 to CH J1740	**2.6-3m**	**Shared with Carriageway / 1.5m**	**N/A**	**1 x 3.3-3.6m lane**	**2.1-3.7m**	**Shared with Carriageway / 1.5m**	**N/A**	**1 x 3.4-3.7 lane**	No inbound / outbound bus lane in the existing conditions, with cycle lanes in both directions in shared facility with the carriageway (Broken white line).
	2m	N/A	3m	1 x 3m lane	2.2m	N/A	N/A	1 x 3m lane	Inbound bus lane provided with cycling facilities shared with bus lane. No outbound bus lane or cycling facilities.

Chainage Reference	Existing Inbound Carriageway Proposed Inbound Carriageway				Existing Outbound Carriageway Proposed Outbound Carriageway				Existing Conditions Notes Proposed Scheme Notes
	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	
(Alignment J) Ashfield Place to Templeogue Village - Templeogue Road									
CH J1740 to CH J1820	**2.8 - 4.7m**	**Shared with Carriageway / 1.5m**	**N/A**	**1 x 3.5-4m lane**	**2.7 - 3.1m**	**Shared with Carriageway / 1.5m**	**N/A**	**1 x 3.5-4.1 lane**	No inbound / outbound bus lane in the existing conditions, with cycle lanes in both directions in shared facility with the carriageway (Broken white line).
	2m	N/A	3m	1 x 3m lane	2.2m	N/A	3m	1 x 3m lane	Inbound bus lane provided with cycling facilities shared with bus lane. Outbound bus lane with shared cycling facilities provided.
(Alignment J) Templeogue Village to Fortfield Road - Templeogue Road									
CH J2040 to CH J2480	**1.7m**	**Shared with bus lane**	**3m**	**1 x 3.6m lane**	**2.4-2.9m**	**N/A**	**3m**	**1 x 3.3m lane**	Bus lanes in both directions in the existing conditions, with cycling facilities largely shared with bus lane.
	1.6-3.3m	1.5m	3m	1 x 3m lane	1.8-4.4m	1.5m	3m	1 x 3m lane	Bus lanes in each direction. Segregated Cycle Tracks in each direction. Grass verge segregation between bus lane and cycle track on outbound approach to our Lady's Hockey Club, width 2.7m. Cycle track width locally narrowed at this section in order to provide appropriate pedestrian and bus facilities.

Chainage Reference	Existing Inbound Carriageway Proposed Inbound Carriageway				Existing Outbound Carriageway Proposed Outbound Carriageway				Existing Conditions Notes Proposed Scheme Notes
	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	Footwa y width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	
(Alignment J) Fortfield Road to Rathdown Avenue - Templeogue Road									
CH J2480 to CH J2800	**1.7m**	**N/A**	**N/A**	**1 x 4.6-5.2 lane**	**Offline 4m**	**N/A**	**N/A**	**1 x 4-4.4m lane**	No inbound / outbound bus lane and cycling facilities in the existing conditions.
	1.8m	N/A	N/A	1 x 3m lane	1.5m	2.5m Two-Way Cycle Track	3m	1 x 3m lane	Outbound bus lane provided. Two-way offline Cycle Track on the outbound side within the vicinity of Bushy Park.
(Alignment J) Rathdown Avenue to Rathdown Crescent - Templeogue Road									
CH J2800 to CH J3240	**1.6m**	**Shared with Bus Lane / 1.2m**	**3.6 - 4m**	**1 x 3m lane**	**N/A**	**N/A**	**N/A**	**1 x 3.1m lane**	Inbound bus lane in the existing conditions with cycle lane in shared facility with the bus lane. No outbound bus lane or cycling facilities.
	2.8m	N/A	N/A	1 x 3m lane	2m	N/A	3m	1 x 3m lane	Outbound bus lane. Cycling facilities provided by means of a quiet street treatment on Rathdown Drive.
(Alignment J) Rathdown Crescent to Terenure Road West - Terenure Road West									
CH J3240 to CH J3650	**1.6-1.8m**	**Shared with Carriageway / 1.2m**	**N/A**	**1 x 4.3m lane**	**1.2-1.5m**	**Shared with Carriageway / 1.2-1.5m**	**N/A**	**1 x 4.2-4.8m lane**	No bus lane in the existing conditions with cycle lanes in both directions in the shared facility with the carriageway.

Chainage Reference	Existing Inbound Carriageway Proposed Inbound Carriageway				Existing Outbound Carriageway Proposed Outbound Carriageway				Existing Conditions Notes Proposed Scheme Notes
	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	
	2.4m	N/A	N/A	1 x 3m lane	1.6m	2m	N/A	1 x 3m lane	No outbound bus lane. Inbound bus priority provided by means of bus gate north of Olney Grove. Segregated Cycle Track outbound with inbound cycling facilities shared with bus lane.
(Alignment A) Nutgrove Avenue to Butterfield Avenue - Rathfarnham Road									
CH A000 to CH A450	**2-3m**	**3.6-4m**	**3.3m Partial Bus Lane**	**1 x 3m lane**	**1.5-2.5m**	**1.4m**	**N/A**	**1 x 3m lane**	Inbound bus lane in the existing conditions with cycling facilities shared with bus lane. Raised Cycle Lane outbound. No outbound bus lane.
	2.2m	2m	3m	1 x 3m lane	2m	2m	3m	1 x 3m lane	Bus lane in each direction. Segregated Cycle Tracks in each direction.
(Alignment A) Butterfield Avenue to Rathfarnham Castle Car Park - Rathfarnham Road									
CH A450 to CH A750	**2.6-3.6m**	**N/A**	**3.5m**	**1 x 3.3-4.5m lane**	**2.6-2.9m**	**N/A**	**3.5m**	**1 x 3.3m lane**	Bus lane in both direction in the existing conditions. Cycling facilities shared with bus lane in both directions.
	2m	2m	3m	1 x 3m lane	3m	2m	3m	1 x 3m lane	Bus lane in each direction. Segregated Cycle Tracks in each direction.

Chainage Reference	Existing Inbound Carriageway **Proposed Inbound Carriageway**				Existing Outbound Carriageway **Proposed Outbound Carriageway**				Existing Conditions Notes **Proposed Scheme Notes**
	Footway width (m)	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	**Footway width (m)**	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	
(Alignment A) Rathfarnham Texaco Station to Rathfarnham Park - Rathfarnham Road									
CH A750 to CH A1110	**1.8 - 2.2m**	**1.6m**	**2.8m Partial Bus Lane**	**1 x 3.6m lane**	**1.8-2.3m**	**1.5m**	**N/A**	**1 x 3-3.3m lane**	Outbound on-road cycle lane, with a partial on-road cycle lane inbound that transitions into cycling facilities shared with the bus lane. Partial inbound bus lane and no outbound bus lane in the existing conditions.
	1.8m	N/A	3m	1 x 3m lane	1.8m	1.5m	N/A	1 x 3m lane	Inbound bus lane with cycling provisions shared with bus lane, cycling facilities transition to a Segregated Cycle Track at approach to Rathfarnham Park. Segregated Cycle Track outbound, cycle track width locally narrowed at this section to provide appropriate pedestrian facilities and minimise widening into adjacent properties.

Chainage Reference	Existing Inbound Carriageway Proposed Inbound Carriageway				Existing Outbound Carriageway Proposed Outbound Carriageway				Existing Conditions Notes Proposed Scheme Notes
	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	
(Alignment A) Rathfarnham Park to Dodder Park Road - Rathfarnham Road									
CH A1110 to CH A1250	**2.4m**	**N/A**	**N/A**	**3 x 3m lanes**	**1.8-2.8m**	**1.5m**	**N/A**	**1 x 3-3.6m lane**	No bus lanes in existing conditions with outbound on-road cycle lanes in shared facility with the carriageway.
	2m	1.5m	3m	2 x 3m lanes	2m	1.5m	N/A	1 x 3m lane	Inbound bus lane. Segregated Cycle Track in both directions, cycle track width locally narrowed at this section to provide appropriate pedestrian facilities and minimise widening into adjacent properties.
(Alignment A) Pearse Bridge - Rathfarnham Road									
CH A1250 to CH A1375	**2.7m**	**N/A**	**N/A**	**1 x 5.2-5.6m lane**	**3.5m**	**Shared with Carriageway / 1.2m**	**N/A**	**1 x 4.6-4.7m lane**	No bus lanes in the existing conditions. Limited outbound on-road cycle lanes in shared facilities with the carriageway.

Chainage Reference	**Existing Inbound Carriageway** **Proposed Inbound Carriageway**				**Existing Outbound Carriageway** **Proposed Outbound Carriageway**				**Existing Conditions Notes** **Proposed Scheme Notes**
	Footway width (m)	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	**Footway width (m)**	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	
	2m	1.5m	N/A	1 x 3m lane	3m	1.5m	3m	1 x 3m lane	Segregated Cycle Tracks in both directions, cycle track width locally narrowed at this section to provide appropriate pedestrian facilities and minimise widening into adjacent properties. Outbound Bus Lane proposed. No inbound bus lane.
(Alignment A) Westbourne Road to Rathdown Park - Rathfarnham Road									
CH A1375 to CH A1550	**1.6-2.1m**	**N/A**	**3.4m Part Time Bus Lane**	**1 x 2.9m lane**	**2-4.4m**	**Shared with Carriageway / 1.2m**	**N/A**	**1 x 4.4-4.7m lane**	Inbound bus lane with cycling provision in shared facility with bus lane in the existing conditions. Outbound cycle lane in shared facility with carriageway. No outbound bus lane.
	3m	1.5m	3m	1 x 3m lane	2m	1.5m	N/A	1 x 3m lane	Inbound bus lane proposed. Segregated Cycle Tracks in both directions, cycle track width locally narrowed at this section to provide appropriate pedestrian facilities and minimise widening into adjacent properties.

Chainage Reference	Existing Inbound Carriageway Proposed Inbound Carriageway				Existing Outbound Carriageway Proposed Outbound Carriageway				Existing Conditions Notes Proposed Scheme Notes
	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	
(Alignment A) Rathfarnham War Memorial Hall to Beechlawn Way - Rathfarnham Road									
CH A1550 to CH A1750	2.2-5.6m	N/A	3.3-3.5m Part Time Bus Lane	1 x 3-3.5m lane	2.3-3.8m	Shared with Carriageway / 1.2m	N/A	1 x 4.3-5.8m lane	Inbound bus lane with cycling provisions in shared facilities with bus lane. Outbound cycle lane in shared facilities with carriageway. No outbound bus lane.
	2.35m	1.5m	3m	1 x 3m lane	2m	1.5m	3m	1 x 3m lane	Bus lane in each direction. Segregated Cycle Tracks in each direction, cycle track width locally narrowed at this section to provide appropriate pedestrian facilities and minimise widening into adjacent properties.
(Alignment A) Beechlawn Way to Terenure Cross - Terenure Road East									
CH A1750 to CH A1860	2.3-5.7m	N/A	3m Part Time Bus Lane	1 x 2.8-3.5m lane	1.6-2.9m	Shared with Carriageway / 1.2m	N/A	1 x 5-6.2m lane	Partial Inbound bus lane at this section with cycling provisions in the shared facilities with the bus lane. Outbound cycle lane in the shared facilities with the carriageway. No outbound bus lane.

Chainage Reference	Existing Inbound Carriageway **Proposed Inbound Carriageway**				Existing Outbound Carriageway **Proposed Outbound Carriageway**				Existing Conditions Notes **Proposed Scheme Notes**
	Footway width (m)	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	**Footwa y width (m)**	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	
	2m	1.5m	3m	1 x 3m lane	2m	1.4-2m	N/A	1 x 3m lane	Segregated Cycle Tracks in both directions. Inbound bus lane proposed. No outbound bus lane.
(Alignment A) Terenure Cross to Glenone Montessori - Terenure Road East									
CH A1860 to CH A2000	**2.2m**	**Shared with Carriageway / 1m**	**N/A**	**1 x 3.8m lane**	**2.2-3m**	**Shared with Carriageway / 1.1**	**N/A**	**1 x 3.8m lane**	No bus lane in the existing conditions. Cycle lanes in both directions in shared facility with general traffic.
	3.5m	N/A	N/A	1 x 3m lane	3m	N/A	N/A	1 x 3m lane	No bus lanes in both directions. Cycling facilities provided by means of shared street.
(Alignment A) Glenone Montessori to Rathgar Avenue - Rathgar Road									
CH A2000 to CH A2450	**2-3.2m**	**Shared with Carriageway / 1-1.7m**	**3.4m Partial Bus Lane**	**1 x 4-4.7m lane**	**1.8-2.5m**	**Shared with Carriageway / Bus Lane / 1.1m**	**3.4m Partial Bus Lane**	**1 x 4.4m lane**	Partial bus lanes in both directions in the existing conditions. Cycle lanes in shared facilities with the carriageway in both directions combined with cycling provisions in shared facilities with bus lane.
	2m	N/A	3m	1 x 3m lane	2.1m	N/A	3m	1 x 3m lane	Bus lanes provided in both directions. Cycling provisions in shared facility with the bus lane.
(Alignment A) Highfield Road to Madison House - Rathgar Road									

Chainage Reference	**Existing Inbound Carriageway** **Proposed Inbound Carriageway**				**Existing Outbound Carriageway** **Proposed Outbound Carriageway**				**Existing Conditions Notes** **Proposed Scheme Notes**
	Footway width (m)	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	**Footwa y width (m)**	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	
CH A2450 to CH A2650	**2.1-3m**	**N/A**	**3m Part Time Bus Lane**	**1 x 3m lane**	**2.3-2.8m**	**1.9-2.1m**	**N/A**	**1 x 3m lane**	Inbound bus lane, with cycling provisions in shared facilities with the bus lane. Outbound cycle lane.
	2m	2m	N/A	1 x 3.25m lane	1.8m	2m	3.3m	N/A	Outbound bus lane proposed and inbound bus lane partially proposed through the section. Segregated Cycle Tracks in each direction, cycle track width locally narrowed at this section to provide appropriate pedestrian facilities and minimise widening into adjacent properties. One-way inbound traffic regime.
(Alignment A) Madison House to Grosvenor Road - Rathgar Road									
CH A2650 to CH A3625	**2-3m**	**N/A**	**3m Part Time Bus Lane**	**1 x 3m lane**	**2-2.5m**	**1.6-1.8m**	**N/A**	**1 x 3-3.3m lane**	Inbound bus lane, with cycling provisions in shared facilities with the bus lane. Outbound cycle lane.

Chainage Reference	**Existing Inbound Carriageway** **Proposed Inbound Carriageway**				**Existing Outbound Carriageway** **Proposed Outbound Carriageway**				**Existing Conditions Notes** **Proposed Scheme Notes**
	Footway width (m)	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	**Footway width (m)**	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	
	2m	1.5m	3m	1 x 3m lane	1.9m	1.5m	3m	N/A	Bus lanes in both direction. Cycle tracks proposed in both direction, cycle track width locally narrowed at this section to provide appropriate pedestrian facilities and minimise widening into adjacent properties. One-way inbound traffic regime.
(Alignment A) Grosvenor Road to Castlewood Avenue - Rathmines Road									
CH A3625 to CH A3840	**2.2-3.7m**	**Shared with Carriageway / 1.1m**	**N/A**	**2 x 2.5-3.2 lanes**	**2-5.5m**	**Shared with Carriageway / 1.1m**	**N/A**	**2 x 2.6-3.2 lanes**	No bus lanes in the existing conditions. Cycle Lanes in both directions in shared facility with general traffic.
	2m	1.5m	3m	1 x 3m lane	2m	1.5m	N/A	1 x 3m lane	Inbound bus lane. Segregated Cycle Track in both directions.
(Alignment A) Swanville Place to Richmond Hill- Rathmines Road									
CH A3840 to CH A4400	**1.9-7.2m**	**N/A**	**3m**	**1 x 3m lane**	**2.5-4m**	**1.5m**	**N/A**	**1 x 3.1m lane**	Inbound bus lane with cycling provision in shared facility with the bus lane. Outbound on-road cycle lane.

Chainage Reference	Existing Inbound Carriageway Proposed Inbound Carriageway				Existing Outbound Carriageway Proposed Outbound Carriageway				Existing Conditions Notes Proposed Scheme Notes
	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	Footwa y width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	
	2.7m	2m	N/A	1 x 3m lane	3.4	2*	N/A	1 x 3m lane	Segregated Cycle Track in both directions. Bus gate and local access measures are introduced on Rathmines Road Lower.
(Alignment A) Richmond Hill to Grove Road - Rathmines Road									
CH A4400 to CH A4710	**2-3m**	**N/A**	**3m**	**1 x 3m lane**	**2-3m**	**1.5-1.7m**	**N/A**	**1 x 3.1m lane**	Inbound bus lane with cycling provision in shared facility with the bus lane. Outbound on-road cycle lane.
	2.7m	2m	N/A	1 x 3.5m lane	3.4m	2m*	3.2m	N/A	Segregated Cycle Track in both directions. Bus gate and local access measures are introduced on Rathmines Road Lower.
(Alignment A) Grove Road to Gordon Place - Richmond Street South									
CH A4710 to CH A4850	**3.8m**	**N/A**	**3.1m**	**1 x 3.2m lane**	**4.8m**	**Shared with Carriageway / 2m**	**N/A**	**1 x 5.3m lane**	Inbound bus lane with cycling provision in shared facility with bus lane. Cycle lane outbound in shared facilities with the carriageway.

Chainage Reference	Existing Inbound Carriageway Proposed Inbound Carriageway				Existing Outbound Carriageway Proposed Outbound Carriageway				Existing Conditions Notes Proposed Scheme Notes
	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	
	1.7m	2m	3m	N/A	1.8m	2m	3m	1 x 3m lane	Bus lane in both directions, with the exception of a short section outbound on approach to Charlemont Mall where bus priority is to be provided by signal-controlled bus priority. Segregated Cycle track in both directions. Cycle track width locally narrowed at this section to provide appropriate pedestrian facilities and minimise widening into adjacent properties.
(Alignment A) Gordon Place to Harcourt Road - Richmond Street South									
CH A4850 to CH A4980	**2m**	**1.7m**	**N/A**	**1 x 3m lane**	**2-3m**	**N/A**	**3.5m**	**N/A**	Inbound on-road cycle lane. Outbound bus lane with cycling provisions in the shared facilities with bus lane in the existing conditions.
	1.9m	2m	3m	N/A	1.8m	2m	N/A	1 x 3m lane	Segregated Cycle Track in both directions, cycle track width locally narrowed at this section to provide appropriate pedestrian facilities and minimise widening into adjacent properties. Inbound bus lane.

Chainage Reference	Existing Inbound Carriageway Proposed Inbound Carriageway				Existing Outbound Carriageway Proposed Outbound Carriageway				Existing Conditions Notes Proposed Scheme Notes
	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	
(Alignment A) Harcourt Road to Charlotte Way - Camden Street Upper									
CH A4980 to CH A5110	**2.3-4.3m**	**2m**	**N/A**	**3 x 3m lanes**	**1.5-7.5m**	**N/A**	**3.3-4.2m**	**N/A**	Inbound on-road cycle lane in the existing conditions. Outbound bus lane with cycling provision in shared facility with bus lane.
	2.3m	2m	3m	1 x 3m lane	2.7m	2m	3m	N/A	Segregated Cycle track in both directions. Bus lane in both directions. One-way inbound traffic regime.
(Alignment A) Charlotte Way to Montague Street - Camden Street Lower									
CH A5110 to CH A5430	**2-4.3m**	**N/A**	**3-3.5m**	**1 x 3-3.5m lane**	**2.2-7.8m**	**N/A**	**3.5-3.8m**	**1 x 2.9-3.3m lane**	Outbound bus lane with cycling provisions in shared facilities with bus lane. Partial bus lane in this section with cycling facilities in shared facilities with bus lane.
	4.5m	1.75m	3m	N/A	3.5m	2m	3m	1 x 3m	Cycle track in both directions. Bus lane in both directions. One-way outbound traffic regime.

Chainage Reference	Existing Inbound Carriageway Proposed Inbound Carriageway				Existing Outbound Carriageway Proposed Outbound Carriageway				Existing Conditions Notes Proposed Scheme Notes
	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	Footway width (m)	Cycle lane/ Track Width (m)	Bus Lane Width (m)	Traffic Lane Width (m)	
(Alignment A) Montague Street to Kevin Street Lower - Wexford Street									
CH A5430 to CH A5560	**2-3.8m**	**Shared with Carriageway / 1.1m**	**N/A**	**1 x 4.1-4.6 lane**	**2.5-9m**	**Shared with Carriageway / 1.2m**	**N/A**	**1 x 4.4-4.6m lane**	On-road cycle lane in both direction in shared facilities with carriageway.
	2.3m	1.5m	3m	N/A	2.4m	1.5m	N/A	1 x 3m lane	Segregated Cycle Tracks in both direction. One-way outbound traffic regime. Outbound bus lane.
(Alignment A) Kevin Street Lower to Dame Street – Redmond's Hill / Aungier Street / South Great George's Street									
CH A5560 to CH A6285	**2-5m**	**Shared with Carriageway / 1.3m**	**3.1m Partial Bus Lane**	**1 x 3.1-4.4m lane**	**2.6-8m**	**Shared with Carriageway / 1.3m**	**3.5m**	**1 x 3-5m lane**	Partial bus lanes in both direction in the existing conditions. Cycling facilities provided by a combination of on-road cycle lanes shared with the carriageway and shared facilities with the bus lane.
	3.6m	2m	N/A	1 x 3m lane	3.3m	1 x 2m	N/A	1 x 3m lane	Cycle track in both directions. No bus lanes proposed.

Chainage Reference	Existing Inbound Carriageway **Proposed Inbound Carriageway**				Existing Outbound Carriageway **Proposed Outbound Carriageway**				Existing Conditions Notes **Proposed Scheme Notes**
	Footway width (m)	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	**Footway width (m)**	**Cycle lane/ Track Width (m)**	**Bus Lane Width (m)**	**Traffic Lane Width (m)**	
(Alignment H) Yewlands Terrace to Parkview Avenue - Harold's Cross Road									
CH H000 to CH H1500	1.5-8.2m	Shared with Carriageway / 1.2-1.5m	2.7m Partial & Part Time Bus Lane	1 x 3-5.7m lane	1.2-3.7m	Shared with Carriageway / 1.2-1.5m	2.7m Partial & Part Time Bus Lane	1 x 3-5.3m lane	Partial bus lane inbound in the existing conditions. Cycling facilities provided by a combination of on-road cycle lanes shared with the carriageway and shared facilities with the bus lane.
	2.8m	2m	N/A	1 x 3m lane	2m	2m	N/A	1 x 3m lane	Segregated Cycle track in both directions. No outbound / inbound bus lane.

4.4 Design Speed and Speed Limit

As outlined in DMURS *'Design speed is the maximum speed at which it is envisaged/intended that the majority of vehicles will travel under normal conditions'*. Therefore the design speed proposed for urban roads is aligned with the proposed speed limit.

For regional roads (R137 Tallaght Road / Templeogue Road / Terenure Place, R821 Grange Road, R115, R114 Rathfarnham Road / Terenure Road East / Rathgar Road / Rathmines Road Lower / Richmond Street South / Camden Street Upper / Camden Street Lower / Wexford Street / Aungier Street / South Great George's Street) the design speed is based on the proposed speed limit. The current speed limit on the Proposed Scheme is mainly 50km/h, with the exception of Templeogue Road (from M50 to Hillcrest) where the speed limit is 60km/h and Camden Street Upper, Camden Street Lower, Wexford Street, Redmond's Hill, Aungier Street and South Great George's Street where the speed limit is 30km/h.

The design speeds used for the proposed mandatory speed limits are detailed in Table 4.4.

Table 4.4: Maximum Design Speeds for Mandatory Speed Limits

Speed Limit km/h	Design Speed km/h	Design Standard
30	30	DMURS
50	50	DMURS
60	60	DMURS
50	60	DN-GEO-03031 (Regional roads only)
60	70	DN-GEO-03031 (Regional roads only)
80	85	DN-GEO-03031 (National roads only)

Table 4.5 indicates the speeds limits proposed for all roads within the Proposed Scheme.

Table 4.5: Proposed Scheme speed limits and design speeds

Road Name	DMURS Description (Arterial / Link / Local)	Design Speed (km/h)	Proposed Speed Limit (km/h)	Existing Speed Limit (km/h)	Reason for speed limit change
Grange Road	Urban Arterial	50	50	50	n/a
Rathfarnham Road (Butterfield Avenue to Main Street Rathfarnham)	Arterial	50	50	50	n/a
Rathfarnham Road (Main Street Rathfarnham to Rathfarnham Park)	Urban Arterial	30	30	50	Proposed regime includes for inbound cyclists sharing the bus lane
Rathfarnham Road (Rathfarnham Park to Bushy Park Road)	Urban Arterial	30	30	50	Speed limit proposed to be reduced for consistency with preceding and following sections, and thus to ensure legibility through the avoidance of multiple changes in speed limit.
Rathfarnham Road (Bushy Park Road to Terenure Cross)	Urban Arterial	30	30	50	Speed limit proposed to be reduced within the urban village of Terenure
Terenure Road East	Urban Arterial	30	30	50	Due to the provision of an offline cycle facility, the proposed regime includes for cyclists sharing the bus lane

Road Name	DMURS Description (Arterial / Link / Local)	Design Speed (km/h)	Proposed Speed Limit (km/h)	Existing Speed Limit (km/h)	Reason for speed limit change
Rathgar Road	Urban Arterial	30	30	50	Speed limit proposed to be reduced for consistency with preceding a following sections, and thus to ensure legibility through the avoidance of multiple changes in speed limit.
Rathmines Road Lower	Urban Arterial	30	30	50	Speed limit proposed to be reduced within the urban village of Rathmines
Richmond Street South	Urban Arterial	30	30	50	Speed limit proposed to be reduced for consistency with preceding a following sections, and thus to ensure legibility through the avoidance of multiple changes in speed limit.
Camden Street Upper	Urban Arterial	30	30	30	n/a
Camden Street Lower	Urban Arterial	30	30	30	n/a
Wexford Street	Urban Arterial	30	30	30	n/a
Redmond’s Hill	Urban Arterial	30	30	30	n/a
Aungier Street	Urban Arterial	30	30	30	n/a

Road Name	DMURS Description (Arterial / Link / Local)	Design Speed (km/h)	Proposed Speed Limit (km/h)	Existing Speed Limit (km/h)	Reason for speed limit change
South Great George's Street	Urban Arterial	30	30	30	n/a
Terenure Road North (Terenure Cross to Whitton Road)	Urban Arterial	30	30	50	Speed limit proposed to be reduced within the urban village of Terenure
Terenure Road North (Whitton Road to Ashdale Road)	Urban Arterial	50	50	50	n/a
Harold's Cross Road	Urban Arterial	50	50	50	n/a
Busy Park Road (between Rathfarnham Road and Wasdale Park)	Urban Arterial	30	30	50	The proposed regime includes for cyclists sharing the general traffic lane
Wasdale Park	Local	30	30	30	n/a
Wasdale Grove	Local	30	30	30	n/a
Victoria Road	Local	30	30	30	n/a
Zion Road	Local	30	50	50	n/a
Orwell Road	Urban Arterial	50	50	50	n/a
Richmond Hill	Local	30	30	30	n/a
Mountpleasant Avenue Upper	Local	30	30	30	n/a
Templeogue Road (from M50 to Hillcrest)	Urban Arterial	60	60	60	n/a

Road Name	DMURS Description (Arterial / Link / Local)	Design Speed (km/h)	Proposed Speed Limit (km/h)	Existing Speed Limit (km/h)	Reason for speed limit change
Templeogue Road (from Hillcrest to Cypress Grove Road)	Urban Arterial	50	50	50	n/a
Templeogue Road (from Hillcrest to Templeville Road)	Urban Arterial	30	30	50	The proposed regime includes for cyclists sharing the general traffic lane and passes through the urban village of Templeogue.
Templeogue Road (from Templeville Road to Lakelands Park)	Urban Arterial	50	50	50	n/a
Templeogue Road (from Lakelands Park to Terenure Place)	Urban Arterial	30	30	50	The proposed regime includes for cyclists sharing the general traffic lane.
Terenure Place	Urban Arterial	30	30	50	Speed limit proposed to be reduced within the urban village of Terenure
Rathdown Drive	Local	30	30	30	n/a
Rathdown Crescent	Local	30	30	30	n/a
Rathdown Park	Local	30	30	30	n/a

4.5 Alignment Modelling Strategy

As part of preliminary design, the 3D road alignment design has been developed on the principles of the Preferred Route Option. The proposed alignment has also taken into consideration public consultation, traffic impact and environmental impact assessments, in addition to a peer review exercise in collaboration with the other Engineering Designers (EDs) for the Proposed Scheme.

The 3D highway design, including the horizontal and vertical alignments, 3D modelling corridors and the associated highways related design features required for all roads included in this preliminary design, has been developed using Civil 3D software. In collaboration with the other EDs for the other CBC schemes, the 3D models have been produced in accordance with the BusConnects BEP.

As part of the alignment design process, the horizontal and vertical design has been optimised to minimise impact to the existing road network and adjoining properties where feasible. Horizontal and vertical alignments have been developed to define the road centrelines for the proposed route layout while also taking cognisance of the existing road network.

In terms of the horizontal alignments, due consideration has been given to aligning the centrelines as close to existing as practicable. However, the over-riding determining factor for locating the horizontal alignment is to ensure it is positioned in the centre of the proposed carriageway.

This is ideally along a central lane marking on the carriageway, in order to minimise rideability issues for vehicles crossing the crown line.

In the case of developing the vertical alignment along the route, a refinement process has been undertaken to minimise any impact to existing road network and develop the proposed carriageway levels as close to existing as practicable. In most circumstances however, due to a change in cross-section, due consideration is given to the resulting level difference at the outer extents of the carriageway, particularly through urban areas where a difference in existing and proposed footpath levels will require additional temporary land-take to facilitate tie-in.

Existing ground levels have been obtained using a triangulated surface (the existing ground model) produced from the topographical survey covering the route. This existing ground model is used to inform the differences in levels between the proposed and existing ground while at the scheme boundary it is also used to ensure an appropriate means of tie-in to existing levels. Furthermore, at junctions linking to existing side roads, the existing ground model is used to determine dwell area gradients and lengths to facilitate junction realignment.

The developed alignment design sets parameters for development of other design elements such as drainage, determination of earthworks, utility/services placement etc.

4.6 Summary of Horizontal Alignment

Existing alignments and crossfalls along the Proposed Scheme have been generally retained wherever practical. DMURS provides the following guidance in relation to modifications of existing arterial and link road geometry:

- *Designers should avoid major changes in the alignment of Arterial and Link streets as these routes will generally need to be directional in order to efficiently link destinations.*

- *Major changes in horizontal alignment of Arterial and Link streets should be restricted to where required in response to the topography or constraints of a site.*

In some areas, minor adjustments are required to the horizontal alignment to deliver the requisite width to ensure the provision of the necessary traffic lanes, bus lanes, cyclist and pedestrian facilities which would also allow the drainage of surface water into new/relocated road gullies.

In areas where road widening and minor changes to the horizontal alignment was not practicable due to constraints (environmental, residential, geometrical etc.), new construction has been provided to ensure the provision of continuity of design throughout the scheme.

In light of the above, the horizontal alignment of the mainline is generally as per the existing parameters and surveys. The alignment of the scheme is generally compatible with the selected design speed and associated safe stopping sight distances.

The Tallaght Road to Rathfarnham Road section of the Scheme (Section 1) commences on the Tallaght Road adjacent to D'Arcy McGee's, east of the M50 interchange, while The Rathfarnham to City Centre section (Section 2) commences at the junction of Grange Road and Nutgrove Avenue. Both sections join at the Terenure Road North Junction and continue towards the City Centre before tying into the existing road network on Dame Street. The horizontal alignment of the Proposed Scheme generally follows the horizontal alignment of the existing carriageways.

Generally all carriageways have been designed in camber with a fall of 2.5% from the centreline of the road. Superelevation has been applied where the proposed curve radius is below the minimum values specified in Section 4.1 above. In a small number of locations crossfalls/superelevation have been implemented to match existing scenario where the geometry allows, to minimise the impact of the Proposed Scheme on the existing network.

In areas where road widening and minor changes to the horizontal alignment are not practicable due to constraints (environmental, residential geometrical etc.), the existing alignment and crossfalls have been maintained as far as practicable to minimise the impact on adjacent properties and driveways.

The following section summarises the horizontal geometry of the carriageways associated with the CBC. All horizontal alignments have been designed using the appropriate set of design guidelines as outlined in Section 4.1. In instances where the desirable minimum parameters defined by the appropriate guidance have not been met, these locations have been detailed within Section 4.17, Deviations from Standard.

Section 1 – Tallaght Road to Rathfarnham Road

The proposal through this section of the Proposed Scheme will upgrade a number of existing junctions, providing improved bus, cyclist and pedestrian facilities along the proposed route. With this in mind it is proposed to upgrade the Spawell

Roundabout to a signalised junction improving the capacity and delay times at the junction.

The alignment will generally maintain a similar geometry and design speed to the existing, as outlined in Section 4.4. However, to facilitate widening and cross-sectional changes at certain locations, the horizontal geometry will deviate from that of the existing, particularly where the Spawell Roundabout is to be replaced with a signalised junction.

The horizontal alignment of Section 1 will largely maintain a similar geometry to existing. Carriageway widening along this section will be achieved by utilising existing grass verges and central medians and by implementing a Bus Gate (CH J3460) to reduce the impact on adjacent properties. There are no curves through this section below the desirable minimum radius (104m for 50km/h & 26m for 30km/h).

Section 2 – Nutgrove Avenue to Terenure Road North

This section commences on Nutgrove Avenue continuing towards Terenure Village along Grange Road and Rathfarnham Road. Similarly to Section 1 the existing horizontal alignment will be maintained through the majority of this section while updating a number of existing junctions. Carriageway widening will be achieved through land take from the Rathfarnham Castle grounds from CH A0120 to A0550. Sections of the existing central median have also been converted to full depth carriageway construction, and the centre line adjusted accordingly, to allow for right and left turns lanes along this section. From CH A0850 to A1100 cycle tracks will only be provided in the outbound direction to minimise the impact of road widening on existing properties. Between CH A0710 and A1250 the outbound carriageway is proposed to be a shared traffic lane to further facilitate road widening along this section. There are no curves through this section below the desirable minimum radius (104m for 50km/h & 26m for 30km/h).

The horizontal alignment has been developed in accordance with the standards and design speeds outlined in Section 4.1 and Section 4.4 respectively. The cross section for this section is described in Section 4.3.

Section 3 – Terenure Road North to Charleville Road

This Section begins in Terenure Village which is highly constrained due to existing properties and businesses adjacent to the Proposed Scheme. As a result the existing alignment is maintained for the entirety of the section, along Terenure Road East and Rathgar Road. Road widening is achieved thorough land take from existing driveways from CH A2000 to CH A2250. This allows for bus lanes and carriageway lanes to be provided in both directions but not cycle tracks. Cycle tracks are introduced again in both directions from CH A2500 onwards. To further reduce the impact on adjacent properties and improve bus facilities there is no outbound general traffic lane provided from CH A2550 to A3650. The removal of this lane allows for cycle tracks and bus lanes in both directions while maintaining the existing Horizontal alignment.

The Design has been developed using appropriate geometric standards applicable to the design speeds outlined in Section 4.4 and the road cross sections as detailed in Section 4.3.

There are no curves through this section below the desirable minimum radius (104m for 50km/h & 26m for 30km/h).

Section 4 - Charleville Road to Dame Street

This section begins at the junction between Rathgar Road and Grosvenor Road, continuing along Rathmines Road Lower towards the canal. Through Rathmines Village the existing alignment is maintained with no land take or widening proposed. Shared traffic lanes are provided from CH A3850 to CH A4400 where a bus gate is introduced. This will prevent general traffic advancing into the City Centre along the route. Cycle tracks are proposed in both directions between these chainages. Any localised narrowing of the Cross Section is outlined in Section 4.3.

As this section continues over the canal and onto Richmond St and Camden St the adjacent property constraints continue. A single outbound general traffic lane is proposed from CH A4960 to A4700. This reduction in general traffic enables cycle tracks to be provided in both directions while maintaining the existing alignment and having no effect on adjacent properties. A single outbound general traffic lane is again provided CH A5150 to CH 5400 while maintaining bus lanes and cycle tracks in both directions. A number of loading bays have been maintained through these chainages to facilitate existing businesses.

From CH A5550 to CH A6285, where the Proposed Scheme ties into Dame St., the existing alignment remains largely unchanged. Shared traffic lanes and cycle tracks are provided in both directions with improvements made to junctions, footpaths and cycle tracks through this section.

The Design has been developed using appropriate geometric standards applicable to the design speeds outlined in Section 4.4 and the road cross sections as detailed in Section 4.3.

There are no curves through this section below the desirable minimum radius (104m for 50km/h & 26m for 30km/h).

4.7 Summary of Vertical Alignment

Due to the nature of the proposed design i.e. the majority of the design proposals involve widening of the existing roadway in order to accommodate additional facilities, every effort has been made to ensure the vertical alignment adheres as closely as practicable to the existing arrangement.

DMURS defines the vertical alignment of a road as follows:

"A vertical alignment consists of a series of straight-line gradients that are connected by curves, usually parabolic curves. Vertical alignment is less of an issue on urban streets that carry traffic at moderate design speeds and changes in vertical alignment should be considered at the network level as a response to the topography of a site."

Visibility concerns associated with adverse vertical crest and sag curves along the alignment have not been identified on the Proposed Scheme due to the nature of the existing urban road network. Notwithstanding, the vertical alignment of the proposed road development has also been assessed to ensure hard standing areas have been designed above the minimum gradient of 0.5% to mitigate localised surface water ponding and facilitate surface run-off drainage measures.

The vertical geometry of the Proposed Scheme takes cognisance of the existing road layout and, particularly through highly constrained locations, the proposed vertical alignment has been developed to match the existing route.

In instances where the desirable minimum parameters defined by the appropriate guidance have not been met, these locations have been detailed within Section 4.17 Deviations from Standard.

The following section summaries the vertical geometry of the carriageways associated with the CBC. All vertical alignments have been designed using the appropriate set of design guidelines/standards as outlined in Section 4.1.

This section should be read in conjunction with the Mainline Plan and Profile drawings in Appendix B.

Section 1 – Tallaght Road to Rathfarnham Road

The layout of this section of the route will involve reconstruction of the existing carriageways with online widening required at certain locations. To facilitate this the proposed vertical alignments have been developed to match existing. This will ensure, so far as is reasonably practicable, that much of the existing carriageway can be incorporated into the works. This also minimises level difference between the existing and proposed levels, and in doing so reduces impact on adjacent land.

The design generally falls from a level of 68.4m AOD at the tie in with the existing M50 roundabout to the tie in with the existing junction at Rathfarnham Road at a level of 42.4m AOD.

At Terenure Village the existing level will be replicated in the proposed design, in order to mitigate any impact on the adjacent structure.

The maximum and minimum gradients along this section are 1.2% and -3.4% respectively. There are no locations where the K value for sag and crest curves fall below the minimum values specified by DMURS.

Section 2 – Nutgrove Avenue to Terenure Road North

To minimise impact on the existing road network, and due to the nature of the additional widening works required to facilitate the Proposed Scheme, the proposed vertical alignment through this section will also generally match the existing.

The sections of both inbound and outbound carriageway running along Nutgrove Avenue and into Terenure Village along Rathfarnham Road will largely remain as per existing with online widening accounting for the majority of the construction works.

The proposed levels of this section rise from 48.9m AOD at the Nutgrove Avenue, CH A0000 to 51.5m AOD at CH A0170. From here the alignment falls to 47.5m AOD at CH A0400 before rising again to 51.8m AOD at CH 0580 adjacent to Rathfarnham Castle, all while largely following the existing road alignment. The alignment then falls to 38.7m AOD at the Dodder Park Road Junction and Pears Bridge before rising back to 44.8m AOD before tying into section 1 and 3 on Terenure Road North at 42.4m AOD.

The maximum and minimum gradients along this section are 3.9% and -3.6% respectively. There is one instance where the K value for sag curves falls below the minimum, K=2.3 for 30km/h, specified by DMURS.

Section 3 – Terenure Road North to Charleville Road

The vertical alignment in this section generally matches the existing road level to minimise impact on adjacent properties. The vertical geometry has been developed to a design speed identified in Section 4.4. The cross section for this section of road is described in Section 4.3.

The design generally falls from 42.4m AOD at the tie in point with Section 1 and 2 to 26.1m AOD at Ch. A3640. The vertical alignment of Terenure Road East and Rathgar Road comply with the minimum requirement identified in Section 1.1.

The maximum and minimum gradients along this section are 1.9% and -2.26% respectively. There are no locations where the K values for sag and crest curves fall below the minimum values specified by DMURS.

Section 4 – Charleville Road to Dame Street

To minimise impact on the existing road network, and due to the highly constrained nature of this section of the Proposed Scheme the vertical alignment will generally remain the same as existing. The vertical geometry has been developed in accordance with the geometric standards applicable to a design speed of 30km.h identified in Section 1.1. The cross section of the Proposed Scheme is described in Table 4.3.

The proposed levels in this section fall from 26.1m AOD at Ch. A3640 to 19.1m AOD at the Rathmines Barracks before rising back up to 22m AOD at La Touche Bridge, crossing the canal. From here the vertical alignment falls to 11.1m AOD, where it ties into the existing road geometry on Dame Street.

There are no locations in this section where the K values for sag and crest curves fall below the minimum values specified by DMURS.

4.8 Forward Visibility

Forward visibility (or Stopping Sight Distance, SSD) has been assessed along the extent of the proposed route against the criteria outlined within the relevant applicable standards of DMURS and TII DN-GEO-03031 for the design speeds listed in Section 4.4.

The desirable minimum forward visibility requirements are achieved across the majority of the Proposed Scheme. Where the desirable minimum forward visibility requirements are not achieved, details are provided in Deviations from Standard, refer to Section 4.17. A summary of the locations that will have a reduction in forward visibility is provided within Appendix C.

Table 4.6 summarises the key geometric design parameters applicable to all urban roads designed in accordance with DMURS.

Table 4.6: Forward Visibility/SSD Parameters for roads designed to DMURS

Road Type	Design Speed (km/h)	Forward visibility (m)	Forward visibility on Bus Routes (m)
Urban Road with 30 km/h Speed Limit	30	2.3	N/A
Urban Road with 50 km/h Speed Limit	50	6.4	4.7
Urban Road with 60 km/h Speed Limit	60	9.2	8.2

4.8.1 Junction Visibility

An assessment of visibility at major and minor junctions has been completed along the route. In accordance with DMURS, the SSD parameters for relevant design speeds has been adopted as the Y-Distance visibility to be achieved while an X-Distance of 2.4m (reduced to 2.0m as a relaxation) has been implemented.

An assessment of the junction visibility at accesses serving individual properties and single dwellings has been undertaken, ensuring that the existing visibility splay "X" and "Y" are maintained or improved.

4.8.2 Junction Intervisibility

In the absence of DMURS guidance with respect to visibility at signalised junctions, the principles and parameters of 'Junction Intervisibility' from DN-GEO-03044 (The Geometric Layout of Signal-Controlled Junctions and Signalised Roundabouts) has been adopted as a benchmark to assess the intervisibility at all signalised junctions.

As many of the junctions along the Proposed Scheme involve retrofitting of the existing layout in an urban environment to provide additional NMU provisions in addition to the requirements to facilitate vehicle swept-paths, junction intervisibility will be impacted.

4.9 Corner Radii and Swept Path

Generally, on junctions along the Proposed Scheme corner radii of 6m has been implemented. 6m will generally accommodate the swept-path of the design vehicles along the scheme without the swept-path crossing the centre line of the intersecting road. However, in areas where swept-path analysis has identified constrained areas and larger vehicles are anticipated to make up a higher portion of the usage (i.e. bus lanes, HGV service areas etc.) the corner radii has been increased to 8 or 10m to facilitate this.

Although swept-path analysis is used to inform the junction design, it is not the determining factor.

There are a number of additional factors relating to the junction design which are considered in the overall methodology including junction intervisibility, speed of turning vehicles and in particular pedestrian safety.

In line with the scheme objectives of improving facilities for walking and cycling, corner radii along the route have been reduced at some locations in order to lower the speed at which vehicles can turn corners and increase inter-visibility between users (see DMURS Section 4.3.3). Reduced corner radii also assist in the creation of more compact junctions which align crossing points with desire lines and reduce crossing distances.

At some of the larger signalised junctions where multi-lane entries are required, widening to the carriageway has been provided and location of the stop-lines have been placed to facilitate vehicular movements, however this has to be balanced with junction intervisibility. It is accepted that at minor type junctions and residential accesses that larger vehicles may have to cross the centreline however usage is expected to be infrequent.

A summary of the vehicles used as part of the overall Swept Path Analysis are outlined below:

- **DB32 Private Car** – Analysis undertaken at private residential properties
- **DB32 Refuse Vehicle** – Analysis undertaken to ensure refuse vehicles can make turns in/out of all side roads and entries concerning residential/commercial properties
- **14.1m Double Decker Regional Bus –** Analysis undertaken along the main alignment of the route concerning bus lanes, including junctions.
- **Rigid Truck** – Analysis undertaken along the main alignment of the route.
- **FTA Design Articulated Vehicle (1998) -** Analysis undertaken along the regional roads of the Proposed Scheme and in any other areas where regular articulated vehicles would be expected (e.g. near supermarkets)

Section 4.16 of this report details areas of turning bans along the Proposed Scheme.

4.10 Kerbing

The kerbing type selected along the Proposed Scheme is primarily dependent upon the presence of a cycle track alongside the carriageway. Where cycle tracks will be present adjacent to the carriageway, the cycle track will be separated by the typical 250mm wide BusConnects kerb, which will have a 120mm upstand to the carriageway and a 60mm upstand to the cycle track (120mm upstand where cycle track is not raised) as shown in Figure 4.3.

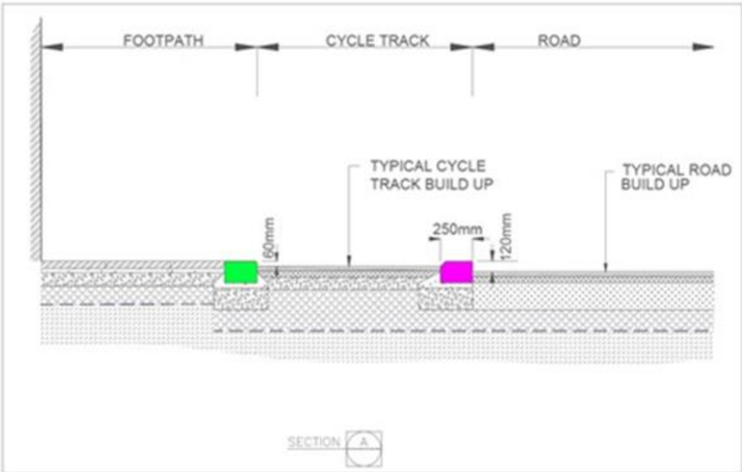


Figure 4.3: Typical Kerb Arrangement

Where this kerb will cross at an uncontrolled junction and at direct accesses, the Raised Table Priority Junction Treatment (Figure 4.4) will be implemented at the majority of locations. At these locations, the kerb will be lowered to a 60mm upstand while the cycle track will be raised throughout. At some locations, where it is necessary to retain the cycle track at carriageway level (e.g. due to cobblestone heritage feature), the kerb will transition to carriageway level and/or terminate as required.

At controlled and signalised junctions, the cycle track will be ramped down to the carriageway level and the kerb will be transitioned to carriageway level and terminated.

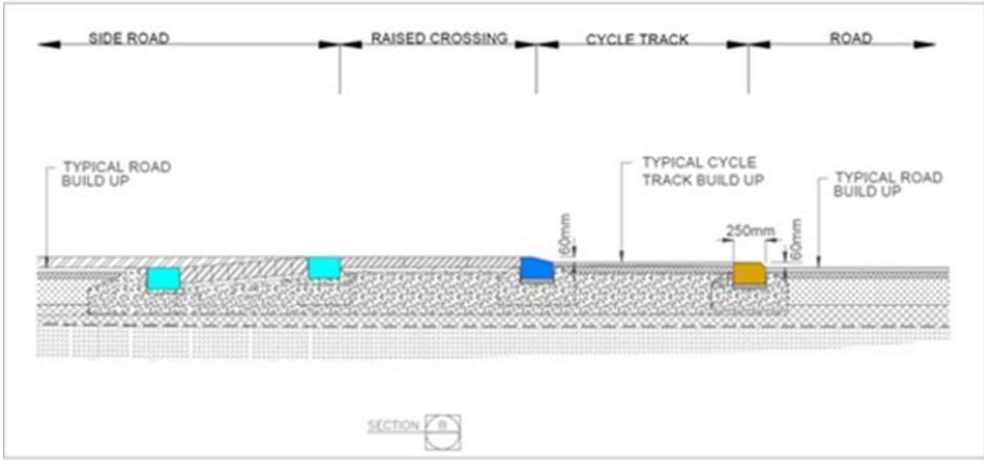


Figure 4.4: Kerb Treatment at Raised Table Priority Junction

At locations where a footpath will be located adjacent to a cycle track, a half-battered kerb with a 60mm upstand is proposed. This 60mm high vertical kerb will be required to ensure that the kerb is properly detectable by visually impaired pedestrians using the footpath.

At locations where a cycle track is not present, and the footpath is adjacent to the carriageway, a standard 125mm upstand is proposed. Dropped and transition kerbs will be provided at driveways and pedestrian crossings.

Along sections of the route where heritage granite kerbing exists (e.g. Richmond Street South, Camden Street), it is proposed to maximise the retention of the existing kerbing where practicable as the outside edge of the footpath, with proposed cycle track being constructed alongside. This is the case in the Camden Street Lower and George's Street sections.

4.11 Bus Provision

One of the main objectives of the Proposed Scheme is to enhance the capacity and potential of the public transport system by improving bus speeds, reliability and punctuality through the provision of bus lanes and other measures to provide priority to bus movement over general traffic movements.

The Proposed Scheme is approximately 10km long (Section 1 - 3.7km, Section 2 to 4 – 6.3km) from end to end. The Preliminary Design drawings show the extent of the infrastructure proposed to deliver this scheme. The length of existing and proposed bus priority as a percentage of the overall route length is as follows:

Section 1 - Tallaght Road to Rathfarnham Road:

- 13% Existing bus priority (outbound)
- 39% Existing bus priority (citybound)
- 79% Proposed bus priority (outbound) *(13% virtual*)*
- 93% Proposed bus priority (citybound) *(39% virtual)*

Section 2, 3 & 4 - Rathfarnham to City Centre - Section:

- 21% Existing bus priority (outbound) *5% virtual)*
- 48% Existing bus priority (citybound) *(1% virtual)*
- 86% Proposed bus priority (outbound) *(40% virtual)*
- 89% Proposed bus priority (citybound) *(23% virtual)*

This increased bus priority will enhance the capacity and potential of the public transport system meeting one of the main objectives of this Proposed Scheme.

* Virtual means Virtual Bus Priority. This refers to cases where physical bus priority (i.e. bus lanes) is not provided, and instead, bus priority is provided within the general traffic lane through the use of signal-controlled priority or bus gates to control the movements of general traffic

4.11.1 Full Bus Priority

Full Bus Priority uses a dedicated lane within the carriageway for the bus to travel unhindered by general traffic. For full priority the provision will continue through junctions and remain unbroken for left turning traffic.

Over the majority of the Proposed Scheme, as per the guidance for traffic lane widths outlined in DMURS, a 3m lane is provided for bus use only except on some sections where no road narrowing/widening is required, and works are contained within existing kerblines, such as the R137 Templeogue Road between the start of the scheme and Cypress Grove Road. Larger lane widths are needed in some instances where the swept path of the bus requires a greater width to undertake the manoeuvre.

Where continuous bus lanes will not be provided due to constraints, measures such as signal controlled priority and bus gates are proposed to be introduced where feasible.

4.11.2 Signal Controlled Bus Priority

Signal Controlled Bus Priority uses traffic signals to enable buses to get priority ahead of other traffic on single lane road sections, but it is only effective for short distances. This typically arises where the bus lane cannot continue due to obstructions on the roadway. An example might be where a road has pinch-points where it narrows due to existing buildings or structures that cannot be demolished to widen the road to make space for a bus lane. It works through the use of traffic signal controls (typically at junctions) where the bus lane and general traffic lane must merge ahead and share the road space for a short distance until the bus lane recommences downstream. The general traffic will be stopped at the signal to allow the bus pass through the narrow section first and when the bus has passed, the general traffic will then be allowed through the lights.

The bullet points below present descriptions of a number of the proposed signal-controlled priority provisions within the Proposed Scheme which result in buses and general traffic sharing a lane:

- R137 Templeogue Road at the Ashfield Place development (outbound) - Approximately 180m length;
- R137 Templeogue Road within Templeogue Village between Templeogue Tennis Club and Hollingsworth Cycles (inbound and outbound) - Approximately 200m length; and
- Rathfarnham Road between Castleside Drive and Dodder Park Road (outbound) - Approximately 450m length;
- Rathfarnham Road between Dodder Park Road and Westbourne Road (inbound) - Approximately 145m length;
- Rathfarnham Road between Westbourne Road and Rathdown Park (outbound) - Approximately 100m length;
- Rathfarnham Road between Rathdown Park and Bushy Park Road (inbound and outbound) - Approximately 50m length;
- Rathfarnham Road and Terenure Road East between St. Joseph's Church and Beechlawn Way (outbound) - Approximately 250m length;
- Terenure Road East between Terenure Cross and St. Joseph's Church (inbound and outbound) - Approximately 150m length;
- Terenure Road East between Highfield Road and Rathgar Park (outbound) - Approximately 45m length;
- Rathgar Road between Rathgar Avenue and Christ Church Rathgar (inbound) - Approximately 40m length;
- Richmond Street South between Richmond Place South and Grove Road (outbound) - Approximately 90m length; and
- Wexford Street between Kevin Street and Montague Street (outbound) - Approximately 100m length.

These instances are detailed within Table 4.7.

Table 4.7: Signal controlled bus priority locations

Location	**Reason for Mitigation**
Templeogue Road – Ashfield Place (Outbound)	To provide priority for buses through this constrained section taking cognisance of existing built form in close proximity to the carriageway.
Templeogue Village (Both directions)	To provide priority for buses through this constrained section taking cognisance of existing built form in close proximity to the carriageway, while also aligning with the recently completed SDCC Templeogue Village Initiative.
Rathfarnham Road – Castleside Drive to Dodder Park Road (Outbound)	To provide priority for buses through this constrained section taking cognisance of existing property boundaries, while also providing footpaths and an outbound cycle track.
Rathfarnham Road – Dodder Park Road to Westbourne Road (Inbound)	To provide priority for buses through this constrained section taking cognisance of the constraints of the existing Pearse Bridge, while also providing footpaths and cycle tracks.
Rathfarnham Road – Westbourne Road to Rathdown Park (Outbound)	To provide priority for buses through this constrained section taking cognisance of existing property boundaries, while also providing footpaths and cycle tracks.
Rathfarnham Road – Rathdown Park to Bushy Park Road (Both Directions)	To provide priority for buses through this constrained section taking cognisance of existing property boundaries, while also providing footpaths and cycle tracks.
Rathfarnham Road and Terenure Road East between St. Joseph's Church and Beechlawn Way (outbound)	To provide priority for buses through this constrained section taking cognisance of existing property boundaries and built form, while also providing footpaths and cycle tracks.
Terenure Road East - Terenure Cross to St. Joseph's Church (Both Directions)	To provide priority for buses through this constrained section taking cognisance of existing built form in close proximity to the carriageway.
Terenure Road East - Highfield Road to Rathgar Park (Outbound)	To provide priority for buses through this constrained section taking cognisance of existing built form in close proximity to the carriageway.

Location	Reason for Mitigation
Rathgar Road - Rathgar Avenue to Christ Church Rathgar (Inbound)	To provide priority for buses through this constrained section taking cognisance of existing property boundaries, while also providing footpaths and cycle tracks.
Richmond Street South – Richmond Place South to Grove Road (Outbound)	To provide priority for buses through this constrained section taking cognisance of existing built form in close proximity to the carriageway as well as the constraints of the existing La Touche Bridge, while also providing footpaths and cycle tracks, including a high-quality right-turning facility for inbound cyclists to join the Grand Canal cycleway.
Wexford Street - Kevin Street to Montague Street (Outbound)	To provide priority for buses through this constrained section taking cognisance of existing property boundaries, while also providing footpaths and cycle tracks.

4.11.3 Bus Gate

A Bus Gate is a sign-posted short length of stand-alone bus lane. This short length of road is restricted exclusively to buses, taxis and cyclists plus emergency vehicles. It facilitates bus priority by removing general through traffic along the overall road where the bus gate is located. General traffic will be directed by signage to divert away to other roads before they arrive at the Bus Gate.

A bus gate is proposed on Templeogue Road between Olney Grove and Terenure Road West. This results in a shared inbound lane for buses and general traffic on Templeogue Road from Fortfield Avenue to Terenure Place - which is approximately 1.2km in length.

This bus gate is proposed to operate from 06:00 to 20:00 and, as such, signage is proposed to enable inbound general traffic on Templeogue Road to enter the bus lane and continue through the bus gate towards Terenure Cross outside of these hours.

A second bus gate is proposed on Rathmines Road Lower between Richmond Hill and Lissenfield. This results in a shared lane in each direction for buses and general traffic on Rathmines Road Lower from Castlewood Avenue to Grove Road - which is approximately 840m in length.

This bus gate is proposed to operate from 06:00 to 20:00 and, as such, signage is proposed to enable general traffic on Rathmines Road Lower to enter the bus lane and continue through the bus gate outside of these hours.

4.12 Cycling Provision

One of the core objectives of the Proposed Scheme is to enhance the potential for cycling by providing safe infrastructure for cycling, segregated from general traffic wherever practicable. Physical segregation ensures that cyclists are protected from motorised traffic as well as being independent of vehicular congestion, thus improving cyclist safety and reliability of journey times for cyclists. Physical segregation can be provided in the form of vertical segregation, (e.g. raised kerbs), horizontal segregation, (e.g. parking/verge protected cycle tracks), or both.

The 'preferred cross-section template' developed for the Proposed Scheme consists of protected cycle tracks, providing vertical segregation from the carriageway to the cycle track and vertical segregation from the cycle track to the footpath.

The principal source for guidance on the design of cycle facilities is the National Cycle Manual (NCM) published by the National Transport Authority.

The desirable minimum width for a single-direction, with-flow, raised-adjacent cycle track is 2.0m. This arrangement allows for two-abreast cycling. Based on the NCM Width Calculator, this allows for overtaking within the cycle track. The minimum width is 1.5m, which based on the NCM Width Calculator, allows for single file cycling.

Localised narrowing of the cycle track below 1.5m may be necessary over very short distances to cater for local constraints (e.g. mature trees).

The desirable minimum width for a two-way cycle track is 3.25m. In addition to this, a buffer of 0.5m should be provided between the two-way cycle track and the carriageway.

Using the NCM width calculator, reduction of these desirable minimum widths can be considered on a case-by-case basis, with due cognisance of the volume of cyclists anticipated to use the route as well as the level of service required.

The Proposed Scheme is approximately 10 km long from end to end. The General Arrangement drawings included within Appendix B show the improved extent of cycle provision, which is summarised as follows:

Section 1 – Tallaght Road to Rathfarnham Road:

- 52% Existing cycle priority (outbound) *(39% segregated, 4% mandatory, 9% advisory)*
- 70% Existing cycle priority (citybound) *(34% segregated, 2% mandatory, 34% advisory)*
- *68%* Proposed cycle priority (outbound) *(68% segregated)*
- 57% Proposed cycle priority (citybound) *(57% segregated)*

Alternative cycle facilities are proposed for sections where the provision of cycle infrastructure is not practicable along the CBC, as summarised below:

- Bushy Park - 300m segregated cycle tracks in both directions within Bushy Park
- Rathdown Drive/Rathdown Crescent/Rathdown Park - 850m quiet street treatment between Rathdown Avenue and Rathfarnham Road

Section 2, 3 & 4 – Rathfarnham to City Centre:

- 71% Existing cycle priority (outbound) *(39% mandatory cycle lane – 27% advisory cycle lane - 5% segregated)*
- 31% Existing cycle priority (citybound) *(31% advisory cycle lane)*
- 90% Proposed cycle priority (outbound) *(90% segregated)*
- 86% Proposed cycle priority (citybound) *(86% segregated)*

Alternative cycle facilities are proposed for sections where the provision of cycle infrastructure is not practicable along the CBC, as summarised below:

- Terenure Road North - 1.5km segregated cycle tracks in both directions between Terenure Cross and Harold's Cross Park
- Orwell Road - 220m of segregated cycle tracks in both direction between Zion Road and Rathgar Village
- Bushy Park Road/Wasdale Park/Wasdale Grove/Victoria Road/Zion Road - 850m quiet street treatment between Rathdown Avenue and Rathfarnham Road

4.12.1 Segregated Cycle Tracks

A cycle track is a segregated track which is physically segregated from the adjacent traffic lane and/or bus lane horizontally and/or vertically, as shown in Figure 4.5, taken from the BCPDGB.

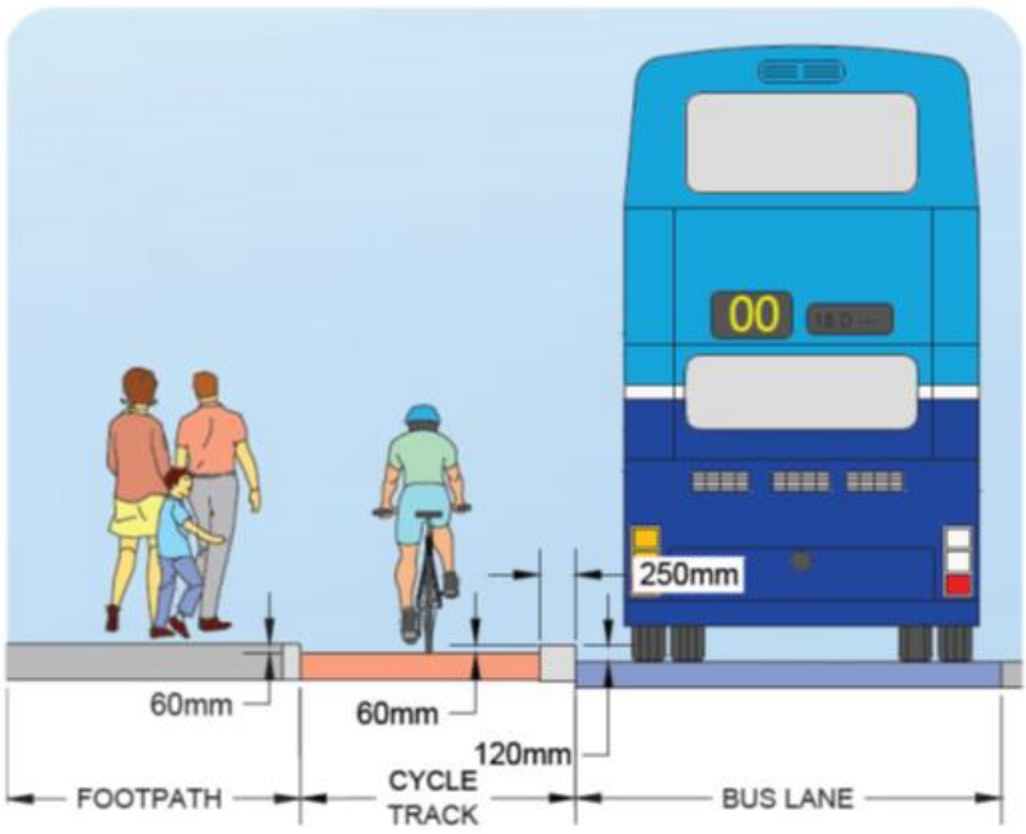


Figure 4.5: Segregated Cycle Track

The desirable minimum width used throughout the Proposed Scheme for a single-direction, with-flow, raised-adjacent cycle track is 2m. This is based on the National Cycle Manual Width Calculator and allows for overtaking within the cycle track. The minimum width is 1.5m, based on the NCM Width Calculator, allows for single file cycling. In addition, a full height 120mm upstand kerb between the carriageway and the cycle track should be provided (120mm kerb height on the bus lane side and 60mm kerb height on the cycle track side). This provides increased protection of the cycle track as well as allowing for side entry drainage systems where applicable.

Cycle track construction guidance is given in Section 5.6 of the NCM. The use of machine laid asphalt for cycle tracks has proven to be an effective way of providing a high level of service with a safe, smooth and continuous surface.

Fully segregated cycle tracks have been provided throughout the majority of the Proposed Scheme. In particularly constrained sections, including Terenure Road East, cycle tracks have not been provided along the CBC corridor, however an alternative route has been provided through the provision of cycle tracks along Terenure Road North and Harold’s Cross Road linking to the Kimmage to City Centre Core Bus Corridor at Harold’s Cross. An additional alternative cycle facility is proposed along Bushy Park Road, Wasdale Park, Wasdale Grove, Victoria Road, Zion Road and Orwell Road to provide a secondary east-west route for cyclists travelling between the CBC on Rathfarnham Road and Rathgar Road.

4.12.2 Offline Cycle Tracks

Offline cycle tracks have been provided in a number of locations:

- Orwell Road; and
- Terenure Road North / Harold's Cross Road.

These offline cycle tracks can be seen on the General Arrangement Drawings within Appendix B.

4.12.3 Quiet Street Treatment

Where roadway widths cannot facilitate cyclists without significant impact on bus priority, alternative cycle routes are explored for short distances away from the Proposed Scheme route. Such offline options may include directing cyclists along streets with minimal general traffic other than car users who live on the street. They are called Quiet Streets due to the low amount of general traffic and are deemed suitable for cyclists sharing the roadway with the general traffic without the need to construct segregated cycle tracks or painted cycle lanes. The Quiet Street Treatment would involve appropriate advisory signage for both the general road users and cyclists.

Quiet street treatments are proposed for the following locations:

- Rathdown Crescent;
- Rathdown Park;
- Bushy Park Road;
- Wasdale Park;
- Wasdale Grove;
- Victoria Road; and
- Zion Road.

These quiet street treatments can be seen on the General Arrangement Drawings within Appendix B.

4.12.4 Treatment at Constraint Areas

At some locations along the Proposed Scheme, desirable minimum width of cycle tracks cannot be achieved, and localised narrowing will be required. All locations where desirable minimum widths will not be achieved are recorded and presented in Appendix C.

Due to the width available, cyclists share the carriageway at the following locations along the Proposed Scheme:

- Rathdown Drive (Inbound & outbound Ch. J2800 to Ch. J3250);
- Rathdown Crescent (Inbound & outbound Offline);
- Rathdown Park (Inbound & outbound Offline);

- Templeogue Road / Terenure Place (Inbound Ch. J3225 to J3750);
- Terenure Place (Outbound Ch. J3700 to J3750);
- Rathfarnham Road (Inbound Ch. A0850 to Ch. A1100); and
- Terenure Road East (Inbound & Outbound Ch. A1875 to Ch. A2500).

It is noted that where cyclists would share the carriageway with buses and/or cars, it is proposed to reduce the speed limit to 30kph.

4.12.5 Cycle Parking Provision

Cycle stands will be provided, where practicable, at island bus stops and key additional locations as noted in the Landscape General Arrangement Drawings, in Appendix B.

4.13 Pedestrian Provision

Footpath widths are to be minimum 2.0m wide where practicable, as shown in Table 4.2. Where this has not been achieved, all deviations from standard have been recorded and tabulated in Appendix C.

Pedestrian crossings have been designed to accommodate a moderate flow of foot traffic along the mainline desire line where practicable, with a minimum width of 2.4m at both signalised junctions and zebra crossings. Pedestrians will share their manoeuvres with cyclists when using toucan crossings, which are to be provided at signalised junctions which cannot accommodate segregated cycle crossings. To facilitate road users who cannot cross in a reasonable time, the desirable maximum crossing length without providing a refuge island is 19m. Where this is not practicable, refuge islands greater than 4m wide are to be used to allow those who cannot cross in a reasonable time to make the journey in two phases. Louvres will be added on green far-side pedestrian aspect if necessary to avoid potential ‘see through’ by pedestrians waiting to cross the nearside crossing.

At signalised junctions and standalone pedestrian crossings, the footway will be ramped down to carriageway level to facilitate pedestrians who require an unobstructed crossing.

At minor junctions, raised tables are provided to raise the road level up to footway level and facilitate unimpeded crossing. Tactile paving is provided at the mouth of each pedestrian crossing and is to be designed in accordance with standards. Audio units are to be provided on each traffic signal push button.

Formal crossing points are to be provided on the upstream side of bus stop islands, consisting of an on-demand signalised pedestrian crossing with appropriate tactile paving, push button units and LED warning studs. A secondary informal crossing should be provided on the desire line on the downstream side of the island.

4.13.1 Footpath Crossfall

Crossfalls have generally been assigned to footpaths in accordance with *DN-PAV-03026, Table 2.3* (extract inserted herein as Table 4.8) which recommends a crossfall of 2%-3.3%. This gradient will allow the footpath to suitably drain without affecting the ability of mobility-impaired people to move safely along the corridor.

In certain circumstances dictated by the constraints of existing land boundaries and (particularly at existing residential accesses) to minimise impacts to adjacent properties it has been necessary to deviate from these values in the proposed design. In most cases the maximum crossfall applied to footpath design is 4.0% over a short distance.

Table 4.8: Geometric Parameters for Footpaths

Parameter	Recommended Limits	Extreme Limits
Longitudinal gradient (normally the same as adjacent highway)	1.25% to 5%	8% maximum*
Width	2m minimum	1.3m minimum
Crossfall	2% to 3.3%	1.5% minimum to 7% maximum at crossings

Note: *In some cases it may be necessary to construct a footway with a gradient of more than 8 per cent. Provision of a handrail is recommended if site constraints necessitate a gradient steeper than 10 per cent.

Table 2.3 Geometric Parameters for Footways

4.13.2 Longitudinal Gradient

The longitudinal gradient of the footpaths along the Proposed Scheme is constrained by the longitudinal gradient of the proposed carriageway.

DN-PAV-03026, Table 2.3 recommends a longitudinal gradient along footpaths of 1.25%-5%. However, in all scenarios of the Proposed Scheme, the footpath gradient is dictated by that of the main carriageway. Similar to the crossfall, the longitudinal fall in the road has been designed to ensure it can suitably drain without affecting the ability of mobility-impaired people to move safely along the corridor.

4.14 Bus Stops

This section of the report presents a summary of the Bus Stop Review process which was conducted for the Proposed Scheme.

The purpose of the process was to review the location of the existing Dublin Bus stops to determine whether a stop should be removed, relocated, or remain where it is. This exercise was carried out to optimise the performance of the bus services travelling along the route by reducing the journey time of the bus service, to increase the walking catchment of the bus stops and to ensure key trip attractors located along the route is sufficiently covered within the catchment of bus stops.

Existing bus stops were therefore rationalised based on best practice principles related to bus stop placement. The outcome of this study was to develop a more efficient route which would attract more passengers by creating a wider population catchment and offer a shorter journey time to destinations.

This section also provides details of the types of bus stop proposed throughout the Proposed Schemes, with reference to Chapter 11 of the BCPDGB within Appendix O, which presents a principle-based approach to the design of bus stops and presents the hierarchy of bus stop options which were considered in designing the Proposed Scheme.

4.14.1 Methodology

The methodology followed as part of this review is set out in the ‘Bus Stop Review Methodology Report’ which is appended to the Bus Stop Review Report in Appendix H. It outlines the methodology to be followed for the bus stop reviews, the various considerations required when assessing a stop location, and the background reasoning for those considerations.

The main principles considered as part of the review were as follows:

- Aim to achieve a bus stop spacing of 400m in suburban locations, and 250m in urban centres;
- Locate bus stop as close as practicable to nearest junction/pedestrian crossing;
- Locate bus stop downstream of junction rather than upstream;
- Consider space requirements to provide bus stop including shelter, waiting area, cycle track and footpath provision and information displays;
- Review existing and proposed boarding & alighting volumes to determine the usage of the bus stop; and
- Consider the potential for interchange with orbital bus services proposed as part of the New Dublin Area Bus Network.

The above principles were considered to determine whether a bus stop should remain where it is, be relocated or be removed.

Following the review of bus stop locations, the catchment analysis was run to review the impact of the changes on the bus network.

The proposed catchments are presented in Figure 4.6 through to Figure 4.9 with population numbers presented in Table 4.9 to Table 4.16.

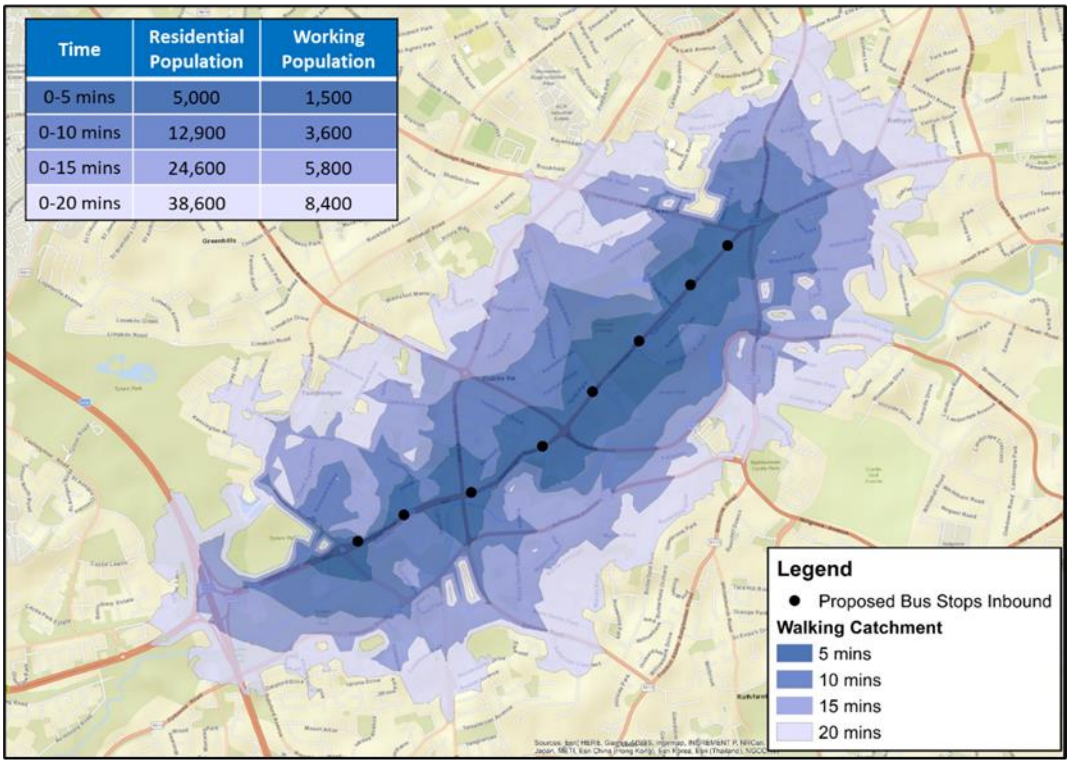
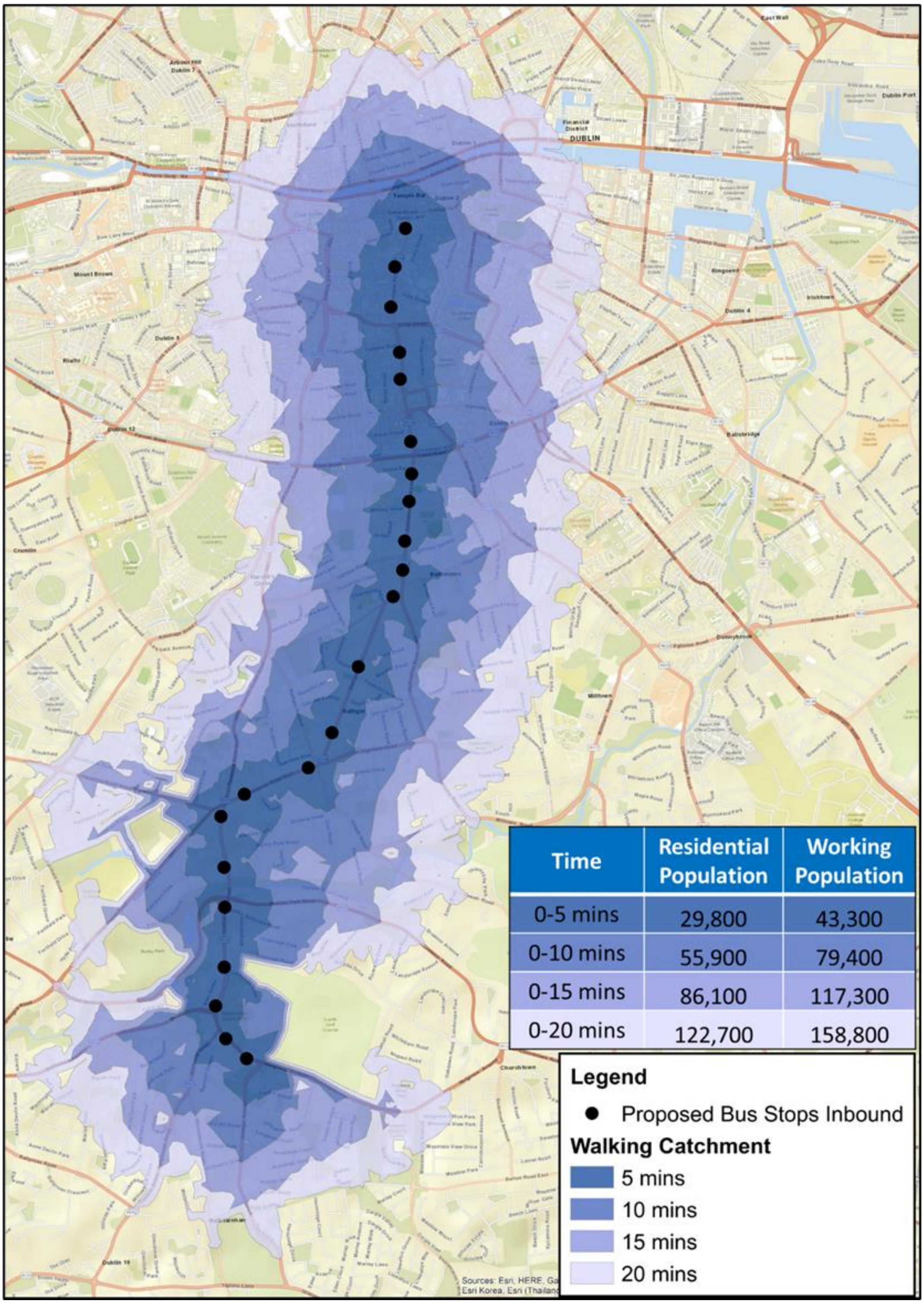


Figure 4.6: Section 1 Proposed Inbound Bus Stop Catchments



Time	Residential Population	Working Population
0-5 mins	29,800	43,300
0-10 mins	55,900	79,400
0-15 mins	86,100	117,300
0-20 mins	122,700	158,800

Figure 4.7: Section 2, 3 & 4 Proposed Inbound Bus Stop Catchments

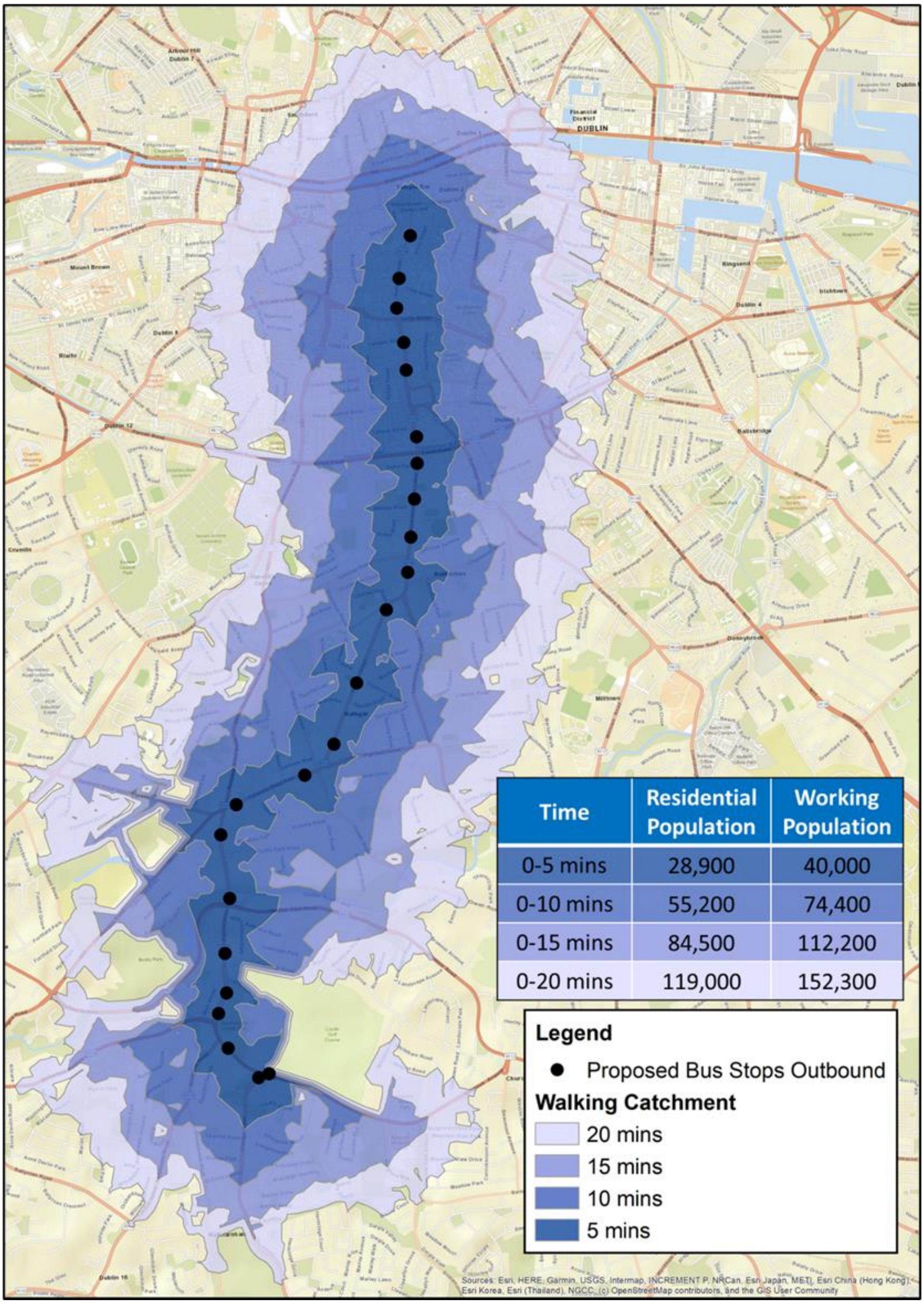


Figure 4.8: Sections 2, 3 & 4 Proposed Outbound Bus Stop Catchments

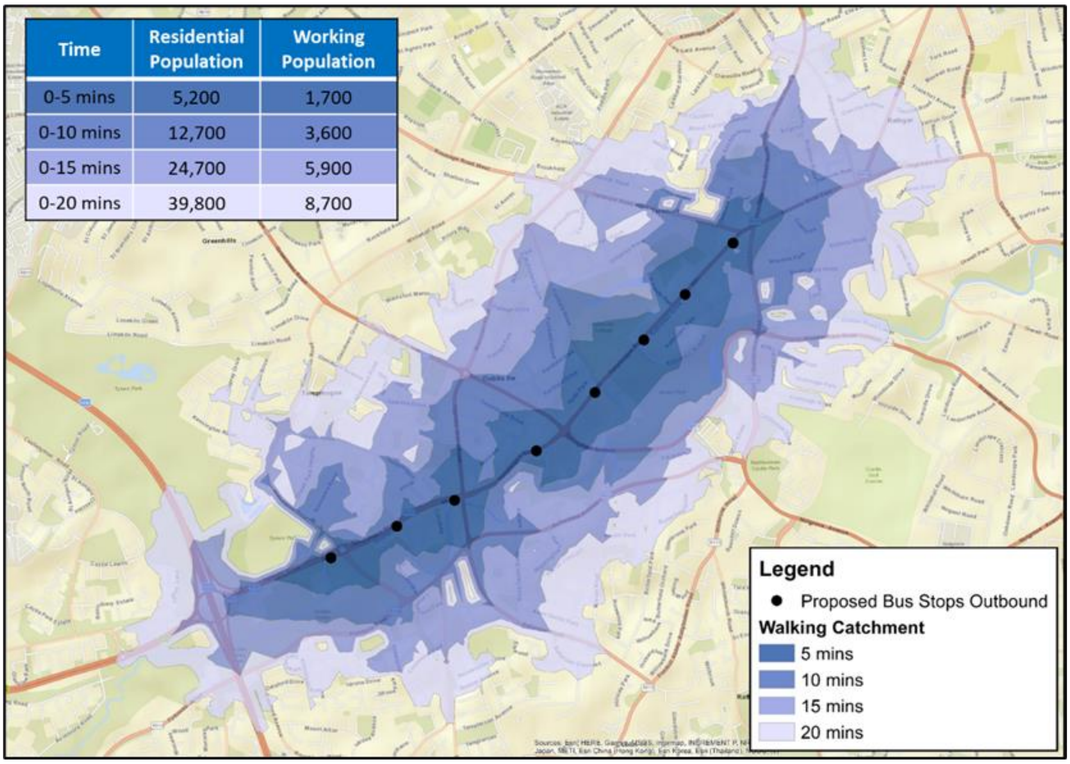


Figure 4.9: Section 1 Proposed Outbound Bus Stop Catchments

Table 4.9: Section 1 Inbound Residential Catchment Populations

Catchment (mins)	Existing (persons)	Proposed (persons)	Difference (persons)
0-5	4900	5000	100
0-10	12600	12900	300
0-15	24700	24600	-100
0-20	38800	38600	-200

Table 4.10: Section 1 Inbound Workplace Catchment Populations

Catchment (mins)	Existing (persons)	Proposed (persons)	Difference (persons)
0-5	1500	1500	0
0-10	3600	3600	0
0-15	5900	5800	-100
0-20	8600	8400	-200

Table 4.11: Section 2, 3 & 4 Inbound Residential Catchment Population

Catchment (mins)	Existing (persons)	Proposed (persons)	Difference (persons)
0-5	28300	30000	1700

Catchment (mins)	Existing (persons)	Proposed (persons)	Difference (persons)
0-10	54300	56800	2500
0-15	83600	86500	2900
0-20	116600	122900	6300

Table 4.12: Section 2, 3, & 4 Inbound Workplace Catchment Population

Catchment (mins)	Existing (persons)	Proposed (persons)	Difference (persons)
0-5	40800	44900	4100
0-10	75300	80300	5000
0-15	113000	118000	5000
0-20	150600	159000	8400

Table 4.13: Sections 2, 3 & 4 Outbound Residential Catchment Populations

Catchment (mins)	Existing (persons)	Proposed (persons)	Difference (persons)
0-5	28200	28900	1300
0-10	54300	55200	1200
0-15	82700	84500	2800
0-20	115300	119000	4800

Table 4.14: Section 2, 3 & 4 Outbound Workplace Catchment Populations

Catchment (mins)	Existing (persons)	Proposed (persons)	Difference (persons)
0-5	37600	40000	3900
0-10	72200	74400	5400
0-15	108400	112200	6900
0-20	147700	152300	7900

Table 4.15: Section 1 Outbound Residential Catchment Populations

Catchment (mins)	Existing (persons)	Proposed (persons)	Difference (persons)
0-5	5000	5200	200
0-10	12500	12700	200
0-15	24600	24700	100
0-20	39700	39800	100

Table 4.16: Section 1 Outbound Workplace Catchment Population

Catchment (mins)	Existing (persons)	Proposed (persons)	Difference (persons)
0-5	1600	1700	100
0-10	3500	3600	100
0-15	5900	5900	0
0-20	8700	8700	0

From the tables above, it is noted that the proposed bus stop locations bring about an increase in both residential and workplace catchments for the inbound and outbound directions. The residential population increases more than the workplace populations, which is likely due to the largely suburban nature of the area through which the route passes.

Each of the study components and proposed bus stops are discussed in more detail in the Bus Stop Review Report in Appendix H.

4.14.2 Route Summary

Table 4.17 and **Table 4.18** outline a summary of the outcome of the bus stop review process.

Table 4.17: Inbound Scheme Summary

Number of Existing Stops	37
Number of Stops Moved	15
Number of Stops Removed	7
Number of Stop Added	0

Table 4.18: Outbound Scheme Summary

Number of Existing Stops	35
Number of Stops Moved	10
Number of Stops Removed	6
Number of Stop Added	1

4.14.3 Bus Shelter

Bus shelters provide an important function in design of bus stops. The shelter will offer protection for people from poor weather, with lighting to help them feel more secure, Seating will be provided to assist ambulant disabled and older passengers and accompanied with Real Time Passenger Information (RTPI) signage to provide information on the bus services. The locations of the bus shelters are presented on the General Arrangement drawing series in Appendix B.

The optimum configuration that provides maximum comfort and protection from the elements to the travelling public is the 3-Bay Reliance ‘mark’ configuration with full width roof. This shelter is a relatively new arrangement which has been developed by JCDecaux in conjunction with the NTA. The shelter consists mainly of a stainless-steel structure with toughened safety glass and extruded aluminium roof beams. Figure 4.10 provides an example image of the preferred full end panel shelter arrangement. The desirable minimum footpath/island widths required to accommodate the full end panel shelter is 3.3m with an absolute minimum width of 3m to facilitate a minimum 1.2m clearance at the end panel for pedestrians. Alternative arrangements for more constrained footpath widths are considered below.

Figure 4.10: Example of a 3-Bay Reliance full end panel bus shelter (Source: JCDecaux)

The cantilever shelter using full width roof and half end panel arrangement provides a second alternative solution for bus shelters in constrained footpath locations. Figure 4.11 provides an example of this type of shelter. Advertising panels in this arrangement are normally located on the back façade of the shelter compared to the full end panel arrangement. The desirable minimum footpath/island widths required to accommodate the full end panel shelter is 2.75m with an absolute minimum width of 2.4m to facilitate a min. 1.2m clearance at the end panels for pedestrians.

Figure 4.11: Example of a 3-Bay Reliance Shelter with full width roof and half end panels (Source: JCDecaux)

Two alternative narrow roof shelter configurations (Figure 4.12) are also available which offer reduced protection against the elements compared to the full width roof arrangements. These shelter configurations are not preferred but do provide an alternative solution for particularly constrained locations where cycle track narrowing to min 1m width has already been considered and 2.4m widths cannot be achieved to facilitate the full width roof with half end panel shelter. The desirable minimum footpath widths for the narrow roof configuration are 2.75m (with end panel) and 2.1m (no end panel).

The absolute minimum footpath widths for these shelters are 2.4m (with end panel) and 1.8m (no end panel) to allow for boarding and alighting passengers in consideration of wheelchair, pram, luggage and other such similar spatial requirements.

Figure 4.12: Example of a 3-Bay Reliance Cantilever shelter with narrow roof configuration with and without half end panels (Source: JCDecaux)

The siting of bus shelters also requires due consideration on a case-by-case basis. Ideally bus shelters should be located on the island bus stop boarding/alighting area where space permits. Where this is not feasible, the shelters should be located perpendicular to the island to the rear of the footpath. Where bus shelters cannot be located directly on the dedicated island or perpendicular to the island due to spatial and or other constraints, they should ideally be located downstream of the stop area. This will inherently promote eye to eye contact between boarding passengers and oncoming cyclists and buses when signalling the bus and also improve the courtesy arrangement for segregation of boarding and alighting passengers. Figure 4.13, Figure 4.14 and Figure 4.15 illustrate each of these scenarios.

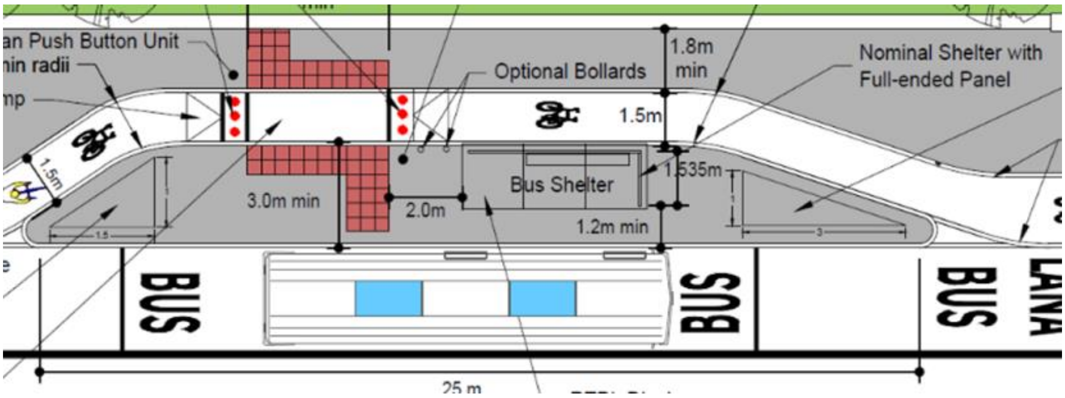


Figure 4.13: Preferred Shelter Location (on island)

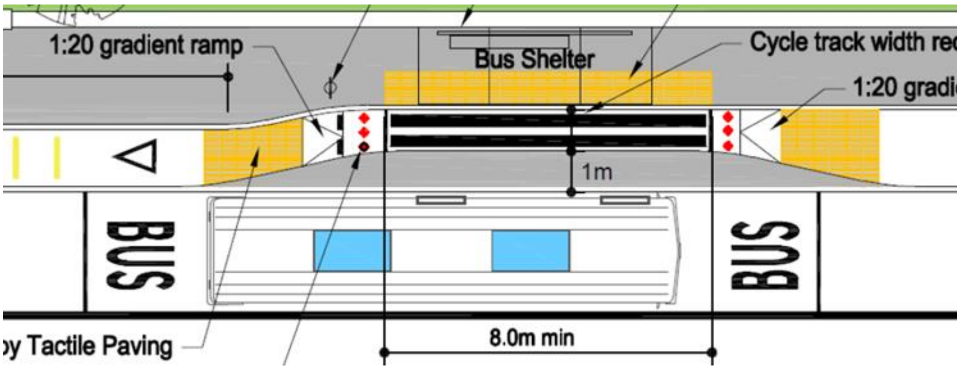


Figure 4.14: Alternative Shelter Location back of footpath (narrow island with adequate footpath widths)

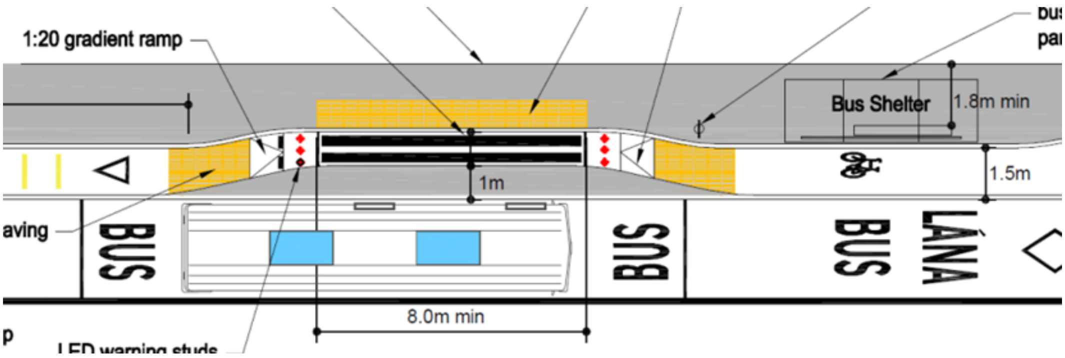


Figure 4.15: Alternative Shelter Location downstream of island (narrow island with narrow footpath widths at landing area)

4.14.4 Island Bus Stops

Where sufficient space is available, Island Bus Stops have been proposed which help to reduce the conflict between users departing the bus and cyclists. The two types of island bus stops which accommodate for one way and two-way cycle tracks are shown within Figure 4.16 and Figure 4.17 respectively. The following features reduce conflict between pedestrians and cyclists while addressing accessibility for mobility impaired users:

- To address the pedestrian/cyclist conflict, a pedestrian priority crossing point will be provided for pedestrians accessing the bus stop area. Part-time signals will enable controlled crossing when required. Visually impaired pedestrians may call for a fixed green signal when necessary and the cycle signal will change to red;
- The cycle track should be deflected behind the bus stop sufficiently to reduce cycling speed for safety through the crossing area so cyclists can give way to pedestrians crossing to the bus stop area. The cycle track will rise in level to meet the footpath level. (Yellow bar markings could also be provided to alert approaching cyclists but the narrowing and deflection should suffice when the approaching cycle track is the nominal 2m width);
- Appropriate signage and lighting will be provided at these locations to ensure that all road users are aware of the potential conflicts in this area; and
- The cycle track will narrow from 2.0m to 1.5m for single file cycling through the bus stop, as overtaking is not required in this area.

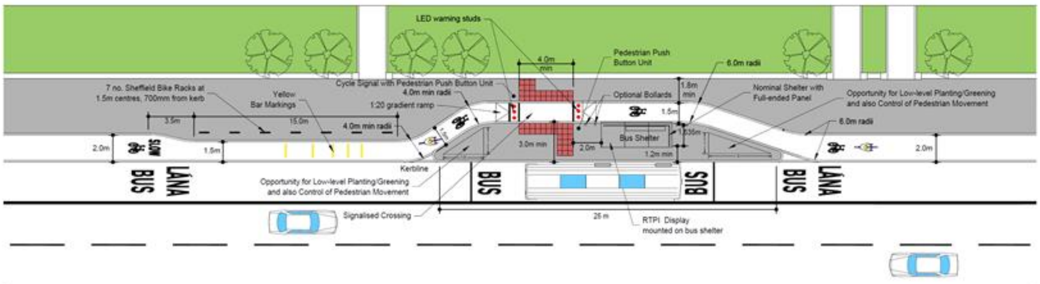


Figure 4.16: Island Bus Stop Arrangement

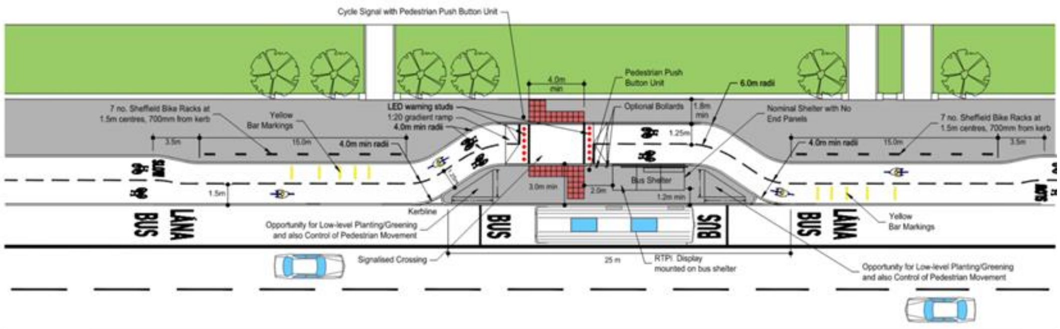


Figure 4.17: Island Bus-Stop Arrangement - Two-way Cycle-Track

Island Bus Stops are used at a number of locations along the Proposed Scheme, as shown in Table 4.19.

Table 4.19: Island Bus Stops

Inbound/ Outbound	Bus Stop Name	Bus Stop No.	Chainage	Bus Shelter	Reason for moving / locating stop
Inbound					
Section 1					
Inbound	Spawell Centre	2599	J750	Proposed: Yes Existing: Yes	This location aligns with principle of having stop located after junction. The current location serves Spawell well but does not serve the surrounding residential areas as well. This location also improves spacing between this and the next stop. Proposed location also improves potential for interchange with route F2 and 82.
Inbound	Cheeverstown House	2600	J1100	Proposed: Yes Existing: Yes	This location is closer to the pedestrian crossing thus facilitating better access to Cheeverstown House.
Section 2					
Inbound	St. Mary's Boys School	1329	A100	Proposed: Yes Existing: Yes	This location has enough space to provide an island bus stop and is located after the junction with good proximity to Grange Road and St, Mary's Boys National School
Inbound	Fergus Road	1336	A1800	Proposed: Yes Existing: Yes	This location brings the stop closer to Terenure Village thus providing better access to the village and improving potential for interchange with Orbital Route S4.
Section 4					
Inbound	Williams Park	1070	A4100	Proposed: Yes Existing: Yes	This location allows for an island bus stop to be provided. This location is only 200m from stop 1069, but this is deemed acceptable in this area which is more densely populated and where there are more trip attractors present.

Inbound/ Outbound	**Bus Stop Name**	**Bus Stop No.**	**Chainage**	**Bus Shelter**	**Reason for moving / locating stop**
Inbound	Camden St Lower	1352	A5200	Proposed: No Existing: No	Consideration was given to removing this stop in lieu of stop 7577 but was retained due to ability to provide island bus stop.
Outbound					
Section 1					
Outbound	Bushy Park House	1125	J2400	Proposed: Yes Existing: Yes	This location is closer to the Fortfield Road junction, and Our Lady's school.
Outbound	Riverside Cottages	1127	J1950	Proposed: by SDCC Existing: by SDCC	Bus stop is outside extent of scheme however does align with the guiding principles for bus stop location with appropriate spaces between adjacent stops. Good location serving Templeogue Village.
Outbound	Cheeverstown House	2550	J1000	Proposed: Yes Existing: Yes	This stop is located immediately adjacent to a pedestrian crossing, providing good connection to the residential area on the northern side of the road
Section 4					
Outbound	Grantham Street	1285	A5200	Proposed: Yes Existing: Yes	Minor amendment to stop location
Outbound	Cuffe Street	7579	A5600	Proposed: Yes Existing: Yes	This location is well positioned to serve the Kevin St area and available space allows an island bus stop to be provided.

4.14.5 Shared Landing Area Bus Stops

Shared landing areas, as shown in Figure 4.18, are used where there is insufficient space to provide an island bus stop. The cycle track width is reduced on the approach to slow cyclists and further reduced to 1.0m at the pedestrian crossing section, along with a 1m island being provided for users departing the bus. This is to prevent bus users stepping directly into the cycleway. Appropriate tactile kerbing will be provided to ensure that visually impaired users are aware of crossing areas. The proposed Shared Bus Stop Landing Zone locations are indicated within Table 4.20.

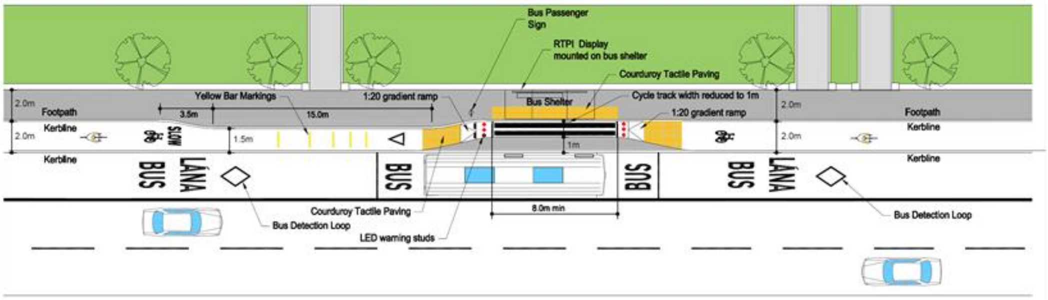


Figure 4.18: Shared Landing Area Bus Stop Arrangement

In particularly constrained locations within urban centres, where the provision of a bus shelter at the rear of the footpath is not practicable due to the presence of frontages, a variation of the Shared Bus Stop Landing Zone arrangement may be considered. This option is presented in Figure 4.19. This option provides a cantilever bus shelter adjacent to the carriageway, to maintain access to frontages at the back of the footpath.

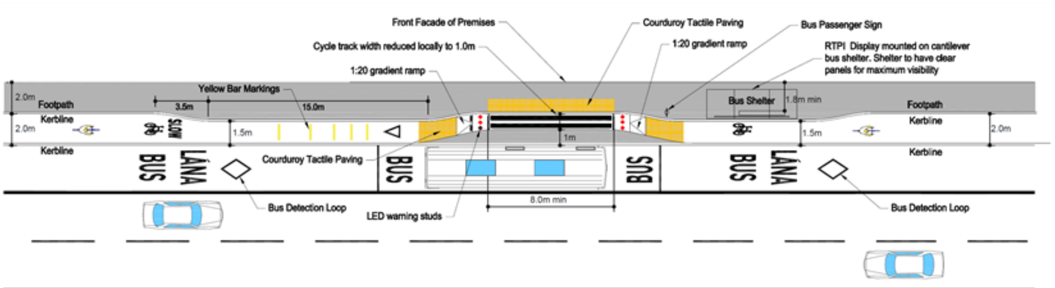


Figure 4.19: Shared Landing Area Bus Stop

The locations of each of these types along the Proposed Scheme are recorded in Table 4.20.

Table 4.20: Shared Landing Bus Stops

Inbound/ Outbound	Bus Stop Name	Bus Stop No.	Chainage	Bus Shelter	Reason for moving / locating stop
			Inbound		
Section 1					
Inbound	Cypress Grove Road	1155	J1500	Proposed: Yes Existing: No	This location would facilitate better access to the stop given proximity to Cypress Grove Road as well as improve potential for interchange with Route F1

Inbound/ Outbound	Bus Stop Name	Bus Stop No.	Chainage	Bus Shelter	Reason for moving / locating stop
Inbound	Riverside Cottages	1157	J2000	Proposed: Yes Existing: Yes	Consideration was given to moving this stop further west, however this would place the stop within the traffic lane and complicate the proposed queue management system.
Inbound	Bushy Park	1159	J2400	Proposed: No Existing: No	This location serves to consolidate stops 1158 and 1159 into one stop, located adjacent to the Fortfield Road junction, which improves accessibility to Fortfield Road while providing more consistent stop spacings. The proposed location is also within a bus lane rather than a traffic lane which will minimise its impact.
Section 2					
Inbound	Willbrook Road	1330	A300	Proposed: Yes Existing: Yes	Consideration was given for removing this stop, due to its proximity to the previous and next stops however, it was retained due to its proximity to trip attractors at Willbrook Road (Church, Rathfarnham Castle & Yellow House) as well as the inability to locate the stop slightly further north due to presence of car parking
Inbound	Butterfield Avenue	1331	A525	Proposed: Yes Existing: Yes	This location improves the catchment area along Butterfield Avenue, and improves access to the southern end of Rathfarnham Village
Section 3					
Inbound	Winton Avenue	1166	A2800	Proposed: Yes Existing: Yes	There is very limited space between the two garden entrances in the existing location. The proposed location lies in front of gardens with no vehicular entrances, allowing more space for the stop to be located here.

Inbound/ Outbound	Bus Stop Name	Bus Stop No.	Chainage	Bus Shelter	Reason for moving / locating stop
Inbound	Grosvenor Road	1168	A3200	Proposed: Yes Existing: No	This stop is located only 450m to the next stop and 450m from the previous stop which is considered appropriate.
Inbound		1170	A3700	Proposed: No Existing: No	This location serves the lower Rathmines area well, along with the catchments along Grosvenor Rd and Rathmines Rd Upper.
Section 4					
Inbound	Rathmines Road	1170	A3700	Proposed: No Existing: No	This location serves the lower Rathmines area well, along with the catchments along Grosvenor Rd and Rathmines Rd Upper
Inbound	Military Road	1071	A4375	Proposed: Yes Existing: Yes	This stop is located in a good location which serves northern parts of Rathmines Village as well as St. Mary's College.
Inbound	Grove Park	4528	A4550	Proposed: Yes Existing: No	This location serves the northern Rathmines area and is deemed to be in an appropriate location
Inbound	Lennox Street	1072	A4750	Proposed: Yes Existing: Yes	Bus stop retained in generally the same location as it is considered to be appropriately located close to the canal and close to nearby trip attractors
Inbound	Grantham Street	7577	Stop removed	To be removed Existing: No	This stop has been removed due to proximity of stop 1352. Stop 1352 considered to provide a better location for stop in this area as island type arrangement can be provided for cyclists.
Inbound	Pleasant Street	1353	A5350	Proposed: Yes Existing: Yes	This location is 175m from previous stop, but this area has a high volume of users and is a location with several trip attractors so this spacing is justified and in line with guidance note

Inbound/ Outbound	Bus Stop Name	Bus Stop No.	Chainage	Bus Shelter	Reason for moving / locating stop
Inbound	Peters Row	1354	A 5650	Proposed: Yes Existing: No	This location utilises space available outside TU Dublin to provide a better bus stop arrangement.
Inbound	Whitefriars Street	1355	A5925	Proposed: No Existing: Yes	This location better serves the Stephen S lower and King St S area as well as improves spacing between stops.
Inbound	Exchequer Street	7578	A6200	Proposed: Yes Existing: No	The location better serves the Exchequer St, Georges St and Dame Street area. Additionally, more space is available at this location to provide a better bus stop / footpath arrangement.
Outbound					
Section 1					
Outbound	Terenure Library	1121	J3600	Proposed: Yes Existing: No	This stop is already well situated in front of the library, close to the junction with enough distance for cars to queue behind without blocking junction.
Outbound	Old Bridge Road	1130	J1350	Proposed: Yes Existing: Yes	This location places the stop after the junction, which aligns with the principle of locating stops after junctions.
Section 2					
Outbound	Fergus Road	1299	A1700	Proposed: No Existing: Yes	This location maintains good spacing between previous and next stops and serves southern areas of Terenure Village well.
Outbound	Butterfield Avenue	1304	A550	Proposed: Yes Existing: Yes	This location serves the southern end of Rathfarnham. New pedestrian crossings are proposed at the junction of Butterfield Avenue.

Inbound/ Outbound	Bus Stop Name	Bus Stop No.	Chainage	Bus Shelter	Reason for moving / locating stop
Outbound	Willbrook Road	1305	A275	Proposed: Yes Existing: Yes	This location serves Willbrook Rd area, and is well spaced between previous and next stops
Section 3					
Outbound	Frankfort Avenue	1079	A3100	Proposed: Yes Existing: No	This location is closer to the junction with Leicester Avenue, thus improving the catchment area for this stop. Greater length available between driveways to provide full stop facilities compared to existing location.
Outbound	Auburn Villas	1080	Stop removed	To be removed Existing: No	This stop is only 180m from the proposed location of the next stop and is no longer needed.
Outbound	Highfield avenue	1081	A2700	Proposed: No Existing: No	This location improves the spacing from the next stop from 200m to 300m and better provides a pair for stop 1166 across the road. Also improves access to northern part of Rathgar Village with stop 1082 serving the southern part.
Outbound	Garda Station	1077	A3600	Proposed: No Existing: Yes	The existing stop is located in shared bus/traffic lane and a stopped bus would therefor restrict movement of traffic. This location allows the stop to be located within a bus lane.
Section 4					
Outbound	Fade Street	1282	A6100	Proposed: Yes Existing: No	Stop serves the Exchequer St and Georges St area well.
Outbound	Whitefriars St	4456	A5800	Proposed: Yes Existing: Yes	This location better serves the Stephen S lower and King St S area.
Outbound	Montague Street	New Stop	A 5375	Proposed: No New Stop	This new stop would provide an outbound equivalent for stop 2353, and improve the stop spacing to bring it closer to the 200m guideline for central locations

Inbound/ Outbound	Bus Stop Name	Bus Stop No.	Chainage	Bus Shelter	Reason for moving / locating stop
Outbound	Lennox Street	1016	A4800	Proposed: No Existing: No	This location is close to canal bridge, there is adequate space in this location and is close to the pedestrian crossing
Outbound	Grove Park	1017	A4650	Proposed: Yes Existing: Yes	This location serves the northern Rathmines area and Grove Park. Spacings to adjacent stops considered to be adequate.
Outbound	Richmond Hill	1018	A4375	Proposed: Yes Existing: No	This location facilitates the provision of the proposed bus gate at the location of the existing stop

4.14.6 Inline Bus Stop

Where there are no cycle tracks provided, inline bus stops are used, where the users departing the bus exit straight on the footway.

Inline bus stops are typically found in the constrained sections of the scheme, as show in Table 4.21.

Table 4.21: Inline Bus Stops

Inbound/ Outbound	Bus Stop Name	Bus Stop No.	Chainage	Bus Shelter	Reason for moving / locating stop
		Inbound			
Section 1					
Inbound	Terenure College	1160	J2800	Proposed: Yes Existing: No	This location is closer to the pedestrian crossing better serving the Rathdown Area. Stop is also closer to the Terenure College Entrance.
Inbound	Lakelands Park	1161	J3250	Proposed: Yes Existing: No	This location is closer to the proposed pedestrian crossing, and better serves the Rathdown Park catchment
Inbound	Olney Crescent	1163	J3550	Proposed: No Existing: No	This stop is located about 320m from both the previous and next stops.

Inbound/ Outbound	**Bus Stop Name**	**Bus Stop No.**	**Chainage**	**Bus Shelter**	**Reason for moving / locating stop**
					It is appropriately located providing access to areas to the south of Terenure Village as well as the village itself with appropriate spacing between stops achieved. Locations enhances potential for interchange with Orbital Route S4.
Section 2					
Inbound	Crannagh Road	1332	A800	Proposed: Yes Existing: Yes	Although it is close to the junction, this location was considered to be more optimal than the existing location as there is more space for congregation and passing pedestrians in this location. It also has less impact on property entrances
Inbound	Brookvale Rd	1333	A1150	Proposed: Yes Existing: No	This location is closer to the Junction with Dodder Park Rd and allows for this stop to be combined with existing stop 1334 thus improving bus stop spacing.
Inbound	Rathdown Park	7293	A1450	Proposed: Yes Existing: No	Consideration was given to moving this stop further north, however there is insufficient space to locate this stop between the Rathdown park and Bushy Park Rd junctions. Locating it after the Bushy Park junction would place it too close to stop relocated stop 1336, and too far away from relocated stop 1333.
Section 3					
Inbound	Brighton Road	1165	A2450	Proposed: Yes Existing: Yes	This location brings the stop closer to Rathgar Village thus providing better access to the village and improving potential for interchange with Route 80.

Inbound/ Outbound	Bus Stop Name	Bus Stop No.	Chainage	Bus Shelter	Reason for moving / locating stop
Outbound					
Section 1					
Outbound	Lakelands Park	1123	J3200	Proposed: Yes Existing: No	This location improves stop spacing, is located just after proposed pedestrian crossing and better serves the Rathdown Park Catchment.
Outbound	Rathdown Avenue	1124	J2850	Proposed: Yes Existing: Yes	The stop already serves the Terenure College entrance, spacing between previous and next stop is appropriate.
Outbound	Wellington Lane	2551	J600	Proposed: Yes Existing: Yes	This location brings the stop closer to the junction improving access to adjacent side roads. The Roundabout is proposed to be converted to a signalised junction, and so space is available for the stop to be located closer to the junction. Proposed location also improves potential for interchange with route F2 and 82.
Section 2					
Outbound	Westbourne Road	1300	A1300	Proposed: Yes Existing: No	The existing location would be present in a shared bus/traffic lane and as such a stopped bus would restrict the flow of traffic on the route. Furthermore, the proposed location would provide a more appropriate spacing between stops in this area.
Outbound	Dodder Park Road	1301	A950	Removed Existing: No	The existing location would be present in a shared bus/traffic lane and as such a stopped bus would restrict the flow of traffic on the route.

Inbound/ Outbound	Bus Stop Name	Bus Stop No.	Chainage	Bus Shelter	Reason for moving / locating stop
					Furthermore, it would be only 100m from stop 1300 and as such it is more appropriate to remove this stop and retain stop 1302.
Outbound	Rathfarnham Castle	1303	A675	Proposed: Yes Existing: No	Consideration was given to locating this stop closer to the Main Street junction. However, there is insufficient width to provide a bus lane at the exit from the junction and any bus stop in this location would therefore hamper the movement of traffic. The optimum solution is therefore to retain the current bus stop location
Section 3					
Outbound	Rathgar Park	1082	A2400	Proposed: No Existing: No	Consideration was given to moving this stop due to restricted space available to provide improved stop infrastructure. However, to improve spacings and overall accessibility, this location, in combination with stop 1081 was considered to be the optimum arrangement for Rathgar Village.
Outbound	Rathfarnham Road	1085	A1950	Proposed: Yes Existing: Yes	This stop is an important Interchange stop, and best serves Terenure Village.
Section 4					
Outbound	Town Centre	1020	A4150	Proposed: Yes Existing: No	This stop serves the central Rathmines area and is located just after a pedestrian crossing. Location and spacings considered to be adequate.

4.14.7 Lay-by Bus Stops

Consideration was also given to locations where private coaches may be required to stop along the Proposed Scheme and therefore a lay-by bus stop would be needed. No such instances were found along this Proposed Scheme.

4.15 Parking and Loading

The Parking Survey Report, included in Appendix G, contains separate analyses of a number of 'self-contained' corridor sections, where groups of parking bays can be considered to provide a local parking supply. The change in on-street parking supply has been identified and assessed in the context of the local needs and adjacent land uses.

The local off-street parking supply and characteristics have also been noted. For the Proposed scheme, the self-contained sections where changes are proposed to parking supply are listed below and are illustrated in Figure 4.20.

- Grange Road / Rathfarnham Road (Between Grange Road and Dodder Park Road);
- Rathfarnham Road / Terenure Road East (between Dodder Park Road and Rathgar Avenue);
- Rathgar Road (between Rathgar Avenue and Rathmines Road Upper);
- Rathmines Road Lower (between Rathmines Road Upper and Grove Road);
- Richmond Street South / Camden Street Lower Wexford Street (between Grove Road and Cuffe Street);
- Redmond's Hill / Aungier Street / South Great George's Street (between Cuffe Street and Dame Street); and
- Terenure Road North / Harold's Cross Road (between Templeogue Road and Parkview Avenue).

It should be noted that there are no existing designated on-street parking spaces on Templeogue Road (between Spawell and Terenure Road West) and this area, therefore, has been excluded from this report.

Existing parking is present within Templeogue Village but this section of the route is not included in the Proposed Scheme and has therefore not been included in this report.

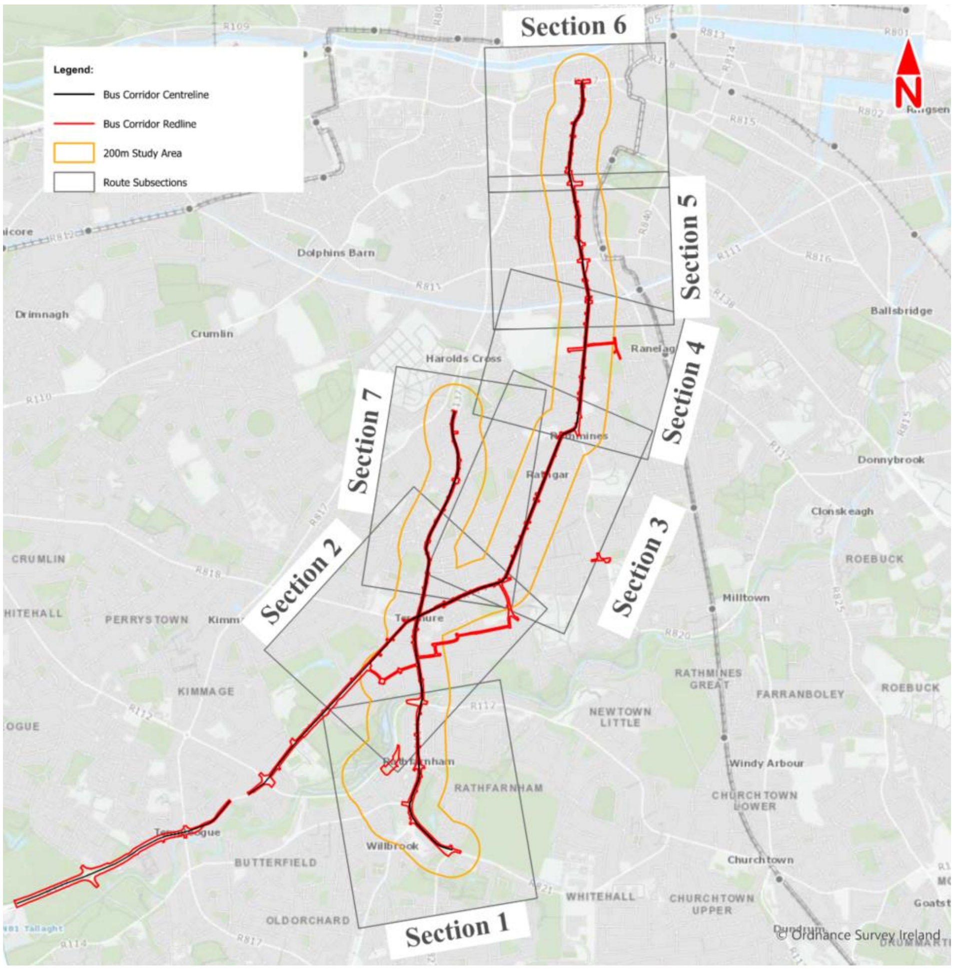


Figure 4.20: Proposed Preliminary Parking Survey Study Areas

4.15.1 Summary of Parking Changes

With the Proposed Scheme infrastructure in place, there will be an associated need to remove some parking spaces to provide improved facilities for pedestrians, cyclists, and buses – which inevitably requires some reallocation of parking road space. To ensure disabled parking bays required as part of the Proposed Scheme are accessible, all disabled parking bay have been designed to Chapter 7 of the Traffic Signs Manual. Typical disabled parking bays layouts are indicated in Figure 4.21.

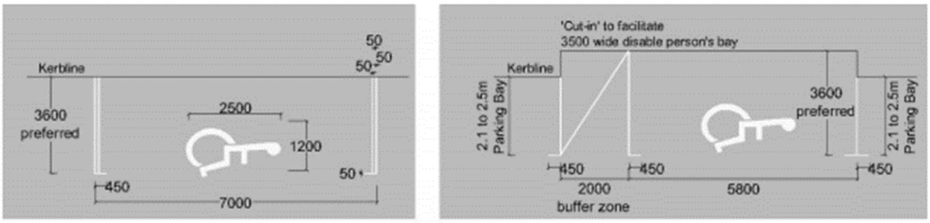


Figure 4.21: Typical disabled parking layout

Refer to Parking summary from the Parking Survey Report in Appendix G.

The proposed changes in parking and loading provision along the Proposed Scheme are summarised in Table 4.22 and Table 4.23.

Table 4.22: Summary of Parking Changes

Location	Baseline		Proposed		Change
	Corridor	Adjacent	Corridor	Adjacent	
Grange Road / Rathfarnham Road (between Grange Road and Dodder Park Road)	7	0	7	0	0
Rathfarnham Road / Terenure Road East (between Dodder Park Road and Rathgar Avenue)	22	83	15	83	-7
Rathgar Road (between Rathgar Avenue and Rathmines Road Upper)	6	35	3	35	-3
Rathmines Road Lower (between Rathmines Road Upper and Grove Road)	21	103	17	103	-4
Richmond Street South / Camden Street Lower Wexford Street (between Grove Road and Cuffe Street)	38	97	22	97	-16
Redmond’s Hill / Aungier Street / South Great George’s Street (between Cuffe Street and Dame Street)	0	53	0	53	0
Terenure Road North / Harold’s Cross Road (between Templeogue Road and Parkview Avenue)	45	132	21	132	-24

Table 4.23: Summary of Loading Changes

Location	Loading Bays		Change
	Baseline	Proposed	
Grange Road / Rathfarnham Road (between Grange Road and Dodder Park Road)	0	0	0
Rathfarnham Road / Terenure Road East (between Dodder Park Road and Rathgar Avenue)	0	0	0

Location	Loading Bays		Change
	Baseline	Proposed	
Rathgar Road (between Rathgar Avenue and Rathmines Road Upper)	6	3	-3
Rathmines Road Lower (between Rathmines Road Upper and Grove Road)	15	21	+6
Richmond Street South / Camden Street Lower Wexford Street (between Grove Road and Cuffe Street)	19	19	0
Redmond's Hill / Aungier Street / South Great George's Street (between Cuffe Street and Dame Street)	29	23	-6
Terenure Road North / Harold's Cross Road (between Templeogue Road and Parkview Avenue)	6	4	-2

4.16 Turning Bans and Traffic Management Measures

Turning bans and other traffic management measures will be implemented on the route to direct traffic away from either the Proposed Scheme corridor (to maximise bus journey time reliability) or to limit use of side streets as a short-cut route by through traffic. All these measures are shown on the General Arrangement Drawings and are listed in Table 4.24 and Table 4.25. Existing turn bans are not included in the below tables.

Table 4.24: Core bus corridor traffic management measures and turning bans

Location	TM measure implemented	Reason for Mitigation	Impact of Mitigation
Templeogue Road/Cypress Grove Road	Bus Priority Signal at Templeogue Road/Cypress Grove Road both inbound and outbound	To allow for bus priority when moving through the junction	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.

Location	TM measure implemented	Reason for Mitigation	Impact of Mitigation
Ashfield Road/Ranelagh Road	Outbound bus priority signal outside of Ashfield Place development	To allow for bus priority on Templeogue Road on constrained section of Templeogue Road at Ashfield Place	Prioritises bus movements and the speed of general traffic is reduced.
R137 Templeogue Road south of Templeogue Village	Priority Bus Signal south of Templeogue Village at Templeogue Tennis Club	To allow for bus priority through Templeogue Village	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.
R137 Templeogue Road north of Templeogue village	Bus Priority Signal north of Templeogue Village at Hollingsworth Cycles	To allow for bus priority through Templeogue Village	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.
Templeogue Road/Springfield Avenue/Templeville Avenue	Bus Priority Signal going from North East to South West	To allow for bus priority on when moving through the junction	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.
Templeogue Road/Springfield Avenue/Templeville Avenue	Existing inbound right turn ban from Templeogue Road onto Springfield Avenue has been removed	To allow traffic to reroute to the Rathfarnham corridor due to the inbound Bus Gate proposed on Templeogue Road	General traffic can now turn right from Templeogue Road on to Springfield Avenue
Templeogue Road/Fortfield Road/Bushy Park House	Bus Priority Signals	To allow for bus priority on when moving through the junction	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.
Templeogue Road/Rathdown Avenue	Bus Priority Signals	To allow for bus priority on when moving through the junction	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.

Location	**TM measure implemented**	**Reason for Mitigation**	**Impact of Mitigation**
Templeogue Road/Rathdown Avenue	No Right turns onto Rathdown Avenue from Templeogue Road	To avoid general traffic travelling through the Rathdown area due to the proposed inbound Bus Gate on Templeogue Road	No right turn inbound movements from Templeogue Road onto Rathdown Avenue
Templeogue Road/Rathdown Park	No Right turns onto Rathdown Park from Templeogue Road	To avoid general traffic travelling through the Rathdown area due to the proposed inbound Bus Gate on Templeogue Road	No right turn inbound movements from Templeogue Road onto Rathdown Park
Templeogue Road/Olney Grove	No left turn from Olney Grove onto Templeogue Road	Inbound bus gate proposed immediately north of this point to ensure bus priority on this constrained section of the CBC	Northbound traffic from Olney Grove must redirect to an alternative route.
Templeogue Road north of Olney Grove	No straight ahead inbound on North Templeogue Road from Olney Grove onwards (06:00-20:00)	Inbound Bus Gate proposed to ensure bus priority through this constrained section of the CBC	Inbound general traffic must redirect to an alternative route.
Templeogue Road/Fergus Road	No right turn from Fergus Road onto Templeogue Road (06:00 – 20:00)	Inbound Bus Gate proposed to ensure bus priority through this constrained section of the CBC	Inbound general traffic must redirect to an alternative route.
Grange Road/Willbrook Road Junction	Bus Priority Signals at Grange Road/Willbrook road Junction	To allow for bus priority on Rathfarnham Road	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.
Rathfarnham Road/Butterfield Avenue Junction	Bus Priority Signals at Rathfarnham Road/Butterfield Avenue Junction	To allow for bus priority on Rathfarnham Road	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.

Location	TM measure implemented	Reason for Mitigation	Impact of Mitigation
Rathfarnham Road/Castleside Drive/Main Street Junction	Bus Priority Signals at Rathfarnham Road/Castleside Drive/Main Street Junction	To allow for bus priority on Rathfarnham Road	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.
Rathfarnham Road/Dodder Park Road Junction	Bus Priority Signals at Rathfarnham Road/Dodder Park Road Junction	To allow for bus priority on Rathfarnham Road	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.
Rathfarnham Road/Rathdown Park Junction	Inbound Bus Priority Signal at Rathfarnham Road/Rathdown Park	To allow for bus priority on Rathfarnham Road	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.
Terenure Road East/Terenure Road West Junction	Right turn for buses from Rathfarnham Road to Terenure Road East introduced through bus priority signal	To allow for bus movements in this direction as per the A spine in the New Dublin Area Bus Network	Buses allowed to turn right from Rathfarnham Road onto Terenure Road East.
Terenure Road East/Greenmount Road Junction	No Right turn allowed from Greenmount Road onto Terenure Road East	To mitigate against inbound traffic bypassing right turn ban at Terenure Cross	No right turn from Greenmount Road onto Terenure Road East for general traffic.
Rathgar Road/Highfield Road Junction	Inbound Bus Priority Signal	To allow for bus priority on Rathgar Road	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.
Rathgar Road/Highfield Road Junction	Outbound Bus Only Signal	One-way general traffic regime on Rathgar Road	Southbound travel is bus only.
Rathgar Road/Wesley Road Junction	No Right turn allowed from Wesley Road onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.

Location	TM measure implemented	Reason for Mitigation	Impact of Mitigation
Rathgar Road/Winton Avenue Junction	No Right turn allowed from Winton Avenue onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.
Rathgar Road/Auburn Villas Junction	No Left turn allowed from Auburn Villas onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.
Rathgar Road/Garville Mews Junction	No Right turn allowed from Garville Mews onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.
Rathgar Road/Belleville Avenue Junction	No Left turn allowed from Belleville onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.
Rathgar Road/Garville Avenue Junction	No Right turn allowed from Garville Avenue onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.
Rathgar Road/Garville Road Junction	No Left turn allowed from Garville Road onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.
Frankfort Avenue/Leicester Avenue/Rathgar Road Junction	Inbound Bus Priority Signal at Frankfort Avenue/Leicester Avenue/Rathgar Road	To allow for bus priority on Rathgar Road	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.
Frankfort Avenue/Leicester Avenue/Rathgar Road Junction	No Right turn allowed from Leicester Avenue onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.
Frankfort Avenue/Leicester Avenue/Rathgar Road Junction	No Left turn allowed from Frankfort Avenue onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.
Grosvenor Road/Rathgar Road Junction	No Right turn allowed from Grosvenor Road onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.
Spike View Lane/Rathgar Road Junction	No Right turn allowed from Spike View Lane onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.

Location	TM measure implemented	Reason for Mitigation	Impact of Mitigation
Rathgar Place/Rathgar Road Junction	No Left turn allowed from Rathgar place Lane onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.
Rathmines Park/Rathgar Road Junction	No Left turn allowed from Rathmines Park Lane onto Rathgar Road	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.
Rathgar Road/Grosvenor Road Junction	Inbound Bus Priority Signal at Rathgar Road/Grosvenor Road	To allow for bus priority on Rathgar Road	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.
Rathgar Road/Grosvenor Road Junction	No Left turn allowed from Rathgar Road North onto Rathgar Road south	One-way general traffic regime on Rathgar Road	Southbound traffic redirected to alternative routes.
Rathmines Road Lower/Castlewood Avenue Junction	Bus Priority Signal at Rathgar Road/Rathmines Road Junction	To allow for bus priority on Rathfarnham Road. Shared bus and general traffic lane north of this point	Improved reliability for bus journey times along the corridor, and improved flexibility in junction stage and operation.
Williams Park	Direction of existing one-way general traffic regime reversed	To allow for inbound traffic to redirect due to the bus gate on Rathmines Road via Military Road, Ardee Road and Williams Park	One-way traffic regime on this street reversed.
Rathmines Road Lower/Williams Park Junction	No Left turn allowed from Rathmines Road Lower onto Williams Park	Bus gate being proposed for Rathmines Village	No traffic allowed to turn left from Williams Park onto Rathmines Road Lower.
Richmond Hill/Rathmines Road Junction	No Right turns from Richmond Hill onto Rathmines Road (06:00-20:00)	Bus gate being proposed for Rathmines Village	Northbound traffic redirected to alternative routes.
Lissenfield/Rathmines Road Junction	No Right turns from Lissenfield onto	Bus gate being proposed for Rathmines Village	Southbound traffic redirected to alternative routes.

Location	TM measure implemented	Reason for Mitigation	Impact of Mitigation
	Rathmines Road (06:00-20:00)		
Rathmines Road south of Lissenfield	No Straight ahead for general traffic	Bus gate being proposed for Rathmines Village	Prevent general traffic from going through Rathmines. Traffic must travel elsewhere.
Rathmines Road/Grove Road Junction	No Straight ahead onto South Richmond Street	One-way outbound regime proposed on South Richmond Street	Northbound traffic redirected to alternative routes.
Rathmines Road/Grove Road Junction	No Right turn from Cheltenham place onto La Touche Bridge	One-way outbound regime proposed on South Richmond Street	Northbound traffic redirected to alternative routes.
Richmond Street South/Charlemont Mall Junction	No Right turn from Charlemont Mall onto South Richmond Street	One-way outbound regime proposed on Richmond Street South	Northbound traffic redirected to alternative routes.
Richmond Place South/Richmond Street South Junction	No Right turn from Richmond Place South onto South Richmond Street	One-way outbound regime proposed on Richmond Street South	Northbound traffic redirected to alternative routes.
Gordon Place/ Richmond Street South Junction	No Right turn from Gordon Street onto South Richmond Street	One-way outbound regime proposed on Richmond Street South	Northbound traffic redirected to alternative routes.
Lennox Street/ Richmond Street South Junction	Closure of Lennox Street to traffic at junction with South Richmond Steet	Traffic restriction on Lennox Street	Traffic redirected to alternative routes.
Richmond Street South/Harrington Street/Harcourt Road Junction	Inbound Bus Only Signal	One-way outbound regime proposed on Richmond Street South	Northbound traffic redirected to alternative routes.
Camden Street	No straight ahead from Camden Street Upper onto Camden Street Lower	One-way outbound regime proposed on Camden Street Lower	Northbound traffic redirected to alternative routes.
Grantham Street	No Left turn from Grantham Street onto Camden Street upper	One-way outbound regime proposed on Camden Street Lower	Northbound traffic redirected to alternative routes.

Location	TM measure implemented	Reason for Mitigation	Impact of Mitigation
Camden Place	No Right turn from Camden Place onto Camden Street Lower	One-way outbound regime proposed on Camden Street Lower	Northbound traffic redirected to alternative routes.
Protestant Row	No Right turn from Protestants Row onto Camden Street Lower	One-way outbound regime proposed on Camden Street Lower	Northbound traffic redirected to alternative routes.

Table 4.25: Turning bans offline from main Core Bus Corridor

Location	TM measure implemented	Reason for Mitigation	Impact of Mitigation
Fortfield Road/Greenlea Road	No Right turn onto Greenlea Road from Fortfield Road	To avoid general traffic travelling through the Greenlea area due to the proposed inbound Bus Gate on Templeogue Road	Risk of diverted through traffic using this route removed. New sign and pole required at the junction.
Fortfield Road/Lavarna Grove	No Right turn onto Lavarna Grove from Fortfield Road	To avoid general traffic travelling through the Lavarna area due to the proposed inbound Bus Gate on Templeogue Road	Risk of diverted through traffic using this route removed. New sign and pole required at the junction.
Kimmage Road Lower/Aideen Avenue	No Right turn onto Aideen Avenue from Kimmage Road Lower.	To mitigate against increased volumes of inbound general traffic redirected as a result of scheme proposals.	Risk of diverted through traffic using this route reduced. New sign and pole required at the junction.
Rathmines Road Upper/Highfield Road	Right turn from Rathmines Road Upper onto Highfield Road reintroduced.	To facilitate outbound general traffic redirected as a result of the proposal to make Rathgar Road one-way inbound for general traffic. Also required to facilitate access to properties at the southern end of Rathgar Road when arriving from the north	Outbound general traffic may turn right from Rathmines Road Upper onto Highfield Road. Risk of diverted through traffic using unsuitable residential streets mitigated. Vehicular access to southern parts of Rathgar maintained from the north.

Location	TM measure implemented	Reason for Mitigation	Impact of Mitigation
			Minor amendments to the junction physical layout and staging operation required.
Cullenswood Avenue/Ranelagh Road	No Right turn for general traffic onto Cullenswood Avenue to Ranelagh Road	To mitigate against increased volumes of inbound general traffic redirected as a result of the proposal to provide a bus gate on Rathmines Road Lower.	Risk of diverted through traffic using this route reduced by removal of ability to travel west-east along Cullenswood Rod and Chelmsford Avenue.
Ashfield Road/Ranelagh Road	No Right turn onto Ranelagh Road from Ashfield Road. No straight ahead onto Chelmsford Lane from Ashfield Road.	To mitigate against increased volumes of inbound general traffic redirected as a result of the proposal to ban the right turn from Cullenswood Avenue onto Ranelagh Road for General Traffic.	Risk of diverted through traffic using this route mitigated. New sign and pole required at the junction.
Chelmsford Lane/Ranelagh Road	No Left turn onto Ranelagh Road from Chelmsford Lane.	To mitigate against increased volumes of inbound general traffic redirected as a result of the proposal to ban the right turn from Cullenswood Avenue onto Ranelagh Road for General Traffic.	Risk of diverted through traffic using this route mitigated. New sign and pole required at the junction.
Sallymount Avenue/Ranelagh Road	No Left turn onto Ranelagh Road from Sallymount Avenue.	To mitigate against increased volumes of inbound general traffic redirected as a result of the proposal to ban the right turn from Cullenswood Avenue onto Ranelagh Road for General Traffic.	Risk of diverted through traffic using this route mitigated. New sign and pole required at the junction.
Merton Drive/Ranelagh Road	No Right turn onto Ranelagh Road from Merton Drive.	To mitigate against increased volumes of inbound general traffic redirected as a result of the proposal to ban the right turn from Cullenswood Avenue onto Ranelagh Road for General Traffic.	Risk of diverted through traffic using this route mitigated. New sign and pole required at the junction.

Location	TM measure implemented	Reason for Mitigation	Impact of Mitigation
Richmond Hill/Mountpleasant Avenue Upper	Right turn reintroduced from Richmond Hill onto Mountpleasant Avenue Upper with new signalised shuttle arrangement.	To mitigate long local diversions required due to the proposal to provide a bus gate on Rathmines Road Lower.	Local diversions mitigated. New shuttle traffic arrangement required at this junction, including signalisation of Richmond Place.
Mountpleasant Avenue Lower	Modal Filter provided on Mountpleasant Avenue Lower north of the junction with Richmond Hill, restricting general traffic while facilitating cyclists.	To mitigate against increased volumes of inbound general traffic redirected as a result of the proposal to provide a bus gate on Rathmines Road Lower.	Risk of diverted through traffic using this route mitigated. New kerb build outs signage required at the junction.
Grand Parade/Dartmouth Place	No Right turn onto Dartmouth Place from Grand Parade.	To mitigate against increased volumes of general traffic redirected as a result of the proposal to provide a modal filter at Lennox Street.	Risk of diverted through traffic using this route mitigated. New signage and pole required at the junction.

4.17 Deviations from Standards

The design has been progressed in accordance with the standards and guidance listed within Section 4.1. However, in some circumstances it has been necessary to digress from the desirable minimum geometric parameters identified.

A schedule of identified deviations from the BCPDGB relating to individual aspects of Road Geometry is included within Appendix C.

4.18 Quality Audit, Road Safety Audit and Road User Audit

DMURS recommends that a Quality Audit should be undertaken to demonstrate that appropriate consideration has been given to all of the relevant aspects of the design of any scheme which involves works on public roads. Furthermore, NGS Circular 3 of 2022, issued by the Department of Transport on the 7th June 2022 notes that Quality Audits are required for all works carried out on public roads which involve new infrastructure or reconfiguration of existing infrastructure.

NGS Circular 3 of 2022 outlines the following stages in the Audit process:

- Stage F: Route selection stage;

- Stage 1: Completion of preliminary design;
- Stage 2: Completion of detailed design,;
- Stage 3: Completion of construction; and
- Stage 4: Early operation.

In line with the above, a Stage 1 Quality Audit has been carried out on the Proposed Scheme. Refer to the Quality Audit Report in Appendix M1.

The Quality Audit considers the following elements, and has been undertaken in general accordance with DMURS:

- Visual Quality Audit;
- Street Use Audit;
- Road Safety Audit;
- Access Audit;
- Walking Audit;
- Cycle Audit;
- Non-Motorised User Audit;
- Community Audit; and
- Place Check Audit.

The Road Safety Audit has been carried out in accordance with TII Publication 'GE-STY-01024 Road Safety Audit' document and includes designer responses with changes made the design as appropriate. Refer to the RSA report in Appendix M2.

5 Junction Layout

5.1 Overview of Transport Modelling Strategy

The design and modelling of junctions has been an iterative process to optimise the number of people that can pass through each junction, with priority given to pedestrian, cycle and bus movements.

The design for each junction within the Proposed Scheme was developed to meet the objectives of the scheme and to align with the geometric parameters set out in Section 4.1 in conjunction with the junction operation principles described in the BCPDG. Various traffic modelling tools were used to assess the impact of the proposals on a local, corridor and surrounding road network level which is further described in Section 5.4.

A traffic impact assessment has been undertaken for the Proposed Scheme in order to determine the predicted magnitude of impact Proposed Scheme measures may have against the likely receiving environment. The impact assessments have been carried out using the following scenarios:

- ‘Do Minimum’ – This scenario represents the likely conditions of the road network with all major committed transportation schemes in place that will impact on the use of public transport and private car, without the Proposed Scheme
- ‘Do Something’ – This scenario represents the likely conditions of the road network with all major committed transportation schemes in place that will impact on the use of public transport and private car, with the Proposed Scheme (i.e. the ‘Do Minimum’ scenario with the addition of the Proposed Scheme) in place.

Both scenarios above comprised of an assessment at opening year (2028) and opening year +15 years (2043). In developing the design proposals for the Proposed Scheme, the 2028 year flows were determined to provide the higher volume of traffic flows for the most part and as such has been generally adopted as the design case scenario for junction development. The final junction design flows have been supplemented with additional cycle volumes to ensure a minimum 10% cycle mode share in terms of people movement at each junction can be achieved in line with the National Cycle Policy Framework.

5.2 Overview of Junction Design

The purpose of traffic signals is to regulate movements safely with allocation of priority in line with transportation policy. For the Proposed Scheme, a key policy is to ensure appropriate capacity and reliability for the bus services so as to maximise the overall throughput of people in an efficient manner. The junctions will provide safe and convenient crossing facilities for pedestrians with as little delay as practicable.

Particular provisions are required for the protection of cyclists from turning traffic, as well as ensuring suitable capacity for a rapidly increasing demand by this mode.

The design of signalised junctions, or series of junctions, as part of the Proposed Scheme has been approached on a case-by-case basis. There have been a number of components of the design development process that have influenced the preliminary junction designs including:

- The junction operational and geometrical principles described in the BCPDG;
- Integration of pedestrian and cycle movements at junctions;
- Geometrical junction design for optimal layouts for pedestrians, cyclists and bus priority whilst minimising general traffic dispersion where practical;
- People Movement Calculator (PMC) to inform junction staging and design development;
- LinSig junction modelling to assess junction design performance and refinement;
- Micro-Sim modelling to assess and refine bus priority designs; and
- Cyclist quantification.

5.3 Junction Geometry Design

5.3.1 Pedestrians

The junction design approach is to minimise delay for pedestrians at junctions, whilst ensuring high quality infrastructure to ensure pedestrians of all ages including vulnerable users can cross in a safe and convenient manner. Pedestrian crossings have been placed as close to pedestrian desire lines as practicable. Where pedestrians are required to cross a cycle track, this is proposed to be controlled by traffic signals to manage potential conflicts.

The preferred arrangement for pedestrians at junctions is to have a wraparound pedestrian signal stage at the start of the cycle. In some instances, this hasn’t been feasible i.e. due to crossing distances and the associated intergreen time for pedestrians to safely clear the junction. A “walk with traffic” system is therefore proposed at certain junctions, in particular where refuge islands have been introduced for a two-stage pedestrian crossing. At these locations, controlled crossing for pedestrians is provided across part of the junction, whilst some of the traffic movements that are now in conflict with the pedestrian movement, are allowed to run at the same time. This facility has the advantage to allowing pedestrians to cross during the cycle whilst having less effect on traffic capacity.

5.3.2 Cyclists

The provision for cyclists at junctions is a critical factor in managing conflict and providing safe junctions for all road users. The primary conflict for cyclists is with left turning traffic.

Based on international best practice, the preferred layout for signalised junctions is the “Protected Junction”, which provides physical kerb build outs to protect cyclists at junctions. The key design features and considerations relating to this junction type are listed below:

- The traffic signal arrangement will remove any uncontrolled conflict between pedestrians and cyclists, assigning clear priority to all users at different stages within a traffic cycle;
- Kerbed corner islands should be provided to force turning vehicles into a wide turn and remove the risk of vehicles cutting into the cycle route at the corner, which is a cause of serious accidents at junctions. The raised islands create a protective ring for cyclists navigating the junction, improving safety for right turning cyclists;
- Cycle tracks that are protected behind parking or loading bays will return to run along the edge of the carriageway approaching the junction. Consideration has been given to remove any parking or loading located immediately at junctions to enhance visibility between motorists and cyclists;
- The cycle track will be typically ramped down to carriageway level on approach to the junction and proceeds to a forward stop line. A secondary cycle stop line is also proposed at an advanced location to the vehicular stop line at a number of junctions to cater for right turning cyclists, which will also place the cyclists within view of traffic waiting at the junction. Cycle signals will control the movement of cyclists including the second stage movement i.e. right turners; and
- Cyclist and pedestrian crossings will be kept as close as practicable to the mainline desire line. However, pedestrian and cyclist crossings will be separated where feasible; in these instances 2-3m separation should be provided between crossings. This is to ensure motorists infer a clear differentiation between cycle track crossing through the junction and a pedestrian crossing across the same arm, which will be controlled separately for the most part.

In some junction locations, constraints in respect of physical space and junction configuration have meant that deflection of cycle tracks with kerbed corner islands is not feasible. In these cases, the cycle track will be aligned alongside the adjacent traffic lane on a straight-through path, with box-turns provided for right turning cyclists where appropriate.

5.3.3 Bus Priority

The Proposed Scheme design at junctions is based on typical layouts described in the BCPDGB document, which sets out four different types of junction, referred to as Junction Types 1-4 (in Section 7.4 Signalised Junction Operation of BCPDGB). The following subsections provide an overview of the context and principles for applying all or part of the junction type layouts for the Proposed Scheme design.

5.3.3.1 Junction Type 1

Junction Type 1 (refer to Section 7.4.1 of the BCPDGB) comprises a dedicated bus lane on both inbound and outbound directions which will continue up to the junction stop line. Due to space constraints, general traffic travelling both straight ahead and turning left will be restricted to one lane. Junction Type 1 is typically chosen for the following reasons:

- Volume of left turning vehicles greater than 100 PCUs per hour; and
- Urban setting, no space available for dedicated left turning lane / pocket.

In this instance, mainline cyclists will proceed with the bus phase. The bus lane gets red, allowing the general traffic lane to proceed. If the volume of turning vehicles is greater than 150 PCUs, then the cyclists should also be held on red. If the volume of left turners is approx. 100 – 150 PCUs, left turners will be controlled by a flashing amber arrow and cyclists should receive an early start.

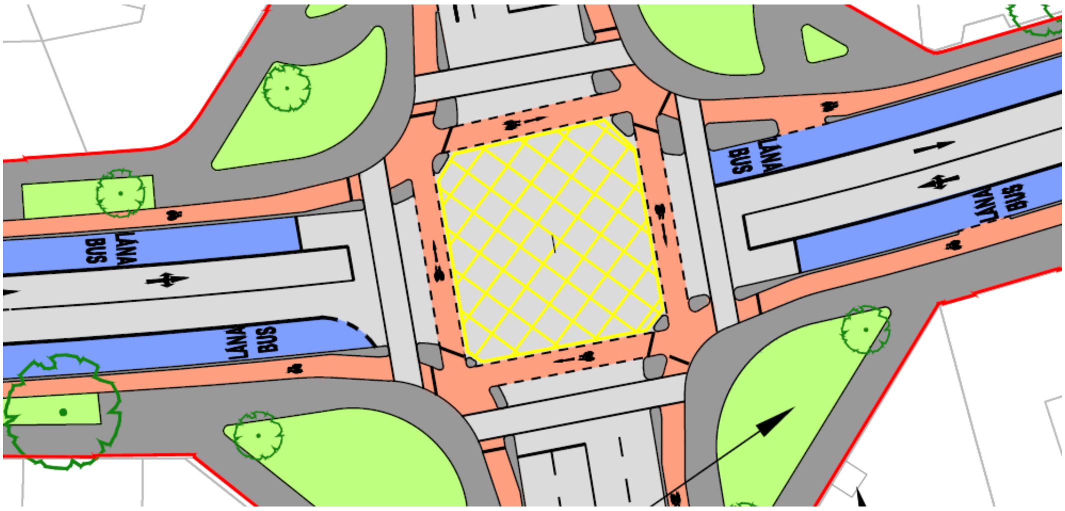


Figure 5.1: Junction Type 1

5.3.3.2 Junction Type 2

Junction Type 2 (refer to Section 7.4.2 of the BCPDGB), shown in Figure 5.2 comprises a signalised junction in a suburban context where there is room for additional lanes. A dedicated bus lane in both inbound and outbound directions continue up to the junction stop line. On the bus lane approach to the junction a yellow box is provided to allow left turners to cross the bus lane to enter a dedicated left turn pocket, where space permits. Junction Type 2 has been chosen for the following reasons:

- Suburban setting where space is available for a dedicated left turning lane / pocket; and
- High volume of left turning traffic which can be controlled separately with exiting traffic from side roads.

A full Junction Type 2 has not been applied to the Proposed Scheme, however the Proposed Scheme has a number of 'hybrid' junctions, which comprise of a Junction Type 2 and another junction type, as shown in Figure 5.2 below.

Figure 5.2: Junction Type 2

5.3.3.3 Junction Type 3

Junction Type 3 (refer to Section 7.4.3 of the BCPDGB) shown in Figure 5.3 illustrates a signalised junction where the inbound and outbound bus lane will terminate just short of the junction to allow left turners to turn left from a short left turn pocket in front of the bus lane. Buses can continue straight ahead from this pocket where a receiving bus lane is proposed. A Junction Type 3 is chosen for the following reasons:

- Volume of left turning vehicles is less than 100 PCUs per hour; and
- Urban setting, no space available for a dedicated left turning lane / pocket.

In this instance, mainline buses and general traffic (including left turners) will proceed together, but before they do, mainline cyclists will be given an early start of approximately 5 seconds to assist with cyclist priority and to minimise potential conflicts. When this early start is complete, the mainline cyclists can still proceed, assuming turning volumes are less than 150 PCUs per hour. Left turning from the left turn pocket are given a flashing amber.

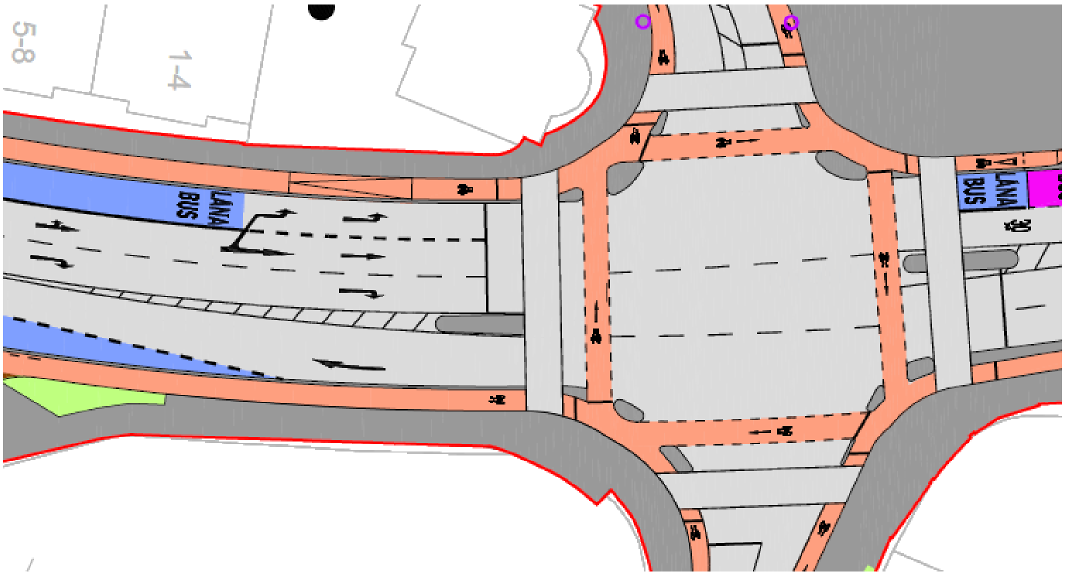


Figure 5.3: Junction Type 3

5.3.3.4 Junction Type 4

Junction Type 4 (refer to Section 7.4.4 of the BCPDGB), shown in Figure 5.4, is a signalised junction with an inbound and outbound bus lane, but also positions the pedestrian crossings on the inside of the cycle tracks across the arms of the junction. Pedestrian crossing distances will be minimised as a result. Signalised pedestrian crossings are proposed across the cycle tracks to allow pedestrians to cross from the footpath to the pedestrian crossing landing areas, thus avoiding uncontrolled pedestrian – cyclist conflict. Other key design features are that left turning cyclists can effectively bypass the junction, while giving way to pedestrians crossing as well as cyclists already on the orbital cycle track, and the number of crossings for pedestrians is increased as pedestrians must cross the cycle track to access the central signal-controlled area.

Junction Type 4 is chosen for the following reasons:

- High incidence of HGV movements e.g. at industrial estates or where two major regional roads meet;
- Suburban setting and lower pedestrian volumes; and
- Appropriate space at junction corners to provide cycle tracks and pedestrian corner islands.

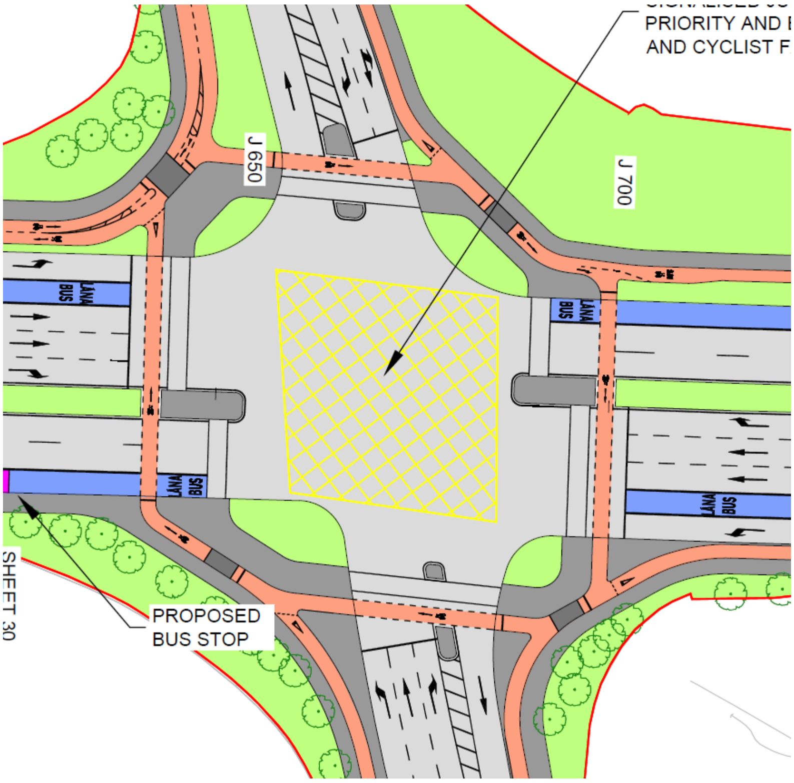


Figure 5.4: Junction Type 4

5.3.4 Staging and Phasing

The optimum staging for each junction is determined by the junction configuration and the level of demand for each movement. One of the key considerations in the design of the signalised junctions is the conflict between left turning traffic and buses, cyclists and pedestrians continuing along the main corridor. The following presents an overview of the design approach:

- Cyclists travelling through the junction across the side road will run with straight ahead traffic movements, including buses in a dedicated bus lane;
- A short early start for straight-ahead cyclists on the main corridor will enable cyclists to advance before general traffic. The amount of green given to cyclists is subject to junction dimensions and signal operation;
- Cycle movements along the main corridor, crossing the side road, can run simultaneously with the bus stage in the same direction, so long as the bus is not permitted to turn left from the bus lane; and
- Cycle movements at junctions are to be controlled by cycle signal aspects where there is an advance stop line ahead of the traffic signals including for hook turns at the far side of the side street crossing. Additional cycle signals are provided for right turning cyclists.

5.3.5 Junction Design Summary

A detailed junction assessment has been undertaken in line with the principles described in Section 5.3. The following summary tables provide an overview of the key design principles adopted at each junction location.

More detailed information for each junction location can be found in the Junction Design Report in Appendix L.

The traffic signal junctions considered as having 'major' changes are listed in Table 5.1 below. This categorisation is based upon the size of the junction; the extent of physical work required to establish them; and the degree of change compared to the existing layout.

Table 5.1: Major Signalised Junctions

Drawing	Name	Summary
Section 1		
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0033	Templeogue Rd/ Templeville Rd	This junction will be based on Junction Type 1. Bus lanes and cycle tracks provided through the junction to facilitate bus priority and improved cyclist safety. Junction converted to protected junction type in accordance with BusConnects Design Guidelines to further improve cyclist safety.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0032	Templeogue Rd / Cypress Grove Rd	This junction will be based on Junction Type 1. Bus lanes and cycle tracks provided through the junction to facilitate bus priority and improved cyclist safety. Junction converted to protected junction type in accordance with BCPDGB to further improve cyclist safety.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0030	Templeogue Rd / Wellington Ln	This junction will be based on Junction Type 4. The existing roundabout junction is proposed to be replaced by a signalised junction with protection for cyclists. The proposed scheme will be compatible with the proposed Wellington Lane cycle scheme.
Section 2		
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0001	Grange Rd / Rathfarnham Wood	This junction will be based on Junction Type 1. Junction is proposed to be upgraded to provide bus lanes and cycle tracks in both directions on Grange Road western approach tying into existing facilities on the eastern approach. A fully protected junction is also proposed to improve cyclist safety.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0004	Rathfarnham Rd / Dodder Park Rd	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by providing bus lanes in each direction on the northern and southern approaches as well as conversion of the junction to a protected junction for cyclists. No inbound bus lane is proposed north of the junction and no outbound bus lane is provided south of the junction with priority maintained in these locations using bus priority signals.

Drawing	Name	Summary
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0002	Rathfarnham Rd / Butterfield Ave	This junction will be based on Junction Type 1. Junction is proposed to be updated to provide bus lanes and cycle tracks in each direction. A fully protected junction is also proposed to improve cyclist safety.
Section 3		
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0006	Rathfarnham Rd / Terenure Rd / Templeogue Road	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by providing a bus lane on the southern approach and providing dedicated cycle facilities along Rathfarnham Road and Terenure Road North. The existing slip lane for traffic turning left from Rathfarnham Road will be removed to improve pedestrian facilities in the village centre. Bus Priority through the junction will be maintained through an inbound bus gate on Templeogue Road approaching the junction and a bus priority signal on Terenure Road East.

There are a number of junctions where the proposed changes are moderate – and are mainly reallocations of space to provide the bus and cyclist facilities, where the overall physical layout will remain largely the same. Table 5.2 summarises these junctions

The operation types described relate to the Typical Protected Junction Types within Section 7.4 of the BCPDGB.

Table 5.2 Moderate Junctions (Signalised)

Drawing	Name	Summary
Section 1		
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0034	Templeogue Rd / Fortfield Rd	This junction will be based on Junction Type 1. Junction modifications are proposed to provide bus lanes in both directions at the junction, with the exception of the inbound direction exiting the junction. Cycle tracks are also proposed at the junction, linking to a two-way facility in Bushy Park to the north-east.
Section 2		
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0002	Grange Rd / Willbrook Rd	This junction will be based on Junction Type 1. This junction is proposed to be upgraded to provide bus lanes and cycle tracks in each direction through the junction. A fully protected junction is also proposed to improve cyclist safety.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0003	Rathfarnham Rd / Castleside Drive	This junction will be based on Junction Type 3. The existing junction is proposed to be altered by providing bus lanes and cycle tracks in each direction on the northern and southern approaches, except for southbound on approach to the junction where no bus lane is provided. A fully protected junction is also proposed to improve cyclist safety.

Drawing	Name	Summary
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0005	Rathfarnham Rd / Rathdown Park	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by providing dedicated cycle tracks in each direction as well as provision of a protected junction for cyclist at Rathdown Park. A bus lane is to be provided on the northern and southern approaches.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0005	Rathfarnham Rd / Bushy Park Rd	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by providing dedicated cycle tracks in each direction as well as provision of a protected junction for cyclist at Rathdown Park. A bus lane is to be provided on the northern and southern approaches.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0025	Orwell Road / Zion Road	The existing junction is proposed to be altered by providing dedicated cycle tracks on the Orwell Road arm of the junction as well as the removal of the slip lane from Zion Road onto Orwell Road.
Section 3		
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0022	Harold's Cross Rd / Rathgar Ave	The existing junction is proposed to be altered by providing dedicated cycle tracks in each direction. The proposed layout will be compatible with the Kimmage to City Centre scheme.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0023	Harold's Cross Rd / Leinster Rd	The existing junction is proposed to be altered by providing dedicated cycle tracks in each direction and toucan crossings on all arms.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0008	Terenure Rd E / Rathgar Rd	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by the provision of cycle tracks in each direction through the junction and Advanced Stacking Locations on Highfield Road and Orwell Road. New toucan crossings are proposed across all arms of the junction to improve pedestrian facilities and turning movements for cyclists.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0008	Rathgar Rd / Highfield Rd	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by the provision of cycle tracks in each direction through the junction and Advanced Stacking Locations on Highfield Road and Orwell Road. New toucan crossings are proposed across all arms of the junction to improve pedestrian facilities and turning movements for cyclists.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0009	Rathgar Rd / Leicester Ave	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by the provision of bus lane in each direction through the junction as well as cycle facilities on each approach. Outbound traffic lane is proposed to be removed.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0011	Rathgar Rd / Grosvenor Rd	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by the provision of an inbound bus lane through the junction as well as protected cycle facilities on each approach.

Drawing	Name	Summary
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0026	Highfield Road / Rathmines Road Upper	The existing junction is proposed to be altered by permitting the right turn from Rathmines Road Upper onto Highfield Road.
Section 4		
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0011	Rathmines Rd Lower / Rathmines Rd Upper	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by the provision of an inbound bus lane through the junction as well as protected cycle facilities on each approach
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0011	Rathmines Rd Lower / Castlewood Ave	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by the provision of improved cycle tracks as well as a bus priority signal on approach from the south. Improvement pedestrian facilities are also provided with pedestrian crossings proposed across each arm.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0012	Rathmines Rd Lower / Leinster Rd	The existing junction is proposed to be altered by the provision cycle tracks as well as the removal of general traffic turning lanes.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0014	Richmond St S / Grove Rd	This junction will be based on Junction Type 1. The existing junction is proposed to be reconfigured to provide a dedicated bus lane inbound, a shared bus/traffic lane outbound, as well as the removal of left turn general traffic lanes and the inbound general traffic lane on La Touche Bridge. A cycle track in each direction is proposed, plus a dedicated turn pocket for cyclists turning from La Touche Bridge onto the canal cycle track which is expected to be a busy movement.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0014	Richmond St S / Charlemont Mall	This junction will be based on Junction Type 1. The existing junction is proposed to be reconfigured to provide a dedicated bus lane inbound, a shared bus/traffic lane outbound, as well as the removal of left turn general traffic lanes and the inbound general traffic lane on La Touche Bridge. A cycle track in each direction is proposed, plus a dedicated turn pocket for cyclists turning from La Touche Bridge onto the canal cycle track which is expected to be a busy movement.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0015	Camden St / Richmond St S / Harrington St /	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by the provision of an inbound bus lane through the junction as well as the removal of inbound general traffic lanes on the Richmond Street South arm of the junction. The junction will be upgraded to include full protection for cyclists through the junction.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0015	Camden St / Charlotte Way	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by the removal of the inbound traffic lane on the Camden Street arm of the junction and the provision of an inbound bus lane through the junction. Continuous cycle tracks are also provided in each direction.

Drawing	Name	Summary
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0017	Kevin St Lower / Wexford St	This junction will be based on Junction Type 1. The existing junction is proposed to be altered by the replacement of the inbound traffic lane on the Wexford Street arm with a bus lane. It is also proposed to remove the existing general traffic slip lanes and provide inbound and outbound cycle tracks on the side arms thereby providing a fully protected junction for cyclists.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0017	South Great George St / Longford St Lower	The existing junction is proposed to be altered by the provision of cycle tracks on approach to the junction on the South Great George Street arms. The existing outbound bus lane on the southern arm of the junction is proposed to be removed.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0018	South Great George St / Stephen St Upper	The existing junction is proposed to be altered by the removal of the existing inbound bus lane on the South Great George's Street arm of the junction and the provision of inbound and outbound cycle tracks.
BCIDC-ARP-GEO_GA-1012_XX_01-DR-CR-0018	South Great George St / Dame St	The existing junction is proposed to be upgraded to accommodate the provision of inbound and outbound cycle tracks along South George's Street.

It is also noted that it is proposed to provide a signalised shuttle arrangement for traffic on Mountpleasant Avenue Upper between Richmond Hill and Richmond Place. This arrangement has not been modelled in LinSig, however has been assessed using traffic modelling first principles and has been found to operate satisfactorily.

5.3.6 Minor and Priority Junctions

There are a total of c. 100 (not including access points for properties) minor junctions without signal control across the Proposed Scheme. These are shown in the General Arrangement drawings in Appendix B.

5.3.7 Roundabouts

There is one mini roundabout proposed as part of the Proposed Scheme on Military Road adjacent to St Mary's College.

5.4 Junction Modelling

5.4.1 LinSig Modelling

Junction modelling using industry standard LinSig software (version 3.2.40) was undertaken to assist the junction design process, as follows:

- To formulate appropriate signal staging for all movements at signal-controlled junctions;
- To understand delays / capacity characteristics for bus movements;

- To ensure that appropriate timings are included within the signal cycle to accommodate the necessary pedestrian and cycling crossing times.

The LinSig analyses and junction layout design were undertaken on an iterative basis – with each junction subject to a design development process to achieve bus priority and high quality provision for walking / cycling movements. In respect of general traffic, LinSig analysis was used to ensure that traffic movements could be practically accommodated within the junction signal staging, but without seeking to minimise delays to traffic.

The following assumptions were generally applied in the LinSig modelling:

- Cycle Time of 120s, reducing to 90s in the city centre;
- Minimum Pedestrian Green Time 6s;
- Pedestrian Intergreen based on a walking speed of 1.2m per second plus a 2 second safety buffer;
- Cyclist Cruise Speed 15km/h; and
- Cyclist Early Start 5s on the majority main CBC arms, with 3s minimum. On the side roads of junctions, 3s cyclist early start.

Table 5.3 provides an overview of the LinSig junction analysis results. The Junction Design Report in Appendix L provides details of LinSig junction modelling outputs. It is noted that the LinSig models produced provide a basis for finalising junction designs, but that implementation of the proposed junctions will require detailed signal controller specifications and associated phasing plans to be produced.

Table 5.3: Proposed Scheme Signalised Junctions

Junction Name	Proposed Cycle Time (Seconds)	Practical Reserve Capacity (%)	
		AM peak Hour	PM Peak Hour
Grange Road / Rathfarnham Wood	120	5%	22%
Grange Road / Willbrook Road	120	7%	17%
Rathfarnham Road / Butterfield Avenue	120	32%	16%
Rathfarnham Road / Castleside Drive	120	38%	-2%
Rathfarnham Road / Dodder Park Road	120	-11%	27%
Rathfarnham Road / Rathdown Park and Rathfarnham Road / Bushy Park Road (combined in one model)	120	24%	15%
Rathfarnham Road / Terenure Road N / Templeogue Road and Terenure Road W / Terenure Place (combined in one model)	120	-2%	-2%

Junction Name	Proposed Cycle Time (Seconds)	Practical Reserve Capacity (%)	
		AM peak Hour	PM Peak Hour
Rathgar Road / Terenure Road and Rathgar Road / Highfield Road (combined in one model)	120	-17%	-1%
Rathgar Road / Leicester Avenue	120	284%	451%
Rathgar Road / Grosvenor Road	90	108%	75%
Rathmines Road Lower / Castlewood Avenue	90	72%	65%
Rathmines Road Lower / Rathmines Road Upper	90	37%	67%
Rathmines Road Lower / Leinster Road	90	134%	124%
Richmond Street S / Grove Road and Richmond Street S / Charlemont Mall (combined in one model)	90	60%	64%
Camden Street / Harrington Street / Richmond Street S	90	-40%	-40%
Camden Street / Charlotte Way	90	14%	33%
Kevin Street Lower / Wexford Street	90	-2%	29%
South Great George Street / Longford Street Lower	90	129%	109%
South Great George Street / Stephen Street	90	126%	179%
South Great George Street / Dame Street	90	67%	70%
Harold’s Cross Road / Rathgar Avenue	120	-33%	-51%
Harold’s Cross Road / Leinster Road	120	29%	46%
Offline Junction: Highfield Road / Rathmines Road Upper	120	9%	20%
Orwell Road / Zion Road	120	104%	134%
Templeogue Road / Wellington Lane	150	-14%	-14%
Templeogue Road / Cypress Grove Road	120	-1%	0%
Templeogue Road / Templeville Road	120	22%	1%
Templeogue Road / Fortfield Road	120	93%	17%

Overall, the junction analyses show that all junctions along the corridor have feasible and functional signal staging plans which will ensure that buses will be able to proceed along the corridor with delays minimised, and that high quality crossing facilities are provided for cyclists and pedestrians.

Two particular locations where some overcapacity issues are noted are:

- Camden Street / Harrington Street / Richmond Street South: This junction is being upgraded in terms of pedestrian and cyclist facilities, including the provision of new controlled pedestrian crossings on the northern and western arms of the junction. It is also proposed to resolve an existing geometry issue which currently precludes buses and traffic from safely turning from Harrington Street onto Camden Street Upper at the same time, through phase separation of these movements. For forecast flows this junction does show some approach arms as overcapacity – but delays to buses are minimised, and provision for cyclists and pedestrians are much improved.
- Harold’s Cross Road / Rathgar Avenue: This junction is being upgraded in terms of pedestrian and cyclist facilities, including the reallocation of road space to provide north/south segregated cycling facilities through the junction. Traffic re-distribution due to proposals on the main CBC corridor results in additional traffic using this junction as an alternative route. For forecast flows the junction does show some approach arms as overcapacity – but provision for cyclists and pedestrians are much improved.

5.4.2 Forecast Traffic Flow Data for Junction Modelling

The EIA process for the Proposed Scheme included a traffic and transport assessment based on strategic area-wide modelling, utilising a Local Area Model (LAM) for the CBC corridor, which was a subset model of the NTA’s Eastern Regional Model (ERM). The LAM outputs provide projected traffic flows for the situation with the Proposed CBC Scheme in place (the ‘Do Something’ scenario), which were input to the LinSig junction models for purposes of refining junction designs. An iterative process was followed in which successive draft outputs from LinSig junction modelling (in respect of staging plans and timings) were coded into the LAM and the resultant LAM forecast traffic flow outputs were inputted to the LinSig models (for the AM and PM peak periods for the projected year of opening in 2028).

The Junction Design Report in Appendix L provides summaries of LinSig junction modelling outputs. The LinSig outputs show that the Proposed Scheme junction designs will operate effectively for the forecast flow scenarios with buses not subject to delay, and with appropriate provision within the signal operation for crossing movement of pedestrians and cyclists.

The EIA investigations also included development of a microsimulation model developed for the Proposed Scheme corridor. The LinSig outputs (in respect of staging plans and timings) were inputted to the corridor micro simulation model, which also assisted in assessing and optimising the junction designs and traffic control strategies. Figure 5.5 provides an overview of the LinSig and transport modelling processes for the proposed scheme.

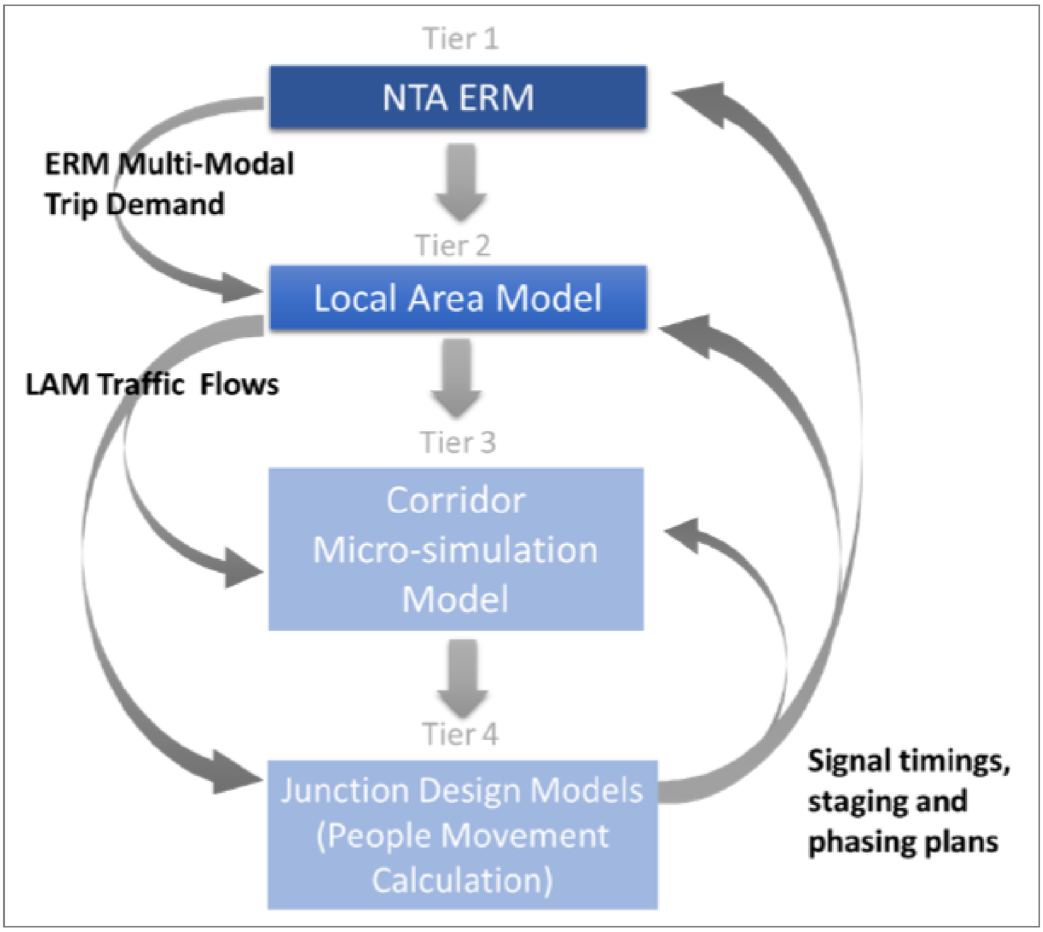


Figure 5.5: Scheme Transport Modelling Hierarchy

5.4.3 People Movement Through Junctions

The design process for junctions has included assessments of the potential people movement throughput at each junction on the Proposed Scheme. For this purpose, a bespoke People Movement Calculation tool was developed, in which the number of people that can theoretically be carried through each junction by each mode was assessed, based on the signal green times allocated to each movement and the person-capacity of the car and bus motorised modes. This approach represents a policy-led influence on design iterations, and ensured that the focus of design was to maximise the number of people able to travel through each junction (rather than cars), with priority given in the design process to sustainable modes i.e. walking, cycling and bus – with a lesser priority given to general traffic movements by car.

The information used for the purposes of People Movement Calculation includes the following:

- Number of buses planned to travel on the corridor (informed by the BusConnects network design proposals);
- Estimated cycling demand (from the ERM), with consideration also to a higher policy-based cycle mode share;

- Pedestrian crossing width and resultant crossing timing requirements; and
- Vehicular capacity at each junction (derived by LinSig).

The Junction Design Report in Appendix L provides summaries of total theoretical movement capacity by each mode at each junction.

6 Ground Investigation and Ground Condition

6.1 Ground Investigation Overview

Following a review of the proposed alignments, a desk study was undertaken along the Proposed Scheme. A Ground Investigation (GI) was scoped and designed based on the findings of the desk study review. The following sections outline the desk study sources, the anticipated ground conditions, the scoped GI, the GI results and their interpretation. A separate section presents hydrogeological information. The last section presents the geotechnical considerations relevant to the proposed structures along the Proposed Scheme.

Refer also to Ground Investigation Report contained in Appendix E.

6.2 Desk Study

The site setting and geotechnical information for the site were obtained from publicly available information. The publicly available sources of information reviewed are as follows:

- 1836 – 1842 Historic map 6 inch (Geohive)
- 1888 – 1913 Historic map 25 inch (Geohive)
- 1830 – 1930 Historic map 6 inch – Cassini (Geohive)
- Contour map (EPA)
- Geological Survey of Ireland (GSI)
- Quaternary Sediments and Geomorphology map (GSI)
- Teagasc Soils map (GSI)
- Unconsolidated Sediments map (GSI)
- Bedrock, Geology100k map (GSI)
- Karst Features map (GSI)
- Depth to Bedrock map (GSI)
- Groundwater Aquifer map (GSI)
- Groundwater Vulnerability map (GSI)
- Groundwater Wells and Springs map (GSI)
- Groundwater Recharge map (GSI)
- Subsoil Permeability map (GSI)
- Active and Historic Pits and Quarries map (GSI)
- Mineral localities map (GSI)
- Historic Ground Investigations map (GSI)

- In-house Ground Investigations database
- Rivers of Dublin (C.L. Sweeney, 1991)

6.2.1 Existing Ground Conditions

6.2.1.1 Section 1

The EPA contour map shows topography ranges from 70m OD in the west down to 50m OD in the east.

Historical ground investigation data was used to create a preliminary stratigraphic profile. Summary of available historical reports and preliminary stratigraphy is as follows:

- Dodder Valley Drainage Scheme - GSI Report: R596
- M50 Tallaght Bypass Junction Slip Road - GSI Report: R3246
- Our Lady's School – Residential Development - GSI Report: R3774

Table 6.1: Summary of Stratigraphic Profile along Section 1 based on Historical Information.

Strata	Top of Layer (m BGL)	Thickness (m)
Topsoil	0.0	0.1-0.25
Made Ground	0.0-0.2	0.5 - >4.0
Soft to Firm silty CLAY	0.2-1.0	0.5 - >2.9
Stiff to hard sandy gravelly CLAY, containing cobbles and boulders	0.7-3.7	Not proven
Sandy GRAVEL / gravelly SAND recorded at the western end of alignment at the intersection with the M50, underlying the Made Ground. Sandy CLAY, sand/gravel with clay and silt recorded as underlying the Made Ground at the intersection of Templeogue Road and Cypress Grove Road, at this location the GSI Quaternary map (see Figure 10) shows alluvium deposits. Made Ground has been described as comprising sandy gravelly CLAY and clayey gravelly SAND, with cobbles and boulders, blocks, wood, red brick, concrete and plastic and tarmac. Groundwater level anticipated to be between 1.75m BGL and 5.5m BGL based on limited groundwater monitoring and observations during the Ground Investigations.		

The GSI Teagasc Soil map shows the alignment is primarily underlain by Made Ground and Till derived from Limestone. Alluvium is noted along the River Dodder. The GSI Quaternary Subsoil map shows that the alignment is underlain mainly by Till derived from Limestone. Alluvium is noted along River Dodder while Gravel derived from Limestone are present towards the western end of the scheme. The GSI Quaternary Geomorphology map shows a meltwater channel running along River Dodder and Hummocky Sand and Gravel at the western end of the alignment at the intersection with the M50.

The GSI Bedrock Geology 100k map states that the rock type along the Proposed Scheme is Limestone of the Lucan Formation.

It is described as comprising dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather usually to pale grey. No faults or any other geological features are present along or in the vicinity of the proposed alignment. The GSI Depth to Bedrock map presents rockhead to typically range from 1 to 10m BGL. Close to the M50 intersection the rockhead drops down to 15m BGL. According to the GSI karst database there are no karst features identified within the examined Route. The GSI Active and Historic Pits and Quarries map present a historic quarry near the intersection of Templeogue Road and Templeville Road.

6.2.1.2 Sections 2, 3 & 4

Based on the EPA contour map the topography ranges from 50m OD at Nutgrove Avenue down to 20m OD at the northern end of the alignment.

The GSI Teagasc Soil map shows primarily Made Ground underlying the proposed alignment. Alluvium and Till derived from Limestone are noted beside River Dodder. Based on the GSI Quaternary Subsoil map Till derived from Limestone underlies the majority of the examined Route. Gravels derived from Limestone are noted towards the southern end of the scheme while Urban (i.e. Made Ground) at the northern section. Alluvium is present mainly along the River Dodder. The GSI Quaternary Geomorphology map presents Hummocky Sand and Gravel at the southern section of the scheme. The map also shows two meltwater channel intersecting the proposed alignment. One meltwater channel follows the River Dodder alignment while the latter is located close to Butterfield Avenue. A third meltwater channel is east of Rathfarnham Road.

Similar to Section 1, the underlying rock type is Limestone of the Lucan Formation. (GSI Bedrock Geology 100k). It is described as comprising dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather usually to pale grey. No faults or any other geological features are present along or in the vicinity of the proposed alignment.

The GSI Depth to Bedrock map presents rockhead to typically range from 3 to 10m BGL. The rockhead is shown to be shallower, 1 to 3m BGL, at the intersection of Terenure Road East and Rathgar Road and it drops down to 15m BGL at parts of the northern sections of the Proposed Scheme.

According to the GSI karst database there are no karst features identified within section 2, 3 & 4. The GSI Active and Historic Pits and Quarries map shows two historic quarries adjacent to the alignment, one along Harold’s Cross Road and one at the intersection of Terenure Road East and Rathgar Road.

6.3 Summary of Ground Investigation

6.3.1 Field Investigation

Following a review of the alignments and the findings of the desk study, a GI was specified for Sections 2 to 4. No GI was designed for proposed Section 1 as the section did not include new structures and the results of the desk study suggested that the ground conditions were fairly consistent along the alignment.

6.3.1.1 Section 2, 3 & 4

The scope of the completed GI consisted of:

- 2 No. Cable Percussion (CP) with follow-on Rotary Coring (RC) boreholes to a maximum depth of 15.5m BGL
- In situ testing (i.e. SPTs)
- 2 No. standpipe installations with groundwater monitoring

6.3.2 Geotechnical Laboratory Testing

6.3.2.1 Section 2, 3 & 4

Scheduled geotechnical and geo-environmental laboratory testing laboratory tests included the following:

- 4 No. Moisture content
- 4 No. Particle size distribution
- 4 No. Atterberg limits
- 7 No. Geo-Environmental testing (WAC assessment)
- A geotechnical factual report

6.4 Ground Summary and Material Properties

6.4.1 Section 1

No GI was carried out along Section 1 – Tallaght Road to Rathfarnham Road.

6.4.2 Section 2, 3 & 4

The borehole logs typically recorded Topsoil over Made Ground over Cohesive Deposits over Granular Deposits over Bedrock. R12-CP02 encountered Granular Deposits both above and below Cohesive Deposits. The following table summarises the encountered stratigraphy along the Rathfarnham to City Centre section of the Proposed Scheme.

Table 6.2: Summary of GI results – Section 2, 3 and 4

Stratum	Description	Depth (m BGL)	Thickness (m)
Topsoil	Brown slightly sandy slightly gravelly Topsoil	0.0	0.4 to 0.8
Made Ground	Brown to brownish grey slightly sandy to sandy gravelly Clay with some angular to subangular cobbles, occasional boulders, occasional plastic and brick	0.4 to 0.8	0.7 to 1.2
Cohesive Deposits	Stiff to very stiff brown slightly sandy gravelly CLAY with occasional cobbles	1.6 to 3.3	0.7 to 1.3
Granular Deposits	Dense brownish grey sandy clayey fine to coarse GRAVEL	1.5 to 3.0	2.5 to 3.4
Bedrock	Grey fine grained fossiliferous LIMESTONE	5.5 to 5.6	N/A

6.4.3 Contaminated Land

There are no licensed facilities within the study area that are either currently licensed or previously licensed with the EPA for waste, industrial emissions and integrated pollution control.

A ground investigation was carried out from October 2020 to November 2021 by GII Ltd. (Report reference - Project No: 9754-07-20 R12, Final, 01.April.2021). Geo-environmental testing was undertaken on seven samples, in natural ground and made ground, from two ground investigation locations.

These results suggest an 'Inert' Waste Acceptance Criteria (WAC) classification. No signs of contamination were noted on ground investigation logs. In the historical ground investigation data, contamination was not described and WAC classification was not carried out.

However, the ground investigations do not cover the whole alignment and contamination is a possibility. Potential sources are listed in the Ground Investigation Report (GIR) within Appendix E.

6.4.4 Summary of Ground Investigation Interpretative Report

6.4.4.1 Section 1

As stated previously, no GI was carried out along the Tallaght Road to Rathfarnham Road section of the Proposed Scheme. Therefore, no interpretation will be provided.

6.4.4.2 Section 2, 3 & 4

The GI recorded along Sections 2, 3 and 4 recorded the following strata.

6.4.4.3 Topsoil

No interpretation is required for Topsoil. Wherever encountered it will be excavated and removed.

6.4.4.4 Made Ground

No interpretation is required for the Made Ground. Wherever encountered it will be excavated and removed.

6.4.4.5 Granular Deposits

Granular Deposits were encountered at all exploratory locations. All the recorded SPT N values are high varying from 31 to above 50 (refusal). According to the PSD results these Deposits are predominantly classified as Gravel. Yet, the content of fines and Sand varies highly. Based on the above the Granular Deposits are sub-divided into coarse-grained Glacial Till and Fluvio-glacial Gravel. The former has a fines and Sand content of around 45% while the latter less than 10%.

The following parameters will be provided for the coarse-grained Glacial Till and Fluvio-glacial Gravel.

A. Coarse-grained Glacial Till

<u>Weight density</u>

The available GI results describe this stratum as dense gravel. Only part of the stratums appears to be below the groundwater table. This leads to a γ value ranging between 18 to 23kN/m^3 (BS8002: 2015). A value of 20kN/m^3 is adopted.

<u>Effective strength</u>

Peck *et al* established a relationship between the SPT N and $\varphi'_{cv,k}$ for coarse-grained soils. Following from that a graph was introduced correlating the above parameters. An SPT test was carried out within the examined stratum and an SPT N value of 31 was recorded. This value, according to the graph mentioned above, corresponds to a $\varphi'_{cv,k}$ of approximately 36°.

BS8002: 2015 presents the following equation to calculate the $\varphi'_{cv,k}$.

$\varphi'_{cv,k} = 30° + \varphi'_{ang} + \varphi'_{PSD}$

where:

φ'_{ang} is contribution to $\varphi'_{cv,k}$ from the angularity of the particles; and

φ'_{PSD} is contribution to $\varphi'_{cv,k}$ from the soil's particle size distribution.

The logs typically describe the angularity of the stratum as sub-rounded to sub-angular which leads to a φ'_{ang} of 2°.

The uniformity coefficient, Cu, is high and the φ'_{PSD} is taken as 2°. By adding the three components the $\varphi'_{cv,k}$ is 34°. Taking into account the above a $\varphi'_{cv,k}$ of 36° is selected. Due to the nature of this layer (coarse-grained) c´= 0kPa

Stiffness

For the estimation of the stiffness the following empirical relationship will be used:

E´ = 1.5 SPT N (in MPa) which leads to an E´ of 46.5MPa.

B. Fluvio-glacial Gravel

Weight density

The available GI results describe this stratum as dense gravel partially below groundwater level. Yet, the recorded SPT N values are above 50 (refusal) and, based on BS 5930:2015, the density of the stratum is classified as very dense. According to BS8002: 2015 a very dense gravel typically has a γ value ranging between 20 to 24kN/m^3. A value of 21kN/m^3 is adopted.

Effective strength

The recorded SPT N values are above 50 (refusal). By following the Peck *et al* approach an SPT N value of 50 corresponds to a $\varphi'_{cv,k}$ of approximately 41°.

BS8002: 2015 presents the following equation to calculate the $\varphi'_{cv,k}$.

$\varphi'_{cv,k} = 30° + \varphi'_{ang} + \varphi'_{PSD}$

where:

φ'_{ang} is contribution to $\varphi'_{cv,k}$ from the angularity of the particles; and

φ'_{PSD} is contribution to $\varphi'_{cv,k}$ from the soil's particle size distribution.

The logs typically describe the angularity of the stratum as sub-rounded to angular which leads to a φ'_{ang} of 3°. The uniformity coefficient, Cu, varies between approximately 2 and 5. These values correspond to an evenly graded material and the φ'_{PSD} is taken as 2°. By adding the three components the $\varphi'_{cv,k}$ is 35°. Taking into account the above a $\varphi'_{cv,k}$ of 38° is selected. Due to the nature of this layer (coarse-grained) c´= 0kPa

Stiffness

For the estimation of the stiffness the following empirical relationship will be used:

E´ = 1.5 SPT N (in MPa) which leads to an E´ of 75MPa.

6.4.4.6 Cohesive Deposits

Cohesive Deposits were recorded at all exploratory locations. The laboratory classification tests and the soil descriptions as included in the BH logs indicate that this material is a low plasticity brown Clay with silt, sand, gravel and boulder content. This material is known as Dublin Boulder Clay.

The following parameters will be provided for the Dublin Boulder Clay.

Weight density

In the absence of laboratory testing which could measure the weight density (γ) directly or indirectly reference is made to BS8002: 2015. According to this document a clay with high undrained shear strength, like the one examined herein, has a weight density which typically varies from 17 to 23kN/m^3. A value of 20kN/m^3 is adopted.

Total strength

The soil descriptions in the logs at the geotechnical report are in accordance with BS5930:2015. The logs describe the stiffness of the Boulder Clay as stiff to very stiff. A stiff to very stiff clay, according to BS5930:2015, has a c_u value which varies from 75 to 300kPa. The recorded SPTs values shown at the borehole logs were above 50 (refusal). The classification testing carried out at samples taken from this stratum showed a PI varying from 11 to 13%. Based on Stroud and Butler graph (1975) such PI values correspond to an f_1 value of around 6. The c_u can be calculated as SPT N x f_1 which will lead to 300kPa. Taking the above into account a c_u value of 150kPa is chosen for design.

Effective strength

No effective stress shear strength laboratory testing was carried out on samples of Dublin Boulder Clay as part of this Scheme. Long and Menkiti (2007) report a value of 44° for the peak compressive angle of shearing resistance (φ'_p) for all formations of the Dublin Boulder Clay. Long and Mentiki (2007) also report a value of 36° for the critical state angle of shearing resistance (φ'_{cs}). This value of φ'_{cs} compares favourably with the findings of Lehane and Faulkner (1998) and Farrell and Wall (1990) who report values of 34°±1° and 35° respectively. In all cases a c′= 0kPa is recommended. Taking the above into account a value of $\varphi'_p = \varphi'_{cs} = 35°$ is chosen for design.

Stiffness

For stiff consolidated clays, the soil undrained stiffness (E_u) can be calculated based on the relationship with undrained shear strength. Published data suggests a value of E_u between 500 c_u and 1000 c_u. In the examined case the E_u will be calculated as follows:

E_u = 500 x c_u = 75MPa

The drained stiffness (E′) can be approximated by taking 80% of this value which leads to a value of approximately 60MPa.

6.4.4.7 Bedrock

Both boreholes recorded Limestone at approximately 5.5m BGL. Based on the latest scope the proposed development includes works which will be limited close to the existing ground level. Therefore, derivation of design parameters for the underlying Limestone will not be provided.

6.4.5 Geotechnical parameters

Table 6.3 presents the geotechnical parameters for the strata encountered during the GI along Sections 2, 3 and 4.

Table 6.3: Geotechnical parameters – Sections 2, 3 and 4

Stratum	γ (kN/m^3)	c_u (kPa)	φ (°)	c´ (kPa)	E_u (MPa)	E´ (MPa)
Topsoil	No geotechnical parameters will be provided for these layers					
Made Ground						
Coarse-grained Glacial Till	20	N/A	36	0	N/A	46.5
Fluvio-glacial Gravel	21	N/A	38	0	N/A	75
Dublin Boulder Clay	20	150	35	0	60	75
Limestone	No geotechnical parameters will be provided for this layer					

6.5 Overview of Soil Classification

6.5.1 Section 1

Based on the findings of the desk study the ground conditions along Section 1 are as follows:

- Topsoil and/or Made Ground is expected to be present along proposed Route.
- Alluvium might be encountered below Topsoil and/or Made Ground at sections of Templeogue Road which are in the vicinity of River Dodder.
- Till derived from Limestone is expected to be present below Topsoil, Made Ground and/or Alluvium and to extend up to rockhead along proposed Route.
- The underlying bedrock along the scheme is expected to be Limestone.

6.5.2 Section 2, 3 & 4

The ground conditions along Sections 2, 3 and 4 are as follows:

- Topsoil and/or Made Ground is expected to be present along proposed Route.
- Coarse-grained Glacial Till will be encountered below Topsoil and/or Made Ground at the sections of proposed alignment which are in the vicinity of River Dodder.
- Dublin Boulder Clay will be present below Topsoil and Made Ground. In the vicinity of River Dodder, Granular Deposits are expected to be overlying Dublin Boulder Clay.

- Fluvio-glacial Gravel is expected to be underlying Dublin Boulder Clay close to River Dodder.
- The underlying bedrock along the scheme is expected to be Limestone.

It should be noted that the desk study showed Alluvium which was not confirmed by the conducted GI.

6.6 Groundwater

6.6.1 Section 1

Based on the findings of the desk study the groundwater level is anticipated to be between 1.75m BGL and 5.5m BGL based on limited groundwater monitoring and observations during the Ground Investigations.

6.6.2 Section 2, 3 & 4

2 No. standpipe installations was carried out during the ground investigation. Groundwaters were measured only one time per borehole. Measured groundwater depths are listed below;

- R12-CP02 2.1m below ground level
- R12-CP03 3.2m below ground level

6.7 Hydrogeology

6.7.1 Section 1

Based on the GSI Groundwater Aquifer map Section 1 crosses areas where the aquifer is classified as locally important and the bedrock is moderately productive only in local zones. According to the relevant GSI map the groundwater vulnerability is typically low. Yet, sections of the Templeogue Road cross areas where the groundwater vulnerability is classified as moderate, high or extreme. The subsoil permeability along Section 1 is classified predominantly as low (GSI; Subsoil Permeability map). At approximately the junction of Cypress Grove Road and Templeogue Road the subsoil permeability is noted as medium. The subsoil permeability has not been mapped around Springfield Avenue. The GSI Wells and Springs map shows a spring around 150m south to Tallaght Road.

6.7.2 Section 2, 3 & 4

The GSI Groundwater Aquifer map states that the aquifer is locally important, as the bedrock is moderately productive only in local zones. The groundwater vulnerability is mainly classified as low or moderate.

Terenure Road East and Harold’s Cross Road cross areas where the groundwater vulnerability increases to high and extreme. The groundwater vulnerability along the River Dodder is also shown as high or extreme.

Based on the relevant GSI map the subsoil permeability is assessed as low apart from the banks of River Dodder where it is classified as medium. The subsoil permeability has not been mapped at small sections of Terenure Road East and Harold’s Cross Road. The GSI Wells and Springs map shows a feature noted as borehole at the Castle Golf Course approximately 700m east to Nutgrove Avenue. Another feature, also described as borehole, is located around 100m east to Rathmines Road Lower.

6.8 Geotechnical Inputs to Structures

The Proposed Scheme includes widening of existing and construction of new pavements. In the absence of *in situ* testing such as California Bearing Ratio (CBR) tests, the CBR values will be estimated taking into account the existing GI results. Based on them the anticipated CBR values are expected to typically range from 2.5 to 3.0% for the cohesive layers and from 4 to 5% for the granular material. These values will have to be confirmed at a later stage.

The proposed design does not include any major structures.

7 Pavement, Kerbs, Footways and Paved Areas

7.1 Pavement

7.1.1 Overview of Pavement

This section covers the preliminary design for the following pavement assets:

- General traffic lanes,
- Bus lanes,
- Cycle tracks, and
- Other specific trafficked areas (e.g. off-line bus stops, bus terminals, off-line parking and loading bays).

For the Proposed Scheme, two pavement networks are being considered, the primary and the secondary networks. The primary network refers to the bus corridor under consideration while the secondary network refers to the roads impacted by the re-routing of existing traffic from the Proposed Scheme to the nearby road network.

The preliminary design of pavement assets is based on the following standards:

- DN-PAV-03021 (Dec. 2010) – Pavement and Foundation Design;
- DN-PAV-03023 (Jun. 2020) – Surfacing Materials for New and Maintenance Construction for use in Ireland;
- AM-PAV-06050 (Mar. 2020) – Pavement Assessment, Repair and Renewal Principles;
- PE-SMG-02002 (Dec. 2010) – Traffic Assessment;
- CC-SPW-00600 (Mar. 2013) – Specification for Road Works Series 600 – Earthworks;
- CC-SPW-00700 (Jan. 2016) – Specification for Road Works Series 700 – Road Pavements – General;
- CC-SPW-00800 (Mar. 2013) – Specification for Road Works Series 800 – Road Pavements – Unbound and Cement Bound Mixtures;
- CC-SPW-00900 (Sep. 2017) – Specification for Road Works Series 900 – Road Pavements – Bituminous Materials.

This section identifies the proposed pavement strategy, setting out the design development considerations for the pavement works in current and future design stages. It also outlines the key elements for consideration for future testing requirements, and consideration for the valorisation of reusable and recyclable materials in new pavement materials in the detailed design stage.

The different pavement assets are designed taking consideration of:

- Traffic loads;
- Changes in road geometry;
- Existing pavement construction build-up;
- Existing pavement condition;
- Landscape Architect's requirements; and
- The impact of other assets such as drainage, utilities and structures.

7.1.2 Design Constraints

7.1.2.1 Traffic Loading Considerations

Use of current Traffic Count data (Traffic Count Data 2019-2020) has been undertaken, to understand the current traffic loads and how they link with the existing pavement construction build-up. A representation of traffic counts along the Proposed Scheme is shown in Figure 7.1 and Figure 7.2 below.

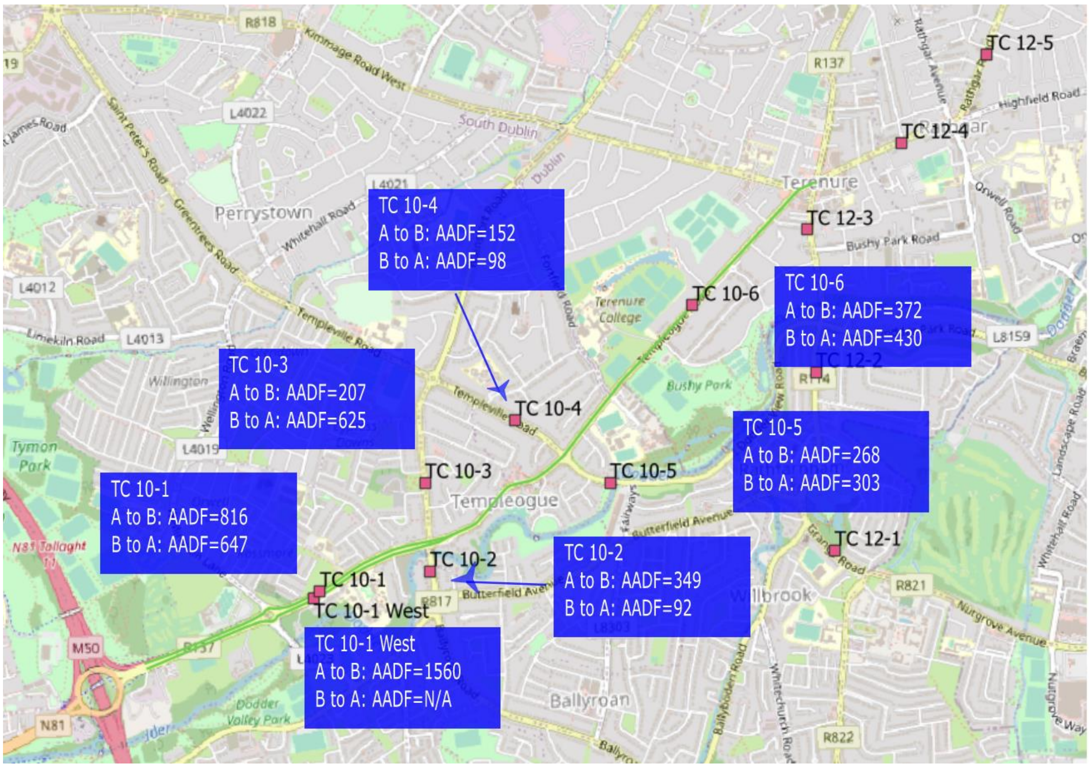


Figure 7.1: 2019-2020 AADF – Section 1

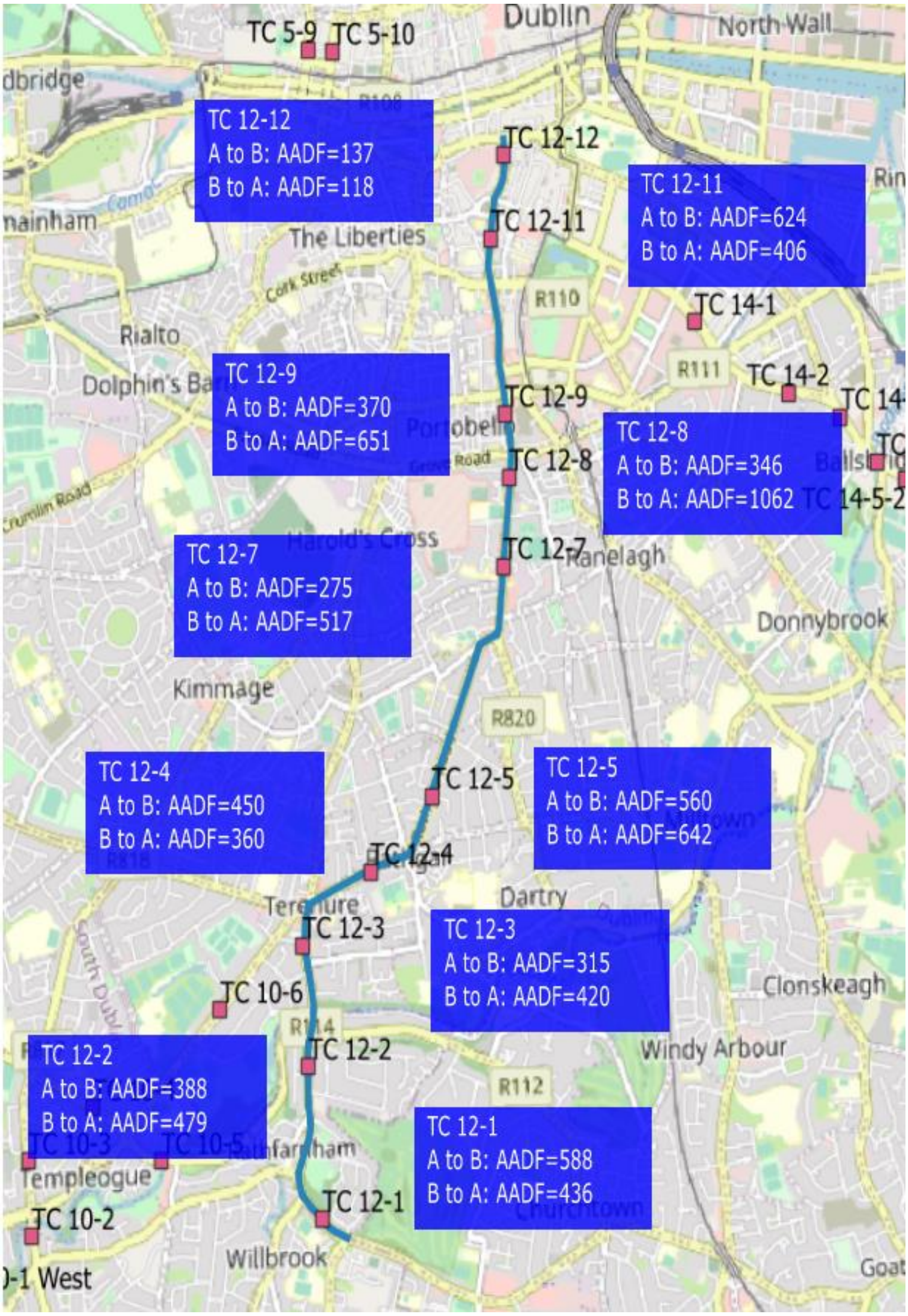


Figure 7.2: 2019-2020 AADF – Section 2, 3 & 4

Assuming that all routes were built for 20-, 30- or 40-year Design Life, the following Design Traffics were estimated.

Table 7.1: Estimated Design Traffic ranges for the Proposed Scheme.

Scheme Section (s)	Design Lives		
	20 Years	30 Years	40 Years
1	1 to 11.5 msa	1 to 17 msa	1.5 to 23 msa
2, 3 & 4	1 to 8 msa	1.5 to 12 msa	2 to 15.5 msa
Note: “msa” stands for million standard axles.			

The Design Traffic ranges displayed in Table 7.1 above are to be read in conjunction with the Construction data given in Section 7.1.2.10. Analysis of those two sets of data will allow the pavement designer to assess the probability for an existing pavement to be fit for current purpose or not.

BusConnects bus traffic data (Revised Network Frequencies) have been used to design bus only permitted lanes. This traffic data does not account for other commercial vehicle use such as non-BusConnects buses.

Traffic Designs have initially been calculated for four various Design Lives: 20 years, 30 years and 40 years and “long life” as per Table 7.2 below.

The Growth Factor for BusConnects buses has been assumed to be 1.

Table 7.2: BusConnects Buses only Traffic Design in Million Standard Axles (msa)

BusConnects Buses only Traffic Design (msa)				
Scheme Section(s)	20-year Design Life	30-year Design Life	40-year Design Life	“Long life”
1	3	4.5	6	80+
2, 3 & 4	4.5 to 10.5	6.5 to 16	8.5 to 21	80+

Specific loading areas will be identified and characterised along the Proposed Scheme:

- Bus stops (on- and off-line),
- Terminus;
- Loading / Unloading areas for delivery vehicles;
- Off-line parking areas; and
- Traffic calming features.

7.1.2.2 Geometry Considerations

The Proposed Scheme proposed to be constructed on existing pavement assets, within constrained urbanised environments. It is therefore essential for the preliminary pavement design to consider the current road geometry and how it is proposed to be amended for the purpose of the Proposed Scheme.

The following road geometry changes expected to have an impact on the preliminary pavement design are:

- Widening,
- Narrowing,
- Horizontal realignment leading to relocation of pavement longitudinal joints (in relation to location of wheel tracks),
- Increase in vertical alignment,
- Decrease in vertical alignment, and
- Any combination of the above.

These are expanded upon in the subsequent sections.

7.1.2.3 Widening

- Widening is about extending transversely a rehabilitated existing pavement meaning that the pavement structure shall be consistent from kerb to kerb and that drainage paths are being maintained. It is therefore essential to understand what the existing pavement construction and condition are, as well as how it will be rehabilitated before finalising the design of any widening.
- It is proposed that any widening will be the full width of any proposed new lane, be it a cycle track, a bus lane or a general traffic lane. The widened lane shall be tied to the existing pavement as per transverse and longitudinal joint details CC-SCD-00704 (Dec. 2010) and CC-SCD-00703 (Sep. 2010).

7.1.2.4 Narrowing

- Narrowing the pavement is probably the least disturbing geometry change. Attention should however be given to the location of longitudinal joints in the existing pavement, if the alignment of the traffic lanes is being shifted one way or the other. No longitudinal joint shall be located in the wheel tracks.
- It is proposed for any narrowing to be limited, in terms of excavation, to the area between the existing and the proposed kerblines.

7.1.2.5 Horizontal Realignment

Usually combined with a widening or a narrowing, a change in lanes alignment will result in the relocation of wheel tracks on the transverse profile of the pavement. If it leads to the relocation of the wheel tracks above an existing pavement joint, pavement works are required to prevent accelerated deterioration. Those pavement works could consist of the relocation of longitudinal joints in the binder and surface courses by renewal of both layers. A geotextile would also be installed on top of the longitudinal joint in the base course to delay reflective cracking.

7.1.2.6 Increase in Vertical Alignment

Depending on the level of rehabilitation works required, it is proposed that the existing surface course be removed, as a minimum, before overlaying to the new finish level. The use of regulating layers and materials is likely to be required.

7.1.2.7 Decrease in Vertical Alignment

Depending on the level of rehabilitation works required, it is proposed that the existing pavement be cold milled down to the proposed finished level of the binder course, as a minimum. If the bond between the layer being cold milled into and the underlying layer is weak (i.e. the planer removed the material down to the interface at some locations), cold milling should be extended to this interface.

7.1.2.8 Relocation of Traffic Islands

Existing traffic islands to be relocated or removed should be fully excavated, while proposed traffic islands may use the existing pavement as foundation where appropriate.

7.1.2.9 Existing Pavement Considerations

7.1.2.10 Construction

As mentioned in the section above on geometry constraints, as the Proposed Scheme runs on existing pavement assets, it is essential to gather intelligence on those existing assets in terms of construction build-up and condition.

For the sections of the Proposed Scheme running on non-national routes, limited construction data is available on the Road Maintenance Office (RMO) portal:

- “Surface Inventory Material Type”: this provides information on which type of surface material or treatment is present;
- “Completed Pavement Interventions”: this provides the location of where the carriageway has been resealed, surface restored, structurally overlaid, fully reconstructed or if a different treatment has been applied as per Table 7.3 below;
- “Planned Pavement Interventions”: this provides the location of where the carriageway is planned to undergo routine maintenance, surface restoration or full depth reconstruction as per Table 7.3.

Table 7.3: Lengths of Completed and Planned Interventions on Local Authorities' networks

Scheme Section (s)	Pavement Interventions (in linear metres)	
	Completed	**Planned**
1	Surface Restoration: 2600 in 2011, and 270 in 2017.	Surface Restoration: 3740 in 2020.
2 - 3 - 4	Surface restoration: 5360 in 2012, 2260 in 2013, 60 in 2018, and 2313 in 2019.	Routine maintenance : 1770 in 2020. Surface restoration : 1634 in 2020.

The surface material recorded against Section 1 is mostly SMA with a section in HRA and some High Friction Surfacing (HFS) at Spawell Roundabout. The surface material recorded against Sections 2, 3 & 4 is SMA only.

It is therefore proposed for a Ground Penetration Radar (GPR) survey to be procured. Cores will be taken at regular intervals to allow for the calibration of the GPR. Such survey would generate the following datasets essential for the pavement design:

- Depth of unbound granular materials;
- Depth of rigid materials (concrete);
- Depth of bituminous materials;
- Detailed pavement build-up (number of layers and their associated thicknesses – bound materials only);
- Condition of the bound materials;
- Condition of the interlayer bonds;
- Condition of the foundation layer(s) through the use of Dynamic Cone Penetrometer (DCP) testing;
- Likely presence of tar contaminated materials.

Local Pavement Asset Managers have also been contacted to establish if tar contaminated materials have been encountered on previous projects in the area. No known issues were identified, notwithstanding future testing will need to be undertaken to confirm the presence of tar contaminated materials.

7.1.2.11 Condition – National Roads

No sections of the Proposed Scheme run on national roads.

7.1.2.12 Condition – Non-National Roads

For the sections of the Proposed Scheme r.2unning on the network of non-national routes, access to the Road Maintenance Office (RMO) datasets was granted. Datasets include:

- **SCRIM data:** Characteristic Skid Coefficient (CSC);
- **RCI Scanner (DCC area only):** Road Condition Index giving an idea of general pavement condition from the analysis of surface observed defects (covering only the portion of Templeogue Road from Fortfield Road to Terenure Cross in Section 1, the portion of Rathfarnham Road from the River Dodder to Terenure Cross in Section 2 and the entirety of Sections 3 and 4 of the Proposed Scheme);
- **PSCI:** Pavement Surface Condition Index giving an idea of general pavement condition from the analysis of surface observed defects; and
- **RSP data:** International Roughness Index (IRI), Mean Profile Depth (MPD), Rutting Depth and Longitudinal Profile Variance (LPV);

From a general pavement condition perspective, Figure 7.3 and Figure 7.4 give the following PSCI breakdown for Section 1, and Sections 2, 3 and 4 of the Proposed Scheme – while the currency of the data is provided in Table 7.4.

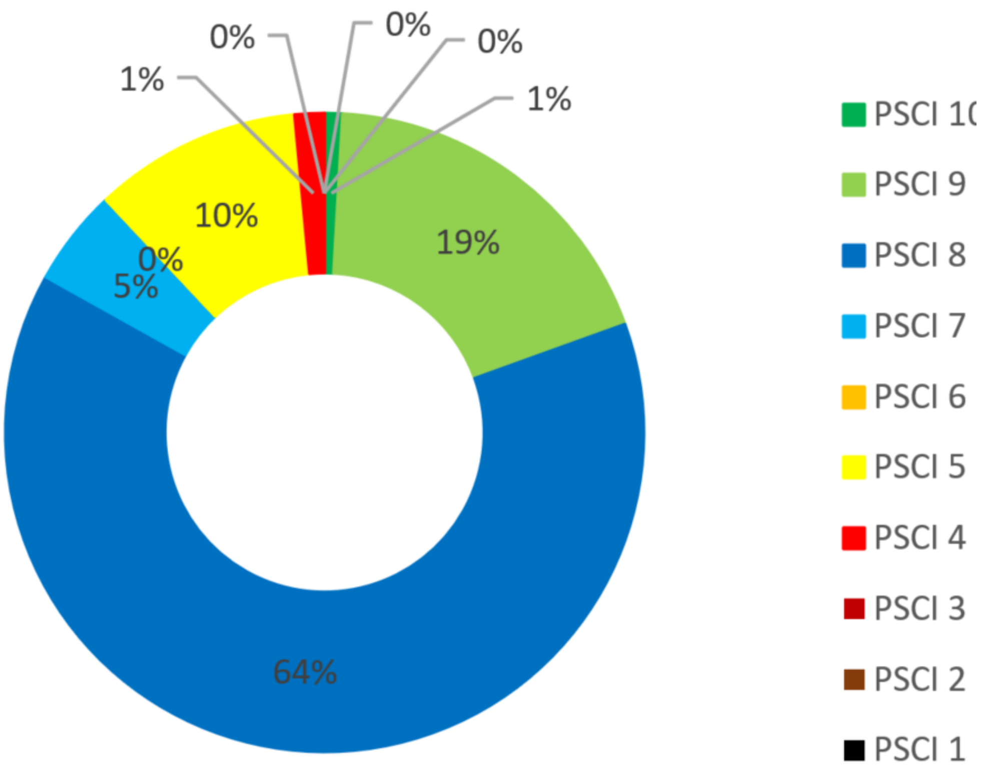


Figure 7.3: Pavement Surface Condition Index (PSCI) – Section 1

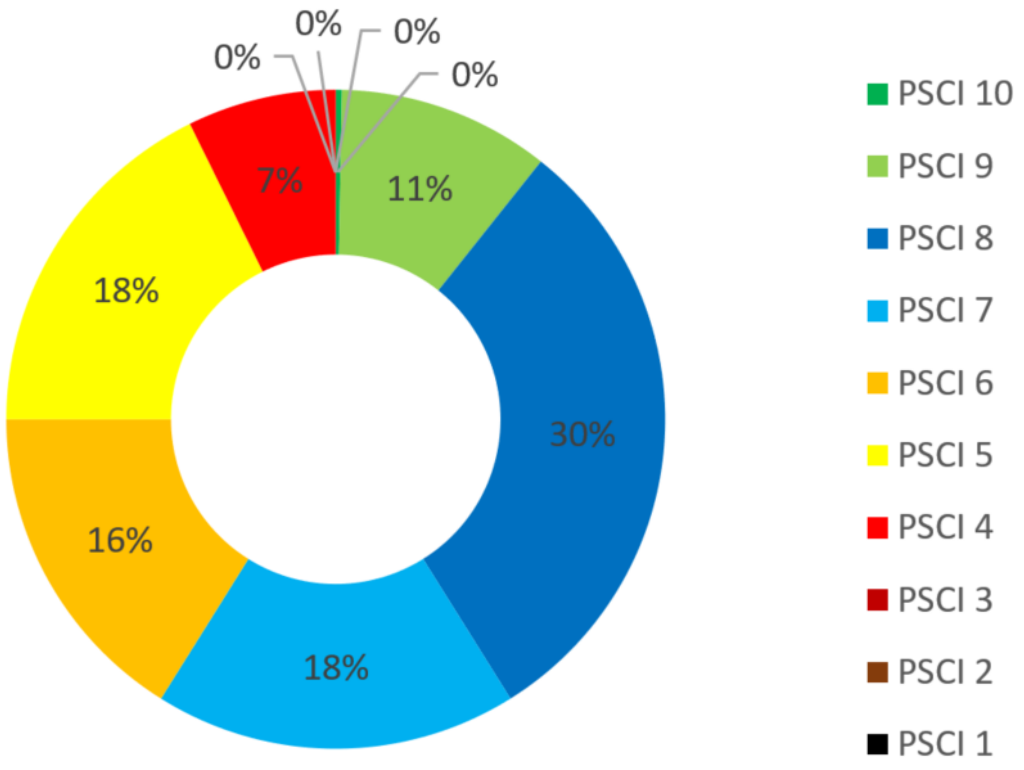


Figure 7.4: Pavement Surface Condition Index (PSCI) – Sections 2, 3 and 4

Table 7.4: Currency of PSCI data

Section	**1**	**2 - 3 - 4**
Currency of PSCI data (Years of survey)	2016 2018 2019	2015 2016 2018 2019

For fully flexible pavements, sections of roads with a score of 9 or 10 require routine maintenance, a score of 7 or 8 could trigger resealing and/or restoration of skid resistance works, scores of 5 or 6 surface restoration works, scores of 3 or 4 structural overlay or inlay works, while scores of 1 or 2 require a full depth reconstruction of the road. (As per "Urban Flexible Roads Manual - Pavement Surface Condition Index" - Volume 2 of 3 -DTTAS – RMO)

For rigid pavements, no maintenance is required for scores of 9 or 10, routine maintenance is required at scores of 7 or 8, surface restoration is needed for scores of 5 or 6, scores of 3 or 4 would trigger a structural rehabilitation, while full depth reconstruction of the road is required at scores of 1 or 2. (As per "Urban Concrete Roads Manual - Pavement Surface Condition Index" - Volume 3 of 3 -DTTAS – RMO)

The PSCI provides a good indication of the general pavement condition by assessing defects recorded at the surface of the pavement structure.

Adopting this method, the pavement surface condition is directly assessed while the pavement structural condition is indirectly estimated. A PSCI score on its own is not sufficient to design and specify a pavement rehabilitation.

The proportion of each group of Proposed Scheme sections per PSCI score shown in Figure 7.3 and Figure 7.4 is a reflection of the overall pavement condition at a point in time. The percentages are expected to remain constant over the following years, as long as the Local Authorities' pavement maintenance strategies remain unchanged. The geographical distribution of sections with various PSCI will evolve between now and the commencement of Proposed Scheme works. This is because pavement assets deteriorate over time and the Local Authorities currently and are expected to continue maintenance of those roads in the interim period.

The other pavement condition indicators are as noted in Figure 7.5 and Figure 7.6:

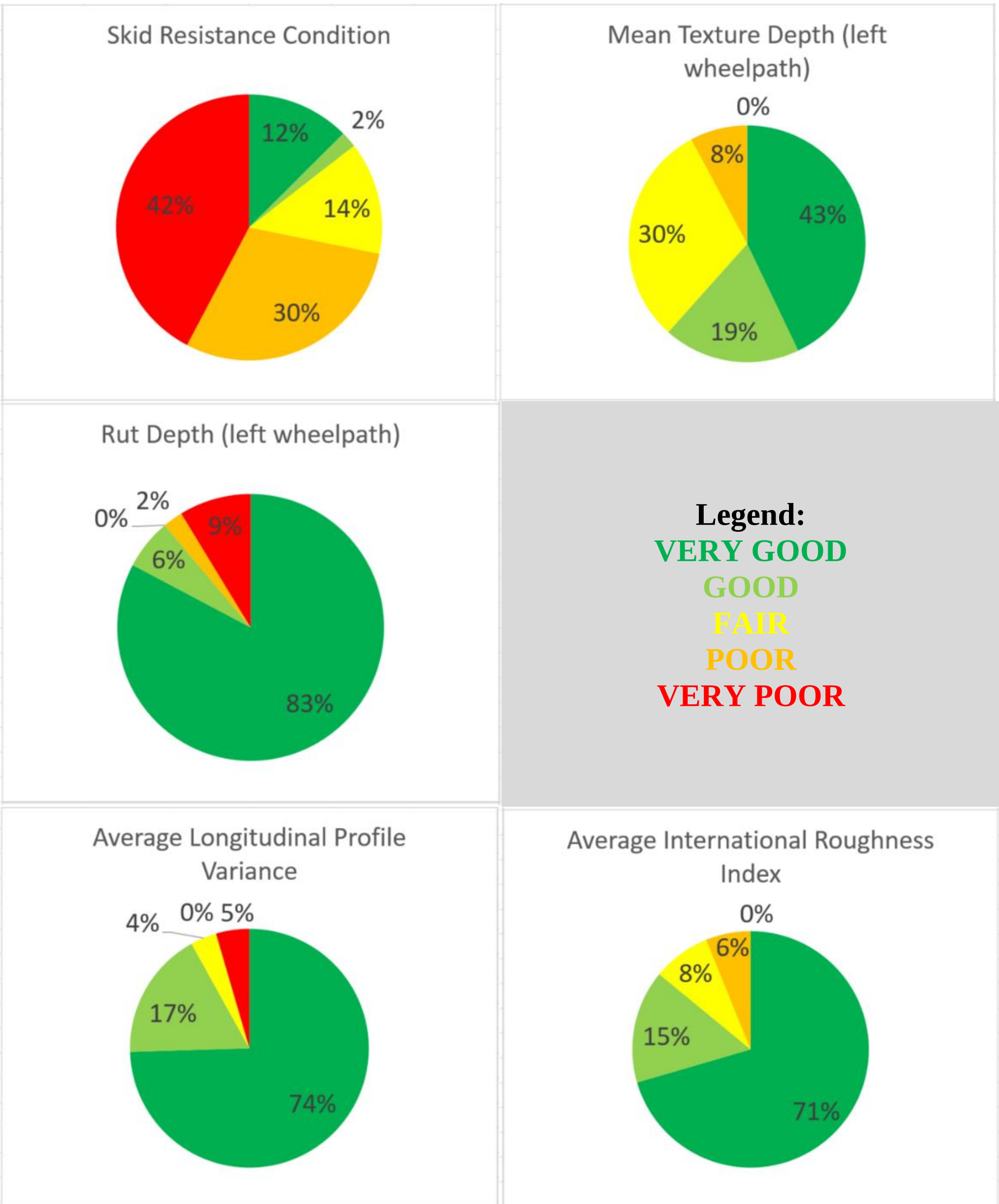


Figure 7.5: Pavement Condition through five Pavement Indicators – Section 1

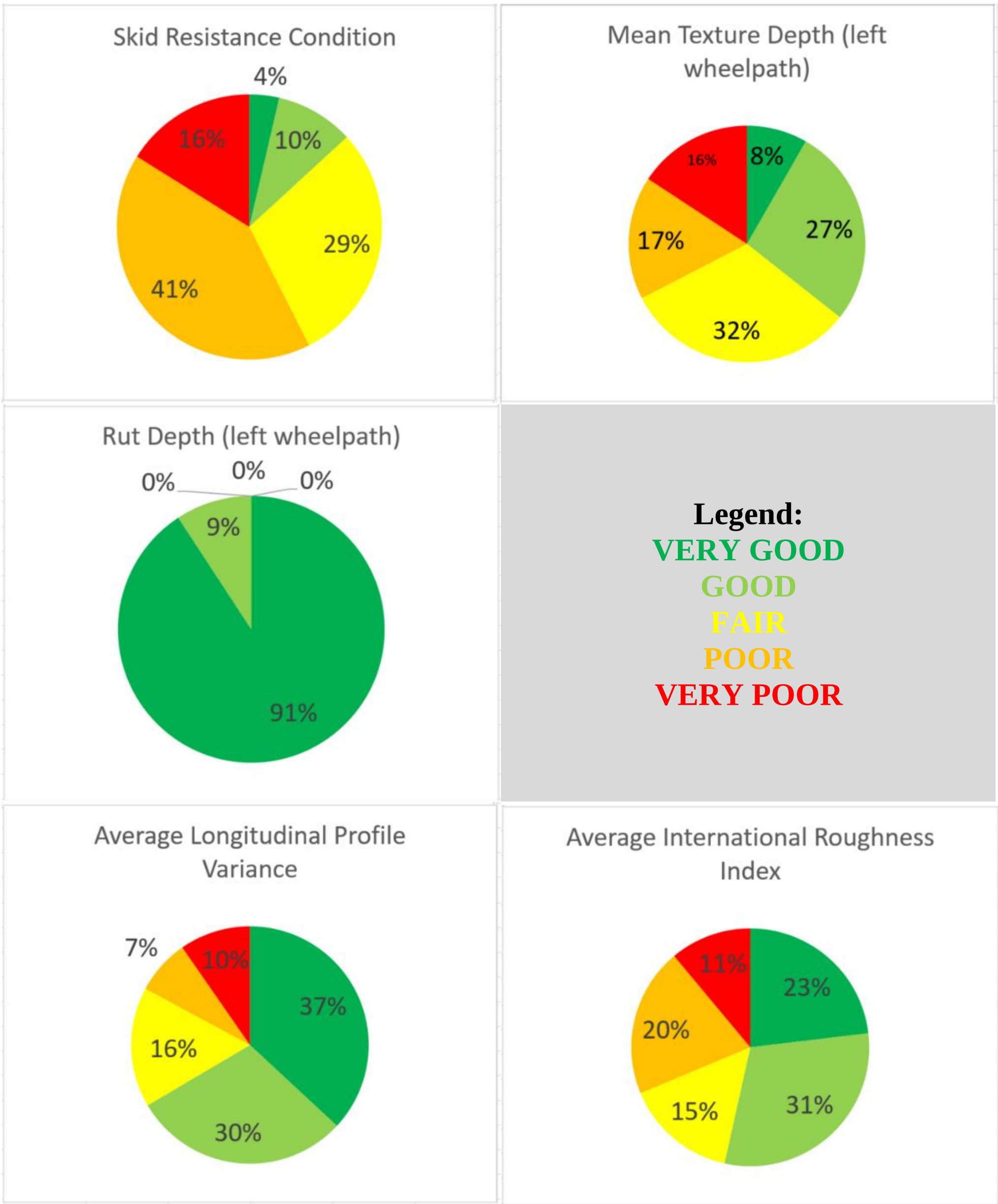


Figure 7.6: Pavement Condition through five Pavement Indicators – Sections 2, 3 and 4

Pavement Surface Condition:

Both the SCRIM and texture depth indicators reflect the skid resistance of the pavement when a road user brakes or turns. On one hand, the SCRIM indicator measures the skid resistance provided by the micro-texture of the pavement surface and is a proxy for skid resistance at low speed and/or in dry weather conditions. On the other hand, the texture depth indicator is a direct measurement of the macro-texture of the pavement surface and is a proxy for skid resistance at higher speeds and/or in wet weather conditions.

8% of Section 1 and 33% of Sections 2, 3 and 4 are in a poor to very poor condition in terms of texture depth while 72% of Section 1 and 57% of Sections 2, 3 and 4 are in a poor to very poor Scrim condition.

Poor skid resistance of the pavement surface may become an issue for vulnerable road users such as pedestrians and cyclists, especially where motorised and non-motorised traffic interact.

The rut depth indicator is showing that approximately 90% of the Proposed Scheme is in good or very good condition. From a pavement surface perspective, this is positive as little to no transversal surface irregularities are expected and little to no water is expected to be ponding in the ruts.

Pavement Structural Condition:

The structural condition of the pavement can only be reported on and assessed from indirect condition indicators taken from the surface of the pavement: rut depth, International Roughness Index (IRI) and Longitudinal Profile Variance (LPV).

The rut depth being at about 90% in the good or very good categories, no structural issue can be identified through this indicator. It does not however mean that there are no structural issues.

Both the IRI and LPV indicators are a reflection of the ride quality of the road, in other words, how smooth the road surface is. Those indicators are in most part influenced by surface defects such as potholes, large cracks or networks of cracks, open joints, poor or failing reinstatements, depression that can originate from the surface or the pavement structure below. Features like gullies, manhole covers or other ironworks and if not filtered out of the survey data, ramps, can also influence the IRI and LPV indicators.

Where high levels of profile variance are observed over long sections of road, it is likely for structural failure to have occurred.

Less than 5% of Section 1, and less than 17% of Sections 2, 3 and 4 are displaying poor or very poor LPV condition while less than 6% of Section 1 and less than 31% of Sections 2, 3 and 4 are displaying poor or very poor IRI condition.

Every effort should be made to address, at the source, all structural failures along the Proposed Scheme in order to guarantee a high ride quality to all bus passengers, cyclists and other road users.

Subgrade Condition:

No information about the subgrade is currently available for the Proposed Scheme in terms of bearing capacity (California Bearing Ratio – CBR).

The foundation for all widening and full depth reconstruction pavement structures is designed on the assumption that the Design CBR is the minimum permitted in Clause 3.23 of DN-PAV-03021 (Dec. 2010): 2.5%.

Additional condition data is expected to become available at Specimen Design stage in the form of core logs taken as part of the GPR survey (Ground Penetrating Survey).

The delivery of the Proposed Scheme works is expected to start in 2024. The condition of all pavements is therefore expected to change - deteriorating in most cases and improving where Local Authorities' interventions occur.

7.1.2.13 Required Complementary Surveys

Additional condition data requirements, including surveys, will be required both at Specimen Design and Detailed Design stages in order to develop and implement Pavement Rehabilitation strategies. Those requirements shall be in line with AM-PAV-06050 (Mar. 2020).

7.1.3 Pavement Design

7.1.3.1 Pavement Materials

At Specimen Design stage, the selection of appropriate pavement materials will be made with the following considerations:

- Which pavement structure is the most appropriate and compatible with the existing pavement? (i.e. Fully flexible vs. Flexible Composite vs. Rigid pavement);
- Which materials are most appropriate from a noise, permeability, colour, texture, etc. perspective?; and
- Which materials, from a lifecycle perspective, provide the best value in terms of environmental impact, durability, maintainability, repairability, recyclability, cost, etc.?

Specific materials will be selected for specific loading areas.

The ambition in terms of pavement materials is to reuse or recycle all of the excavated materials. The specification of materials and processes with a reduced environmental impact will be prioritised.

The choice of surfacing materials will be discussed with the Landscape Architect.

7.1.3.2 Pavement Strategy

7.1.3.3 New Pavement and Bus Interchange Strategy

No new pavement or bus interchange are proposed on the Proposed Scheme.

7.1.3.4 Pavement Rehabilitation Strategy

At Specimen Design stage, different pavement strategies will be developed for:

- areas to be widened or fully reconstructed; and
- areas to be rehabilitated (do minimum, intermediary strategies, fully reconstruct).

Additional testing requirements in line with AM-PAV-06050 will be specified for the successful Contractor to complete the Detailed Pavement Design.

The risk of tar contaminated material presence in the existing pavement is expected to be mitigated at Specimen Design stage with the delivery of the GPR survey through the testing of the calibrating cores for tar.

In order to estimate the waste quantities and the carbon emissions from the Proposed Scheme pavement works, the following assumptions were taken:

- Where full depth reconstruction is anticipated (e.g. widening, traffic island relocation…), a conservative fully flexible pavement design is assumed: 350mm of bituminous mixtures on top of 150mm of subbase material and 400mm of capping material.
- Where the existing pavement is anticipated to only require rehabilitation, the assumed materials and associated depths depend on the PSCI for the pavement design:
    - Fully Flexible Carriageway

      PSCI ⩾ 7: no works

      PSCI = 5 or 6: 50mm Bituminous Inlay

      PSCI = 3 or 4: 200mm Bituminous Inlay

      PSCI = 1 or 2: 350mm Bituminous Inlay + 150mm Subbase Inlay + 400mm Capping Inlay
    - Rigid Carriageway

      PSCI ⩾ 5: no works

      PSCI ⩽ 4: 200mm Concrete Inlay.

7.1.3.5 Opportunities for Innovation

Innovative materials and processes delivering enhanced environmental, social and financial benefits are being promoted in the ongoing pavement design process.

7.1.3.6 Reuse and Recycling Considerations

Opportunities for reuse and recycling of secondary materials have and will continue to be identified and quantified throughout the Specimen Design process.

Current opportunities include but are not limited to:

- Incorporation of minimum 20% of Reclaimed Asphalt into new base and binder layers of the pavement;
- Excavated capping layer material to be reused as new capping material if compliant with current standards; and

- Excavated subbase layer material to be reused as new subbase material if compliant with current standards.

7.2 Kerbs, Footways and Paved Areas

7.2.1 Overview of Kerbs, Footways and Paved Areas

This section covers the preliminary design for the following Kerbs, Footways and Paved Areas (KFPA) assets:

- Kerbs,
- Footways (concrete, bituminous and paved), and
- Cycle tracks.

For the Proposed Scheme, two pavement networks are being considered, the primary and the secondary networks. The primary network refers to the bus corridor under consideration while the secondary network refers to the roads impacted by the re-routing of existing traffic from the Proposed Scheme to the nearby road network.

The preliminary design of KFPA assets is based on the following standards:

- DN-PAV-03021 (Dec. 2010) – Pavement and Foundation Design;
- DN-PAV-03026 (Jan. 2005) – Footway Design;
- Construction Standards for Road and Street Works in Dublin City Council (May 2016) – Revision 1;
- PE-SMG-02002 (Dec. 2010) – Traffic Assessment;
- CC-SPW-00600 (Mar. 2013) – Specification for Road Works Series 600 – Earthworks;
- CC-SPW-00700 (Jan. 2016) – Specification for Road Works Series 700 – Road Pavements – General;
- CC-SPW-00800 (Mar. 2013) – Specification for Road Works Series 800 – Road Pavements – Unbound and Cement Bound Mixtures;
- CC-SPW-00900 (Sep. 2017) – Specification for Road Works Series 900 – Road Pavements – Bituminous Materials;
- CC-SPW-01000 (Mar. 2013) – Specification for Road Works Series 1000 – Road Pavements – Concrete Materials;
- CC-SPW-01100 (Feb. 2012) – Specification for Road Works Series 1100 – Kerbs, Footways and Paved Areas; and
- BS 7533 series of standards (1999 – 2021) – Pavement Constructed with Clay, Natural Stone or Concrete Pavers.

This section identifies the proposed pavement strategy, setting out the design development considerations for the pavement works in current and future design stages.

It also outlines the key elements for consideration for future testing requirements, and consideration for the valorisation of reusable and recyclable materials in new pavement materials in the detailed design stage.

This section should be read in conjunction with the Pavement Treatment Plans in Appendix B.

The different KFPA assets are designed taking consideration of:

- Traffic loads;
- Changes in road geometry;
- Existing KFPA construction build-up;
- Existing KFPA condition;
- Landscape Architect's requirements; and
- The impact of other assets such as drainage, utilities and structures.

7.2.2 Design Constraints

7.2.2.1 Traffic Loading Considerations

Depending on the expected traffic characteristics (volumes, pedestrian vs. vehicular) and the proposed surface material, the Design Traffic may be categorised slightly differently as illustrated on Figure 7.7.

For bituminous footways and segregated cycle tracks, the Design Traffic will be calculated in accordance with PE-SMG-02002 (Dec. 2010) and categorised as per DN-PAV-03026 (Jan. 2005) if the Design Traffic is below 50,000 standard axles over their lifetime (40 years).

For concrete footways, the Design Traffic will be calculated in accordance with PE-SMG-02002 (Dec. 2010) for a 40-year design life.

And for paved footways, the Design Traffic will be calculated in accordance with PE-SMG-02002 (Dec. 2010) and categorised as per BS 7533 series.

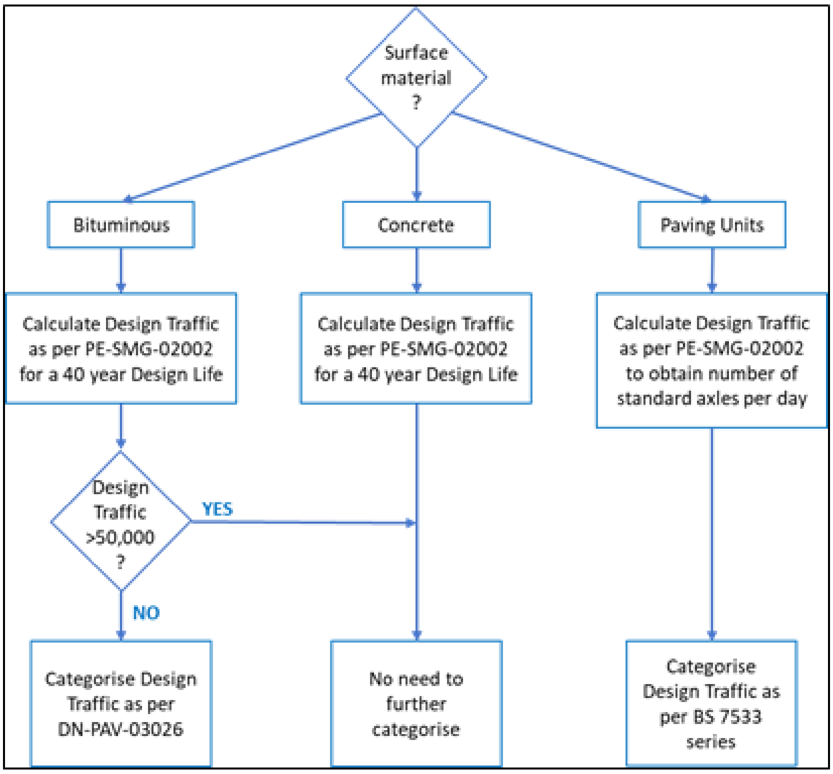


Figure 7.7: Traffic Design and Categorisation for KFPA

7.2.2.2 Geometry Considerations

At Specimen Design stage, the 3D geometry model will be further analysed to identify footways and segregated cycle tracks requiring full depth reconstruction and those that can be maintained in place.

The current assumption for footpaths and segregated cycle tracks is for full depth reconstruction.

7.2.2.3 Existing Pavement Condition Considerations

For the footways and segregated cycle tracks that will be fully reconstructed, the design of the foundation will be based on an assumed Design CBR of 2.5%, the minimum permitted value as per Clause 3.23 of DN-PAV-03021 (Dec. 2010).

If some existing footways and segregated cycle tracks are proposed to be maintained, their condition will be assessed visually before proposing any potential rehabilitation works.

7.2.3 Pavement Design

7.2.3.1 Pavement Materials

At Specimen Design stage, the selection of appropriate pavement materials will be undertaken with the following considerations:

- Which pavement structure is the most appropriate and compatible with the existing pavement? (i.e. Fully flexible vs. Rigid pavement structure);
- Which materials are most appropriate from a noise, permeability, colour, texture, etc. perspective?; and
- Which materials, from a lifecycle perspective, provide the best value in terms of environmental impact, durability, maintainability, repairability, recyclability, cost, etc.?

Specific materials will be selected for specific loading areas.

The ambition in terms of pavement materials is to reuse or recycle all of the excavated materials. The specification of materials and processes with a reduced environmental impact will be prioritised.

The Landscape Architect's design will be considered at Specimen Design stage to identify the choice of surfacing materials which will in turn dictate the choice of materials used for the underlying footway and segregated cycle track structure.

For bituminous footways and segregated cycle tracks, the bituminous layer(s) could make use of as much recycled material as practicable. Low Energy Bound Mixtures (LEBM) will be considered as an alternative to the conventional Asphalt Concrete (AC), Hot Rolled Asphalt (HRA) and Stone Mastic Asphalt (SMA) mixtures.

As per Section 5.5 of the BCPDGB, in order to provide a visual differentiation between the carriageway and cycle tracks and cycle lanes, it is proposed that all cycle tracks and cycle lanes are to have red coloured epoxy type surfacing, or red coloured HRA, or similar in accordance with the National Cycle Manual.

7.2.3.2 Pavement Structure

The appropriate pavement structures for footways and segregated cycle tracks will be defined at Specimen Design stage.

7.2.3.3 Opportunities for Innovation

Innovative materials and processes delivering enhanced environmental, social and financial benefits are being promoted in the ongoing pavement design process.

7.2.3.4 Reuse and Recycling Considerations

Opportunities for reuse and recycling of secondary materials have and will continue to be identified and quantified throughout the Specimen Design process.

Current opportunities include but are not limited to:

- Excavated capping layer material could be reused as new capping material if compliant with current standards;
- Excavated subbase layer material could be reused as new subbase material if compliant with current standards;
- Up to 50% of capping and subbase materials could be substituted with Reclaimed Asphalt;
- Concrete base to paved areas could make use of Recycled Aggregate, Recycled Concrete Aggregate and more sustainable hydraulic binders (e.g. CEM III/A);
- Concrete footways could also make use of more sustainable hydraulic binders;
- Jointing and bedding mortars used in the construction of paved areas could contain recycled materials; and
- Aggregate for base/binder layer for off-road cycle tracks could be 100% Reclaimed Asphalt (Low Energy Bound Material – LEBM).

8 Structures

8.1 Overview of Structures Strategy

Where the route interfaces with an existing bridge structure a visual inspection has been carried out to identify the current condition and any repair/maintenance works required.

Where alterations to the existing carriageway lines, kerbs lines and verge widths are proposed a Stage 1 Structural Assessment has been carried out to ensure the structural capacity can withstand the revised arrangement.

8.2 Summary of Existing Structures

Table 8.1 below lists the existing major structures along the Proposed Scheme and identifies those that are being impacted.

Table 8.1: Summary of Existing Structures

Structure Type	Name/ Description	Jurisdiction	Impact
Bridge	Old Bridge Road bridge over river Dodder	SDCC	No impact
Bridge	Butterfield Avenue Bridge	SDCC	No impact
Bridge	Pearse Bridge	DCC	No impact
Bridge	La Touche Bridge	DCC	No impact

8.3 Summary of Principal Structures

Principal Structures are defined as those that require technical approval following the processes outlined in TII Publication DN-STR-03001.

8.3.1 Bridges and Bridge Sized Culverts

There is no impact on existing bridge structures, nor is there a requirement for new bridges as part of the Proposed Scheme.

8.3.2 Retaining Walls

Retaining walls with a retained height greater than 1.5 m are classified as principal structures.

There is no impact on existing retaining walls greater than 1.5m, nor is there a requirement for new retaining walls greater than 1.5m as part of the Proposed Scheme.

8.3.3 Sign Gantries

There are no existing gantries being impacted along the Proposed Scheme.

8.4 Summary of Miscellaneous Structures

8.4.1 Existing Archways

Templeogue Archway Conservation

The existing free-standing stone arch adjacent to the R137 Templeogue Road will be cleared of the overgrown vegetation which currently covers it and conserved in its existing location. The existing fencing around the arch will be removed and the arch opened up to the public realm. It is proposed to install high quality stone paving, decorative lighting and soft landscaping elements around the arch as well as to construct a new footpath running behind the arch.

A Conservation Engineer undertook an assessment of the existing arch. The assessment report is provided in Appendix P. The proposed repair works include the following:

1. Arch to be consolidated by replacing fallen stone on top of arch, bedded in an appropriate lime-based mortar. The placement of this stone should be informed by careful interrogation of the historic photographs.
2. Joints between stones to be repointed, ensuring a self-draining surface. Any large joints between arch voussoirs to be packed tightly with slithers of stone/natural slate. However, joints should be recessed to respect the original intention of a weathered appearance.
3. All algae and lichen growth on stones to be cleaned off using an appropriate biocide.
4. Banked earth/debris against base of flanking walls to be carefully removed to give a level surface between the walls at a similar level to the outside face of the walls.
5. Banked earth/debris against base of flanking walls to be carefully removed to give a level surface between the walls at a similar level to the outside face of the walls.
6. Banked earth/debris against base of flanking walls to be carefully removed to give a level surface between the walls at a similar level to the outside face of the walls.
7. Flanking wall tops to be flaunched to shed water. Exact wall top detail to be agreed once exemplars of options presented during works on site.

8.4.2 Retaining Walls (<1.5m)

Figure 8.1 indicates the location of the only retaining wall less than 1.5m high proposed. Further details about this wall are summarised in Table 8.2.

Figure 8.1: Retaining Wall RW01 <1.5m - location

Table 8.2: Summary of Minor Retaining Walls <1.5m

Ref.	Location	Length (m)	Max Retained Height (m)
RW01	Adjacent to access/service road at 252 – 256 Templeogue Road	Approx. 15m	1.2

8.4.3 Other

Digipoles/Digipanels

As part of the Proposed Scheme, road widening is required at locations where digital advertising panels are currently placed. The following panels or poles will be appropriately relocated to the adjacent footpath as part of the works:

- Junction of Rathmines Road Upper and Rathmines Road Lower – Outbound Footpath;
- Junction of Camden Street Lower and Charlotte Way – Within central Traffic Island; and
- Camden Street Lower – South of Montague Street - Outbound Footpath.

Refer to General Arrangement drawing series in Appendix B for details of their proposed locations.

9 Drainage, Hydrology and Flood Risk

9.1 Overview of Drainage Strategy

The drainage preliminary design was developed following consultation with the relevant Local Authorities and Irish Water where applicable. The strategy and design parameters to be adopted throughout Dublin BusConnects is summarised in the Design Basis Statement Document No. BCIDX_ARP-PMG_PS-0000_XX_00-SD-ZZ-0002 included in Appendix K. The Design Basis Document was developed whilst taking into account the Greater Dublin Regional Code of Practice (GDRCoP), Greater Dublin Strategic Drainage Study (GDSDS), planning requirements of Local Authorities within the Dublin region, Transport Infrastructure Ireland (TII) requirements and international best practices such as CIRIA The SuDS Manual (C753).

The principal objectives of drainage design are as follows:

- To drain surface water from existing and proposed pavement areas throughout the BusConnects Development and maintain the existing standard of service.
- To maintain existing runoff rates from existing and newly paved surfaces using Sustainable Urban Drainage Systems (SuDS).
- To minimise the impact of the runoff from the roadways on the surrounding environment using SuDS and/or silt traps.

No drainage features like gullies or manholes will be located at, or any ponding will be allowed to occur at, pedestrian cross-walk locations or at bus-stop locations. Where any such drainage features currently exist at such locations, they will be relocated. Drainage of newly paved areas includes SuDS measures to treat and attenuate any additional run-off. These measures will ensure that there is:

- No increase in existing runoff rates from newly paved areas; and
- Appropriate treatment to ensure runoff quality.

A hierarchical approach to the selection of SuDS measures has been adopted with ‘Source’ type measures e.g. tree pits implemented in preference to catchment type measures, e.g. attenuation tanks. Further details of the SuDS hierarchy are provided in Drainage Design Basis.

9.2 Existing Watercourses and culverts

All watercourses in the vicinity of the proposed area have been identified as shown in the Table 9.1 below.

A Stage 1 Flood Risk Assessment (FRA) has been completed on the Preliminary Design and is summarised in Section 9.7, with the full Stage 1 FRA Report included in Appendix N.

The location of existing watercourses and culverts has been identified using OS Mapping (www.osi.ie). The Proposed Scheme crosses the following watercourses:

Table 9.1: Location of Existing Watercourses

Watercourse	Chainage	Crossing Detail
River Dodder	A1320	Bridge
	J1425	Bridge
Grand Canal	A4700	Bridge

9.3 Existing Drainage Description

Based on the information received from Irish Water, the Proposed Scheme is serviced by surface water and combined drainage networks. The surface water drainage system is managed by the local authority, whilst combined sewers systems are managed by Irish Water. Flows are typically collected in standard gully grates and routed via a gravity network to outfall points. There are no SuDS/attenuation measures on the existing drainage networks to treat or attenuate runoff from the existing highway.

The existing drainage network along the Proposed Scheme can be split into the 18 catchment areas based on topography and the existing pipe network supplied by Irish Water. The approximate catchment areas, existing sewer networks, outfalls and watercourses are shown on the Surface Water drawings, BCIDC-ARP-DNG_RD-1012_XX_00-DR-CD-1001 to BCIDC-ARP-DNG_RD-1012_XX_00-DR-CD1003 which can be found in Appendix B. The catchments are summarised in Table 9.2.

Table 9.2: Summary of Existing Catchments

Existing Catchment Reference	Chainage	Approx. Drainage Catchment Area (km^2)	Existing Network Type	Existing Outfalls
Catchment 1	A 0000 – A0162	0.127	Surface Water (Storm)	Network outfalls to the River Dargle
Catchment 2	A0162 - A0612	0.026	Surface Water (Storm)	Network outfalls to the Owendoher River
Catchment 3	A0612 – A1318	0.045	Surface Water (Storm)	Network outfalls to the River Dodder
Catchment 4	N/A (Dodder View Road)	0.012	Surface Water (Storm)	Network outfalls to the River Dodder
Catchment 5	A1318 –A1534 & A1534 – A1859 (Left) & J3704 - J3771	0.070	Surface Water (Storm) & Combined	Network outfalls to London Bridge Pumphouse which discharges to Ringsend

Existing Catchment Reference	**Chainage**	**Approx. Drainage Catchment Area (km^2)**	**Existing Network Type**	**Existing Outfalls**
				Treatment Works with overflows to the River Dodder
Catchment 6	B0500 – B1121	0.235	Combined	Network outfalls to London Bridge Pumphouse which discharges to Ringsend Treatment Works
Catchment 7	A1534 - A1859 (Right), A1859 – A2057, A2057–A2134 (left) & B0000 – B0180	0.123	Combined	Network outfalls to London Bridge Pumphouse which discharges to Ringsend Treatment Works with overflows to the River Dodder
Catchment 8	N/A Rathmines Road Upper & Highfield Road Junction	0.432	Combined	Network outfalls to London Bridge Pumphouse which discharges to Ringsend Treatment Works
Catchment 9	A2057–A2134 (right), A2103 - A4695 & B0180 – B0500 & H0000 – H1548	2.101	Combined	Network outfalls to London Bridge Pumphouse which discharges to Ringsend Treatment Works with partial overflows to Grand Canal Dock and River Liffey
Catchment 10	A4695 – A5704	0.232	Combined	Network outfalls to London Bridge Pumphouse which discharges to Ringsend Treatment Works with overflows to River Liffey
Catchment 11	A5704 – A6047	0.028	Combined	Network outfalls to Ringsend Main Lift Pumphouse which discharges to Ringsend Treatment Works
Catchment 12	A6047 – A6285	0.013	Combined	Network outfalls to Ringsend Main Lift Pumphouse which discharges to Ringsend Treatment Works with

Existing Catchment Reference	Chainage	Approx. Drainage Catchment Area (km^2)	Existing Network Type	Existing Outfalls
				overflows to River Liffey
Catchment 13	J0100 – J0712	0.351	Surface Water (Storm)	Network outfalls to the River Dodder
Catchment 14	J0712 – J1429	0.557	Surface Water (Storm)	Network outfalls to the River Dodder
Catchment 15	J1429 – J1550	0.169	Surface Water (Storm)	Network outfalls to the River Dodder
Catchment 16	J2116 – J2200	0.034	Surface Water (Storm)	Network outfalls to the River Dodder
Catchment 17	J1550 – J2115 J2200 – J2717	0.091	Foul & Combined	Network outfalls to the London Bridge Pumphouse which discharges to Ringsend Treatment Works and overflows to the River Dodder.
Catchment 18	J2717 – J3704	0.340	Surface Water (Storm)	Network outfalls to the London Bridge Pumphouse which discharges to Ringsend Treatment Works and overflows to the River Dodder.

9.4 Overview of Impacts of Proposed Works on Drainage / Runoff

Whilst in some areas the Proposed Scheme increases the impermeable areas, additional permeable areas are also provided by the softening of urban realm along the Proposed Scheme. The drainage design aims to sustain flow levels within the existing pipe network after a rainfall event by controlling discharge rates within each catchment. Flows are being controlled by the implementation of SuDS techniques. One of the principal objectives of the road drainage system is to minimise the impact of the runoff from the roadways on the surrounding environment via the positioning of: filter drains, swales, bio retention areas, tree pits, silt traps and attenuation features if necessary. The welfare of pedestrians and cyclists is a high priority in the consideration of the drainage system design.

The proposed surface water drainage works are shown on drawings BCIDC-ARP-DNG_RD-1012_XX_00-DR-CD-9001 in Appendix B.

Table 9.3 provides information of the proposed additional catchments (new paved areas) against the proposed permeable areas (current paved areas to become grassed).

Each catchment area has been broken down into sub-catchments in order to define the change in impermeable surface area as a result of the Proposed Scheme. Where there is a net increase in impermeable surface area, a form of attenuation will be required prior to discharge. Where there is no net change or net decrease, then no form of attenuation will be required prior to discharge. A summary list of the sub-catchments, the associated chainage, and impermeable surface area differential is given in the table below. The following table contains a column entitled "Net change" which takes account of the change of use from impermeable to permeable areas and vice versa.

Table 9.3: Summary of Increased Permeable and Impermeable areas

Existing Catchment Reference	Chainage	Road Corridor Area (m^2)	Change of use to Impermeable area (m^2)	Change of use to permeable area (m^2)	Net Change (m^2)	Percentage change (%)
Catchment 1	A0000 – A0162	6,141	1,005	920	882	15
Catchment 2	A0162 - A0612	10,557	1,431	188	1,243	11.8
Catchment 3	A0612 – A1318	16,514	152	133	19	0.1
Catchment 4	Dodder View Road	2,155	86	0	86	4.0
Catchment 5	A1318 – A1534 & A1534 – A1859 (Left) & J3704 - J3771	11,112	204	28	176	1.6
Catchment 6	B0500 – B1121	9,771	0	0	0	0.0
Catchment 7	A1534 - A1859 (Right), A1859 – A2057, A2057– A2134 (left) & B0000 – B0180	9,038	521	0	521	5.8

Existing Catchment Reference	Chainage	Road Corridor Area (m^2)	Change of use to Impermeable area (m^2)	Change of use to permeable area (m^2)	Net Change (m^2)	Percentage change (%)
Catchment 8	N/A Rathmines Road Upper & Highfield Road Junction	3,004	0	0	0	0.0
Catchment 9	A2057–A2134 (right), A2103 - A4695 & B0180 – B0500 & H0000 – H1548	86,430	480	267	213	0.2
Catchment 10	A4695 – A5704	26,848	0	152	-152	-0.6
Catchment 11	A5704 – A6047	6,225	0	0	0	0.0
Catchment 12	A6047 – A6285	6,858	0	0	0	0.0
Catchment 13	J0100 – J0712	35,214	4,105	2,506	1,599	4.5
Catchment 14	J0712 – J1429	26,229	1,646	192	1,454	5.5
Catchment 15	J1429 – J1550	4,988	459	146	313	6.3
Catchment 16	J2115 – J2200	4,882	190	278	-88	-1.8
Catchment 17	J1550 – J2115 J2200 – J2717	18,409	1,155	-74	1,229	6.7
Catchment 18	J2717 – J3704	25,859	206	97	109	0.4

9.5 Preliminary Drainage Design

The existing drainage network will be maintained and used as the main discharge point for the new drainage system. The purpose of the design will be to replicate the existing situation. Where new multiple gully connections discharging to a combined sewer are required, a new surface water pipe will be provided where practicable and connected to the combined sewer as per Irish Water requirements.

The following drainage systems were considered for the CBC Scheme where new paved areas are proposed:

- **Sealed drainage (SD)** comprises of side entry gullies and sealed pipes. They will collect, convey and discharge runoff. The side entry gullies will be located within the kerb line mostly between the cycle track and bus lane and/or the footpath and the cycle track depending on the carriageway profile. Their location will also depend on the bicycle and/or bus wheel-track in consideration of the cycling safety and ride-quality.
- **Grass Surface Water Channels, Swales and Bio Retention Areas/Rain Gardens (SW/RG)** are provided as road edge/footpath edge drainage collection systems. They will provide treatment and might provide attenuation if required. A filter drain can be laid below the bio-retention areas to keep them dry during low return period rainfall events.
- **Filter Drains (FD)** are provided as road edge channels. These comprise a perforated pipe with granular surround and are designed to convey, attenuate and treat runoff prior to discharge.
- **Tree Pits (TP)** are provided in close proximity to the road, where practicable. These receive flows from the sealed pipe network and from footpaths. They are designed to convey, attenuate and treat runoff prior to discharge.
- **Attenuation Tanks/Oversize Pipes (AT/OSP)** Where there is insufficient attenuation volume provided by proposed SuDS drainage measures, hard attenuation measures such as concrete attenuation tanks and/or oversize pipes can be provided to meet the required attenuation volume.

9.5.1 Summary of Surface Water Drainage

The proposed drainage types for the Proposed Scheme are listed on Table 9.4.

Table 9.4: Summary of Proposed Surface Water Infrastructure

Catchment	Chainage	Drainage Type
Asset Owner/Location: South Dublin County Council		
Catchment 1	A0058 to A0024 (left)	bio retention area/rain garden
Catchment 1	A0024 to A0076 (left)	bio retention area/rain garden & filter drain
Catchment 1	A0076 to A0162 (both)	bio retention area/rain garden, filter drain, tree pits & sealed pipe network

Catchment	Chainage	Drainage Type
Catchment 2	A0162 to A0333 (right)	Tree pits, filter drain & sealed pipe network
Catchment 2	A0162 to A0347 (left)	Sealed pipe network
Catchment 2	A0333 to A0430 (right)	Tree pits, filter drain & sealed pipe network
Catchment 2	A0350 (left)	bio retention areas/rain gardens
Catchment 2	Butterfield Avenue	bio retention areas/rain gardens
Catchment 2	A0430 to A0470 (right)	Tree pits & filter drain
Catchment 3	A0470 to A0518 (left)	bio retention area/rain garden
Catchment 3	A0580 to A0770 (right)	bio retention area/rain garden, tree pits, & filter drain
Catchment 3	A0837 to A1135 (left)	Tree pits, filter drain & sealed pipe network
Catchment 4	Dodder View Road (both sides)	Filter drain
Asset Owner/Location: Dublin County Council		
Catchment 5	A1339 to A1499 (left)	Tree pits, filter drain, oversized pipe & sealed pipe network
Catchment 5	A1735 (left)	Bio retention area/rain garden
Catchment 5	A1795 (left)	Bio retention area/rain garden
Catchment 7	A1550 to A1745 (right)	Tree pits, filter drain, & sealed pipe network
Asset Owner/Location: Irish Water		
Catchment 7	A1859 to A1978 (left)	Sealed pipe network
Catchment 7	A1978 to A2065 (left)	Tree pits & filter drain
Catchment 7	A2065 to A2134 (left)	Sealed pipe network
Catchment 9	A2055 to A2147 (right)	Tree pits & filter drain
Catchment 9	A2147 to A2267 (both sides)	Tree pits, filter drain & sealed pipe network
Catchment 9	A2267 to A2495 (both sides)	Sealed pipe network

Catchment	**Chainage**	**Drainage Type**
Catchment 9	A2495 to A2717 (left)	Sealed pipe network
Catchment 9	A2530 (right)	Bio retention areas/rain gardens
Catchment 9	A2717 to A2968 (left)	Sealed pipe network
Catchment 9	A2968 to A3349 (left)	Sealed pipe network
Catchment 9	A3349 to A3658 (left)	Bio retention area/rain garden & sealed pipe network
Catchment 9	A3658 to A3761 (left)	Sealed pipe network
Catchment 9	A3761 to A3795 (left) & A3795 to A3863 (both sides)	Bio retention area/rain garden & sealed pipe network
Catchment 9	A3863 to A4134 (both sides)	Bio retention area/rain garden & sealed pipe network
Catchment 9	A4134 to A4338 (both sides)	Sealed pipe network
Catchment 9	A4364 to A4698 (both sides)	Sealed pipe network
Catchment 10	A4775 to A5015 (both sides)	Sealed pipe network
Catchment 10	A5015 to A5170 (both sides)	Sealed pipe network
Catchment 10	A5170 to A5410 (both sides)	Sealed pipe network
Catchment 10	A5410 to A5545 (both sides)	Sealed pipe network
Catchment 10	A5615 (right)	Bio retention area/rain garden
Catchment 12	A5980 to A6190 (both sides)	Sealed pipe network
Catchment 12	A6190 to A6285 (both sides)	Sealed pipe network
Asset Owner/Location: South Dublin County Council		
Catchment 13	J0100 to J0203 (cycle track)	Swale, filter drain
Catchment 13	J0203 to J0289 (left)	Swale, filter drain
Catchment 13	J0289 to J0384 (left)	Swale, filter drain

Catchment	Chainage	Drainage Type
Catchment 13	J0384 to J0549 (left)	Swale, filter drain
Catchment 13	J0549 to J0673 (left)	Bio retention areas/rain gardens
Catchment 13	J0583 to J0673 (right)	Bio retention areas
Catchment 13	J0673 to J0783 (left)	Bio retention areas/rain gardens, attenuation pond & underground storage (OGCR)
Catchment 14	J0783 to J0860 (right)	Filter drain
Catchment 14	J0860 to J1005 (right)	Filter drain
Catchment 14	J1054 to J1143 (left)	Bio retention areas/rain gardens & filter drain
Catchment 14	J1143 to J1259 (left)	Bio retention areas/rain gardens & filter drain
Catchment 14	J1259 to J1441 (left)	Bio retention areas/rain gardens & filter drain
Catchment 15	J1441 to J1477 (left)	Bio retention area/rain garden
Catchment 15	J1477 to J1555 (left)	Sealed pipe network
Catchment 15	J1454 to 1555 (right)	bio retention areas/rain gardens & filter drain
Catchment 17 (New system discharges to Templeogue Village Scheme)	J1555 to J1743 (both sides)	Tree pits & sealed pipe network. Templeogue Village Scheme drainage system has been constructed with enough capacity to collect BusConnects Scheme from J1555 to J2149, including additional catchments.
Catchment 17 (Templeogue Village Scheme)	J1743 to J2044 (left)	Tree pits. Templeogue Village Scheme drainage system has been constructed with enough capacity to collect BusConnects Scheme from J1555 to J2149, including additional catchments.
Catchment 17 (New system discharges to Templeogue Village Scheme)	J2044 to J2116 (both sides) & Ch. 2116 to 2149 (left)	Bio retention area/rain garden & sealed pipe network. Templeogue Village Scheme drainage system has been constructed with enough capacity to collect BusConnects Scheme from J1555 to J2149, including additional catchments.
Catchment 16	J2116 to J2149 (right)	Bio retention areas/rain gardens.
Catchment 16	J2149 to J2200 (left)	Bio retention area/rain garden & sealed pipe network
Catchment 16	J2149 to J2200 (right)	Bio retention area/rain garden

Catchment	Chainage	Drainage Type
Catchment 17	J2200 to J2310 (both sides)	Sealed pipe network
Catchment 17	J2310 to J2479 (right)	Bio retention areas/rain gardens, filter drain & sealed pipe network
Asset Owner/Location: Dublin County Council		
Catchment 17	J2479 to J2724 (both sides)	Sealed pipe network
Catchment 18	J2800 to J3237 (cycle track & footpath)	Permeable paving

9.5.2 Summary of Attenuation Features, SuDS and Outfalls

Where practicable, and in new areas of urban realm gained as part of the design, a sustainable drainage system is considered in the form of rain gardens, bioretention areas, filter drains, swales, tree pits, permeable paving etc. SuDS are also being considered in existing areas, where practicable.

The proposed attenuation measures for the Proposed Scheme are summarised for each proposed catchment in Table 9.5. Chainage locations not shown in the table below do not require attenuation or SuDS.

Table 9.5: Summary of Proposed Attenuation Features, SuDS & Outfalls

Chainage	Existing Catchment Reference (Refer to Table 9.2)	Approx. Impermeable Surface Area		Permitted Discharge (l/s)	Possible SuDS solution/ attenuation measure	Catchment Outfall
		Existing (m^2)	Change (m^2)			
Asset Owner/Location: South Dublin County Council						
A0058 to A0024 (left)	Catchment 1	807	447	11.3	RG 5.5 m^3	Existing SW, Ch. A0007
A0024 to A0076 (left)	Catchment 1	1,593	181	22.2	RG 4.5 m^3 & DN225 FD, 54m long	Existing SW, Ch. A0021
A0076 to A0162 (left)	Catchment 1	1,533	291	21.4	TP, DN225 FD, 20m long & DN225 SD,127m long	Existing SW, Ch. A0076
A0162 to A0333 (right)	Catchment 2	879	904	12.4	TP, DN225 FD, 163m long & DN225 SD, 156m long	Existing SW, Ch. A0346

Chainage	Existing Catchment Reference (Refer to Table 9.2)	Approx. Impermeable Surface Area		Permitted Discharge (l/s)	Possible SuDS solution/ attenuation measure	Catchment Outfall
		Existing (m^2)	Change (m^2)			
A0333 to A0430 (right)	Catchment 2	588	464	8.3	TP, DN225 FD, 77m long & DN300 OSP, 41m long	Existing SW, Ch. A0402
A0430 to A0470 (right)	Catchment 2	355	37	4.9	TP, DN225 FD, 18m long	Existing SW, Ch. A0430
A0580 to A0770 (right)	Catchment 3	500	30	7	DN225 FD, 40m long	Existing SW, Ch. A0707
A0837 to A1135 (left)	Catchment 3	322	61	4.5	TP, DN225 FD, 36m long & DN225 SD, 8m long	Existing SW, Ch. A1135
Dodder view road (both sides)	Catchment 4	203	97	2	DN225 FD, 60m long	Existing SW at Dodder Park Road
Asset Owner/Location: Dublin County Council						
A1339 to A1499 (left)	Catchment 5	1,216	204	16.9	TP, DN225 FD, 111m long; DN225 SD, 62m long & DN300 OSP, 66m long	Existing SW, Ch. A1355
A1550 to A1745 (right)	Catchment 7	1,533	317	21.4	TP, DN225 FD, 37m long; DN225 SD, 194m long	Existing SW, Ch. A1745
Asset Owner/Location: Irish Water						
A1978 to A2065 (left)	Catchment 7	495	205	6.9	TP, DN225 FD, 57m long	Existing combined, Ch. A2002

Chainage	Existing Catchment Reference (Refer to Table 9.2)	Approx. Impermeable Surface Area		Permitted Discharge (l/s)	Possible SuDS solution/ attenuation measure	Catchment Outfall
		Existing (m^2)	Change (m^2)			
A2055 to A2147 (right)	Catchment 9	288	379	4.1	TP, DN300 FD, 75m long	Existing combined, Ch. A2055
A2147 to A2267 (both sides)	Catchment 9	1,726	194	24	TP, DN225 FD, 59m long; DN225 SD, 121m long	Existing combined, Ch. A2273
J0100 to J0203 (cycle track)	Catchment 13	483	174	6.77	DN225, 104m long FD & SW	Existing SW, Ch. J0203
J0203 to J0289 (left)	Catchment 13	292	192	4.1	DN225,75m long FD & SW	Existing SW, Ch. J0289
J0289 to J0384 (left)	Catchment 13	348	214	4.88	DN225,88m long FD & SW	Existing SW, Ch. J0384
J0384 to J0549 (left)	Catchment 13	576	494	8.1	DN225, 131m long FD & SW	Existing SW, Ch. J0471
J0673 to J0783 (left)	Catchment 13	1,735	798	24.3	36 m^3 AP + OGCR	Existing SW, Ch. J0673
J0783 to J0860 (right)	Catchment 14	678	404	9.5	DN225, 67m long FD	Existing SW, Ch. J0860
J0860 to J1005 (right)	Catchment 14	1,759	386	24.5	DN375 FD, 45m long & DN450 FD, 91m long	Existing SW, Ch. J1011
J1054 to J1143 (left)	Catchment 14	1,141	309	16	DN300, 77m long FD & RG	Existing SW, Ch. J1147
J1143 to J1259 (left)	Catchment 14	1,887	174	26.22	DN375, 90m long FD & RG	Existing SW, Ch. J1247
J1259 to J1441 (left)	Catchment 14	1,888	170	25.8	DN300, 47m long FD & RG	Existing SW, Ch. J1357
J1441 to J1477 (left)	Catchment 15	157	93	2	1 m^3 RG	Existing SW, Ch. J1454
J1454 to J1555 (right)	Catchment 15	1,660	265	23.1	DN225, 78m long RG & SD	Existing SW, Ch. J1470

Chainage	Existing Catchment Reference (Refer to Table 9.2)	Approx. Impermeable Surface Area		Permitted Discharge (l/s)	Possible SuDS solution/ attenuation measure	Catchment Outfall
		Existing (m^2)	Change (m^2)			
J2149 to J2200 (left)	Catchment 17	178	42	2	1 m^3 RG	Existing SW, Ch. J2197
J2200 to J2310 (both sides)	Catchment 17	2,069	153	28.8	DN300, 97m long OSP	Existing SW, Ch. J2309
J2310 to J2479 (right)	Catchment 17	2,491	239	34.7	RG, DN225 FD, 23m long; DN225 SD, 95m long & DN300 OSP, 63m long	Existing SW, Ch. J2309
Asset Owner/Location: Dublin County Council						
J2479 to J2560 (both sides)	Catchment 17	1908	282	26.62	DN300, 69m long OSP	Existing SW, Ch. 2724

9.6 Drainage at New Bridge Structures

There are no new bridge structures in the Proposed Scheme that require special surface water management techniques.

9.7 Flood Risk

The Stage 1 FRA for the Proposed Scheme, included in Appendix N, consisted of a study carried out for the areas relating to Section 1 of the Proposed Scheme, and another carried out for the areas relating to Sections 2, 3 and 4 of the Proposed Scheme. The Stage 1 FRA is a high-level study of the Proposed Scheme to identify flood risks to the Proposed Scheme and any potential flooding issues arising due to the Proposed Scheme. The report informs the planning process and identifies whether a further Stage 2 FRA is required.

The FRA includes the following:

- Confirmation of the sources of flooding which may affect the site;
- A qualitative assessment of the risk of flooding to the site and to adjacent sites as a result of construction of the proposed development;
- Review of the availability and adequacy of existing information;
- Identification of possible measures which could mitigate the flood risk to acceptable levels; and
- Areas for further investigation (Stage 2 FRA) if required.

Sections and below summarise the Stage 1 FRA.

9.7.1 Flood Risk Assessment – Section 1

There are no recorded historic flood events along this section of the Proposed Scheme. Two historic flood events within a 1km proximity of the Proposed Scheme have been identified, however these are deemed low risk due to their location.

There is no risk of fluvial flooding to Section 1 of the Proposed Scheme in the present, or future climate change scenario.

The site is located approximately 10 km from the nearest coastal boundary and elevated high above sea level. There is therefore no risk of coastal flooding to the site in the present, or future climate change scenario.

The groundwater vulnerability varies along Section 1, with the majority lying in areas at low vulnerability, but with some areas at moderate or high. As most of the scheme is on existing roads with no known flooding specifically due to groundwater it is not expected that this risk will increase with the construction of the scheme.

The risk of pluvial flooding along the majority of the proposed route is medium, however this risk exists in the current scenario and will be reduced as a result of the Proposed Scheme.

All new surface water sewers provided as part of the scheme shall be designed so that no flooding will occur for a return period up to 30 years. This is an improvement when compared to some of the existing historical drainage infrastructure to be replaced and will reduce the risk of pluvial flooding.

Also, as part of the scheme new drainage infrastructure will be provided which will include new Sustainable (Urban) Drainage Systems (SuDS) such as rain gardens, swales and tree pits. These SuDS features will provide some surface water storage and thus reduce the risk of pluvial flooding.

The site is classified as Flood Zone C as per OPW Guidelines. A Justification Test for the development is therefore not required. It is considered that the proposal is in keeping with the principles of the Flood Risk Guidelines which seeks to locate development in appropriate locations.

9.7.2 Flood Risk Assessment – Sections 2, 3 and 4

There are a number of historic flood events at different locations along or near to the Proposed Scheme. The Proposed Scheme is largely on existing roads and will result in minimal additional paved areas and will therefore not increase the risk of these events reoccurring compared to the current scenario.

Two areas in Rathfarnham are at medium (1 in 100 year) and high risk (1 in 100 year) of flooding from the River Dodder and Whitechurch stream respectively.

The areas consist of Area 1 on Rathfarnham Road near Dodder View Road which falls within flood zone B and Area 2 at Nutgrove Avenue falls within flood zone

A. The rest of the route does not fall within any flood extents therefore is within Flood Zone C.

There is no risk of coastal flooding to the site in the present, or future climate change scenario.

The groundwater vulnerability varies along the Proposed Scheme, with many areas shown to be in areas of moderate groundwater vulnerability. Groundwater level measurements have shown the levels to be 2.13-3.15m bgl. As most of the scheme is on existing roads with no known flooding specifically due to groundwater it is not expected that this risk will increase with the construction of the scheme.

The risk of pluvial flooding along the majority of the proposed route is high, however this risk will be reduced as a result of the Proposed Scheme.

As areas of the scheme are identified as being within Flood Zone A and Flood Zone B a Justification Test is required. The Plan Making Justification Test and Development Management Justification have been assessed and passed, therefore further investigation of the flood risk in the form of a Stage 2 FRA is not required.

10 Services & Utilities

10.1 Overview of Utilities Strategy and Survey

Utility records from all providers were sought at an early stage of the scheme design. These records combined with topographic survey records, walk over inspections and desktop analysis of the Proposed Scheme identified areas of risk to existing assets. Where risk was initially identified to high value assets, such as high voltage ESB cables, high pressure gas mains and trunk water mains, a review was undertaken to ascertain if the risk could be mitigated by amending the highways design whilst still meeting the objectives of the scheme. Some areas of conflict were designed out at this stage; however, some remained and had to be accommodated within the overall scheme design.

10.1.1 Record Information

Available utility records were submitted by service providers and reviewed by Arup along the Proposed Scheme. These records have assisted with informing the Proposed Scheme design. Utility records were received from the following service providers:

- Irish Water;
- Gas Networks Ireland (GNI);
- Electricity Supply Board (ESB);
- Eir;
- Virgin Media;
- BT;
- Vodafone;
- Enet;
- South Dublin County Council;
- Dublin City Council.

10.1.2 Phase 1 Utility Survey

A targeted utility survey to *British Standards Institution (BSI) PAS 128A, Specification for underground utility detection, verification and location* including GPR (Ground Penetrating Radar), was commissioned by the NTA to investigate areas where there is risk identified to existing high value assets such as high voltage ESB cables, high pressure gas mains and trunk water mains due to the proposed carriageway alignment. Some areas where there is a high concentration of utility diversions proposed were also surveyed to ensure that adequate spacing is available for relocation of assets.

The results of the utility survey have been reviewed to confirm the adequacy of design provisions made with respect to diversion proposals. Additionally, a more extensive utility survey will be required to inform the detailed design phase of the scheme.

10.1.3 Consultation with Utility Service Providers

Consultation with all relevant utility service providers was undertaken to evaluate the impact of the Proposed Scheme on existing utilities.

Based on records and topographical survey that was available, utility diversions and areas where protection measures might be required were identified. These potential impacts were documented on a set of consultation drawings and a technical note was prepared for each utility company.

Consultation meetings were held with ESB, Gas Networks Ireland, Irish Water and Eir. The Proposed Scheme proposals were outlined to them and scenarios where utility infrastructure might be impacted by the Proposed Scheme were discussed.

10.2 Overview of Service Diversions

The construction of the proposed Scheme will result in conflicts with several existing utility assets.

These conflicts have been identified, and preliminary consultation has been undertaken with the relevant service providers so that the conflict can be resolved by relocating or diverting the services where necessary and protecting in-situ where appropriate.

The principal statutory and other service providers affected are:

- ESB;
- Irish Water (Water & Public Sewer);
- GNI; and
- Telecommunications Services – Eir, Virgin Media & Cignal Infrastructure Ltd.

In addition to the above, it will be necessary to relocate and upgrade some of the existing public lighting and traffic signalling network and equipment along the extents of the scheme.

The services conflicts and the associated diversions will need to be considered in the design and construction of the scheme. The design considerations have been taken into account as much as practicable at this stage, but it is likely that design modifications will be required at detailed design stage when further site investigations have taken place.

During construction, it may be necessary to maintain supply to certain services.

This will require the retention and protection of existing utility supplies until such time as permanent diversions can be commissioned, or alternatively the construction of temporary diversions to facilitate completion of the works including the permanent diversion of services. The sequence of works must also take into account the need to liaise with service providers and, subject to their availability to carry out diversions, staging of the works may be necessary.

The service diversions required for this development are discussed in the following paragraphs and are summarised in Table 10.1, Table 10.2, Table 10.3, Table 10.4 and Table 10.5. The locations of all known services from records provided from the service providers are shown on Combined Utility Drawings in Appendix B.

10.3 Summary of Recommended Diversions

10.3.1 Gas Networks Ireland

No impacts to high pressure gas mains have been identified. There are two locations where GNI medium pressure gas mains require a diversion. There are seven locations where GNI low pressure gas mains require a diversion. Table 10.1 below outlines proposed diversions of Gas Networks Ireland services, and are illustrated on drawing series BCIDC-ARP-UTL_UG-1012__XX_00-DR-CU-0001 to 0037 included in Appendix B.

Table 10.1: GNI Proposed Diversion Schedule

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12-UG-MP-001	GNI	A0035 – A0090 LHS	Medium pressure gas main along southern side of Grange Road.	Proposed diversion length of 63m for GNI utility.
R12-UG-MP-002	GNI	A0100 LHS	District Regulator Installation along southern side of Grange Road.	Proposed relocation for GNI utility. New location to be agreed with GNI.
R12-UG-LP-003	GNI	A1370 – A1415 LHS	Low pressure gas main along western side of Rathfarnham Road	Proposed diversion length of 46m for GNI utility.
R12-UG-LP-004	GNI	A1570 – A1665 RHS	Low pressure gas main along eastern side of Grange Road.	Proposed diversion length of 93m for GNI utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12-UG-LP-005	GNI	A1990 – A2075 LHS	Low pressure gas main along northern side of Terenure Road East.	Proposed diversion length of 83m for GNI utility.
R12-UG-LP-006	GNI	A2160 – A2270 LHS	Low pressure gas main along northern side of Terenure Road East.	Proposed diversion length of 111m for GNI utility.
R12-UG-LP-007	GNI	A3770 – A3800 RHS	Low pressure gas main along eastern side of Rathgar Road.	Proposed diversion length of 23m for GNI utility.
R10-UG-LP-001	GNI	J1525 – J1610 LHS	Low pressure gas main present along northern side of R137 Templeogue Road.	Proposed diversion length of 76m for GNI utility.
R10-UG-LP-002	GNI	J1725 - J1820 LHS	Low pressure gas main present along northern side of R137 Templeogue Road.	Proposed diversion length of 90m for GNI utility.

10.3.2 ESB

There is one section of high voltage underground cabling, seven sections of medium voltage underground cabling and there are seven sections of low voltage underground cabling requiring diversions along the route. There are also twelve sections of overhead low voltage cabling requiring diversions along the route. Table 10.2 below outlines several potential diversions for ESB services, and are illustrated on drawing series BCIDC-ARP-UTL_UE-1012_XX_00-DR-CU-0001 to 0037 included in Appendix B.

Table 10.2: ESB Proposed Diversion Schedule

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12-UE-LV-OHL-001	ESB	A0010 – A0080 LHS	Low voltage overhead cable poles in Grange Road carpark.	Proposed diversion length of 82m for ESB utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12-UE-MV-002	ESB	A0135 – A0185 RHS	Medium voltage ducting along Grange Road.	Proposed diversion length of 50m for ESB utility.
R12-UE-LV/MV-003	ESB	A0320 – A0445 LHS	Low and medium voltage ducting along Grange Road.	Proposed diversion length of 140m for each ESB utility.
R12-UE-LV-OHL-004	ESB	A0820 – A0940 LHS	Low voltage overhead cable poles in Rathfarnham Road.	Proposed diversion length of 120m for ESB utility.
R12-UE-LV-OHL-005	ESB	A1280 – A1310 LHS	Low voltage overhead cable poles in Rathfarnham Road.	Proposed diversion length of 26m for ESB utility.
R12-UE-LV-OHL-006	ESB	A1260 – A1255 RHS	Low voltage overhead cable poles in Rathfarnham Road.	Proposed diversion length of 53m for ESB utility.
R12-UE-LV-007	ESB	A1365 – A1435 LHS	Low voltage ducting along Rathfarnham Road.	Proposed diversion length of 78m for each ESB utility.
R12-UE-MV-008	ESB	A1365 – A1435 LHS	Medium voltage ducting along Rathfarnham Road.	Proposed diversion length of 75m for each ESB utility.
R12-UE-MV-009	ESB	A1600 – A1650 RHS	Medium voltage ducting along Rathfarnham Road.	Proposed diversion length of 50m for each ESB utility.
R12-UE-LV-010	ESB	A1600 – A1650 RHS	Low voltage ducting along Rathfarnham Road.	Proposed diversion length of 50m for each ESB utility.
R12-UE-LV-011	ESB	A1980 – A2070 LHS	Low voltage ducting along Terenure Road East.	Proposed diversion length of 88m for ESB utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12-UE-LV-012	ESB	A2020 RHS	Micro pillar present along Terenure Road East.	Proposed relocation of ESB utility.
R12-UE-LV-013	ESB	A2150 – A2265 LHS	Two low voltage ducting along Terenure Road East.	Proposed diversion length of 115m for each ESB utility.
R12-UE-MV-014	ESB	A2250 – A2270 LHS	Medium voltage ducting along Terenure Road East.	Proposed diversion length of 18m for each ESB utility.
R12-UE-LV-OHL-015	ESB	H0525 – H0545 LHS	Low voltage overhead cable poles in Harold’s Cross Road.	Proposed diversion length of 23m for ESB utility.
R12-UE-LV-016	ESB	K0105 – K0120 RHS	Low voltage ducting along Military Road roundabout	Proposed diversion length of 11m for ESB utility.
R10-UE-MV-001	ESB	J0750 – J0845 LHS	Medium voltage ducting along R137 Templeogue Road.	Proposed diversion length of 93m for ESB utility.
R10-UE-LV-OHL-002	ESB	J1000 – J1120 RHS	Low voltage overhead poles in R137 Templeogue Road.	Proposed diversion length of 117m for ESB utility.
R10-UE-LV-OHL-003	ESB	J1520	Low voltage overhead poles in R137 Templeogue Road.	Proposed diversion length of 32m for ESB utility.
R10-UE-MV-004	ESB	J1560 – J1600 LHS	Medium voltage ducting along R137 Templeogue Road.	Proposed diversion length of 50m for ESB utility.
R10-UE-HV-005	ESB	J1565 – J1825 RHS	High voltage ducting along R137	Proposed diversion length of 252m for ESB utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
			Templeogue Road.	
R10-UE-LV-OHL-006	ESB	J2125 – J2200 LHS	Low voltage overhead poles in R137 Templeogue Road.	Proposed diversion length of 117m for ESB utility.
R10-UE-LV-OHL-007	ESB	J2215	Low voltage overhead poles in R137 Templeogue Road.	Proposed diversion length of 16m for ESB utility.
R10-UE-LV-OHL-008	ESB	J2440	Low voltage overhead poles in R137 Templeogue Road.	Proposed diversion length of 20m for ESB utility.
R10-UE-LV-OHL-009	ESB	J2450 – J2510 LHS	Low voltage overhead poles in R137 Templeogue Road.	Proposed diversion length of 58m for ESB utility.
R10-UE-LV-OHL-010	ESB	J2780 – J3645 LHS	Low voltage overhead poles in R137 Templeogue Road.	Proposed diversion length of 1033m for ESB utility.

10.3.3 Irish Water - Watermains

There are sixteen sections of watermains requiring diversions along the route. Table 10.3 below outlines several proposed diversions for watermain services, and are illustrated on drawing series BCIDC-ARP-UTL_UW-1012_XX_00-DR-CU-0001 to 0037 included in Appendix B.

Table 10.3: Irish Water – Watermain Asset Diversions

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12-UW-001a	Irish Water	A0790 – A0800 LHS	Watermain located along Rathfarnham Road.	Proposed diversion length of 14m for Irish Water utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12-UW-001	Irish Water	A0855 – A0980 LHS	Watermain located along Rathfarnham Road.	Proposed diversion length of 136m for Irish Water utility.
R12-UW-002	Irish Water	A1160 – A1175 LHS	Watermain located along Rathfarnham Road.	Proposed diversion length of 14m for Irish Water utility.
R12-UW-003	Irish Water	A1575 – A1660 RHS	Watermain located along Rathfarnham Road.	Proposed diversion length of 81m for Irish Water utility.
R12-UW-004	Irish Water	A1800 – A1810 LHS	Watermain located along Rathfarnham Road.	Proposed diversion length of 10m for Irish Water utility.
R12-UW-005	Irish Water	A1980 – A2060 LHS	Watermain located along Terenure Road East.	Proposed diversion length of 80m for Irish Water utility.
R12-UW-006	Irish Water	A2150 – A2265 LHS	Watermain located along Terenure Road East.	Proposed diversion length of 122m for Irish Water utility.
R12-UW-007	Irish Water	A2800 – A2820 LHS	Watermain located along Rathgar Road.	Proposed diversion length of 16m for Irish Water utility.
R12-UW-008	Irish Water	A2800 – A2820 LHS	Watermain located along Rathgar Road.	Proposed diversion length of 12m for Irish Water utility.
R12-UW-009	Irish Water	A4140 – A4145 RHS	Watermain located along Rathmines Road Lower	Proposed diversion length of 9m for Irish Water utility.
R12-UW-010	Irish Water	A5800 – A5810 RHS	Watermain located along Aungier Street.	Proposed diversion length of 8m for Irish Water utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12-UW-011	Irish Water	A6210 – A6221	Watermain located along South Great George's Street.	Proposed diversion length of 11m for Irish Water utility.
R10-UW-001	Irish Water	J1570 – J1630 LHS	Watermain located along R137 Templeogue Road.	Proposed diversion length of 52m for Irish Water utility.
R10-UW-002	Irish Water	J1700 – J1830 LHS	Watermain located along R137 Templeogue Road.	Proposed diversion length of 125m for Irish Water utility.
R10-UW-003	Irish Water	J1970 – J2260 LHS	Watermain located along R137 Templeogue Road.	Proposed diversion length of 90m for Irish Water utility.
R10-UW-004	Irish Water	J3605 – J3615 RHS	Watermain located along R137 Templeogue Road.	Proposed diversion length of 12m for Irish Water utility.

10.3.4 Irish Water- Foul Sewers

Table 10.4 below outlines a number of proposed manhole adjustments for foul sewer services, and are illustrated on drawing series BCIDC-ARP-UTL_UD-1012_XX_00-DR-CU-0001 to 0037 included in Appendix B. No diversions of foul sewer pipelines are proposed.

Table 10.4: Irish Water-Foul Sewer Asset Diversion

Reference No.	Utility Provider	Chainage	Asset/ Apparatus Impacted	Description of Works
R12-UD-001	Irish Water	A0910 RHS	Combined sewer located along Rathfarnham Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-002	Irish Water	A0970 RHS	Foul sewer located along Rathfarnham Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.

Reference No.	Utility Provider	Chainage	Asset/ Apparatus Impacted	Description of Works
R12-UD-003	Irish Water	A0995 RHS	Foul sewer located along Rathfarnham Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-004	Irish Water	A1030 RHS	Foul sewer located along Rathfarnham Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-005	Irish Water	A1200 RHS	Combined sewer located along Rathfarnham Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-006	Irish Water	A1700 LHS	Combined sewer located along Rathfarnham Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-007	Irish Water	A1755 RHS	Combined sewer located along Rathfarnham Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-008	Irish Water	A5410 RHS	Combined sewer located along Wexford Street.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-009	Irish Water	A5425 RHS	Combined sewer located along Wexford Street.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-010	Irish Water	A5770 LHS	Combined sewer located along Aungier Street.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-011	Irish Water	H0420 LHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.

Reference No.	Utility Provider	Chainage	Asset/ Apparatus Impacted	Description of Works
R12-UD-012	Irish Water	H0560 LHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-013	Irish Water	H0630 LHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-014	Irish Water	H0710 LHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-015	Irish Water	H0725 LHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-016	Irish Water	H0810 LHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-017	Irish Water	H0965 LHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-018	Irish Water	H0960 RHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-019	Irish Water	H1060 RHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-020	Irish Water	H1095 LHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.

Reference No.	Utility Provider	Chainage	Asset/ Apparatus Impacted	Description of Works
R12-UD-021	Irish Wat er	H1130 LHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-022	Irish Water	H1140 RHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-023	Irish Water	H1235 RHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-024	Irish Water	H1240 LHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R12-UD-025	Irish Water	H1455 RHS	Combined sewer located along Harold`s Cross Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R10-UD-001	Irish Water	J2260 LHS	Foul sewer located along R137 Templeogue Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R10-UD-002	Irish Water	J2315 LHS	Foul sewer located along R137 Templeogue Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.
R10-UD-003	Irish Water		Combined sewer located along R137 Templeogue Road.	Proposed manhole cover adjustment to avoid clash with new kerbline.

10.3.5 Telecommunications

There are one hundred and ninety-five locations along the route where conflicts with telecommunications infrastructure occur, and diversions or relocations will be required.

In addition to chambers identified as Eir assets on the topographical survey that are identified as requiring modification, there are other chambers that might contain telecommunications assets that are impacted by the Proposed Scheme. Further investigation is required to confirm at the construction design stage.

Table 10.5 below outlines several proposed diversions for telecoms services, and are illustrated on drawing series BCIDC-ARP-UTL_UT-1012_XX_00-DR-CU-0001 to 0037 included Appendix B.

Table 10.5: Telecoms Asset Diversions

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 001	Eir	A0010 LHS	Eir chamber located along Grange Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 002	Eir	A0010 RHS	Eir chamber located along Grange Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 003	Eir	A0012 RHS	Kiosk located along Grange Road with kerb line construction assumed.	Proposed kiosk relocation for telecom utility.
R12 - UT – 004	Eir	A0040 RHS	Eir chamber located along Grange Road with kerb line construction assumed.	Proposed chamber relocation for telecom utility.
R12 - UT – 005	Eir	A0130 RHS	Eir chamber located along Grange Road with kerb line construction assumed.	Proposed chamber relocation for telecom utility.
R12 - UT - 006	Eir	A0135 – A0350 RHS	Ducting along northern side of Grange Road.	Proposed diversion length of 218m for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 007	Eir	A0350 RHS	Kiosk located on Grange Road.	Proposed kiosk relocation for telecom utility.
R12 - UT – 008	Eir	A0360 RHS	Kiosk located on Grange Road.	Proposed kiosk relocation for telecom utility.
R12 - UT – 009	Eir	A0370 – A0420 RHS	Ducting along north-western side of Rathfarnham Road.	Proposed diversion length of 65m for telecom utility.
R12 - UT – 010	Eir	A0540 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 011	Eir	A0745 LHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 012	Eir	A1220 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 013	Eir	A1300 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 014	Eir	A1345 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 015	Eir	A1390 LHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 016	Eir	A1410 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 017	Eir	A1480 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 018	Eir	A1485 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 019	Eir	A1485 LHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 020	Eir	A1510 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 021	Eir	A1530 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 022	Eir	A1530 LHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 023	Eir	A1560 LHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 024	Eir	A1575 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 025	Eir & Virgin Media	A1575 – A1660 RHS	Ducting along eastern side of Rathfarnham Road.	Proposed diversion length of 86m for each telecom utility.
R12 - UT – 026	Eir	A1630 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 027	Eir	A1670 LHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 028	Eir	A1680 LHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 029	Eir	A1750 LHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 030	Eir	A1730 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 031	Eir	A1775 LHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 032	Eir	A1770 RHS	Eir chamber located along Rathfarnham Road.	Proposed chamber relocation for telecom utility.
R12 - UT – 033	Eir	H0050 LHS	Eir chamber located along Terenure Road North.	Proposed chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 034	Eir	H0070 LHS	Kiosk located along Terenure Road North.	Proposed kiosk relocation for telecom utility.
R12 - UT – 035	Eir	A1980 LHS	Eir chamber located along Terenure Road East.	Proposed chamber relocation for telecom utility.
R12 - UT – 036	Eir	A2025 LHS	Kiosk located along Terenure Road East.	Proposed kiosk relocation for telecom utility.
R12 - UT – 037	Eir	A2070 RHS	Eir chamber located along Terenure Road East.	Proposed chamber relocation for telecom utility.
R12 - UT – 038	Eir	A2080 RHS	Eir chamber located along Terenure Road East.	Proposed chamber relocation for telecom utility.
R12 - UT – 039	Eir	A2100 RHS	Eir chamber located along Terenure Road East.	Proposed chamber relocation for telecom utility.
R12 - UT – 040	Eir	A2050 – A2090 RHS	Ducting along southern side of Terenure Road East.	Proposed diversion length of 36m for telecom utility.
R12 - UT – 041	Eir	A2135 RHS	Eir chamber located along Terenure Road East.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 042	Eir	A2160 RHS	Eir chamber located along Terenure Road East.	Proposed Eir chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 043	Eir	A2100 – A2200 RHS	Ducting along southern side of Terenure Road East.	Proposed diversion length of 94m for telecom utility.
R12 - UT – 044	Eir	A2180 RHS	Eir chamber located along Terenure Road East.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 045	Eir	A2150 – A2230 LHS	Ducting along northern side of Terenure Road East.	Proposed diversion length of 87m for telecom utility.
R12 - UT – 046	Eir	A2200 LHS	Eir chamber located along Terenure Road East.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 047	Eir	A2260 LHS	Eir chamber located along Terenure Road East.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 048	Eir	A2505 RHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 049	Eir	A2600 RHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 050	Eir	A2610 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 051	Eir	A2690 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 052	Eir	A2780 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 053	Eir	A2850 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 054	Eir	A2900 RHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 055	Eir	A2980 RHS	Kiosk located along Rathgar Road.	Proposed kiosk relocation for telecom utility.
R12 - UT – 056	Eir	A3140 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 057	Eir	A3155 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 058	Eir	A3170 LHS	Eir chamber located along Rathgar Road with kerb line construction assumed.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 059	Eir	A3260 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 060	Eir	A3300 – A3350 LHS	Ducting along western side of Rathgar Road.	Proposed diversion length of 44m for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 061	Eir	A3440 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 062	Eir	A3450 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 063	Eir	A3550 RHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 064	Eir	A3550 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 065	Eir	A3550 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 066	Eir	A3620 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 067	Eir	A3660 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 068	Eir	A3760 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 069	Eir	A3800 RHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 070	Eir	A3810 RHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 071	Eir	A3835 RHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 072	Eir	A3840 RHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 073	Eir	A3840 RHS	Kiosk located along Rathgar Road with kerb.	Proposed Kiosk relocation for telecom utility.
R12 - UT – 074	Eir	A3845 LHS	Eir chamber located along Rathgar Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 075	Eir	A3870 RHS	Eir chamber located along Rathmines Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 076		A3965 LHS	Telecom chamber located along Rathmines Road.	Proposed Telecom chamber relocation for telecom utility.
R12 - UT – 077	Eir	A4010 RHS	Eir chamber located along Rathmines Road Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 078	Eir	A4070 LHS	Eir chamber located along Rathmines Road Lower.	Proposed Eir chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 079	Eir	A4140 RHS	Eir chamber located along Rathmines Road Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 080	Eir	A4170 LHS	Eir chamber located along Rathmines Road Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 081	Eir	A4250 LHS	Eir chamber located along Rathmines Road Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 082	Eir	A4300 LHS	Eir chamber located along Rathmines Road Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 083	Eir	A4390 LHS	Eir chamber located along Rathmines Road Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 084	Eir	A4440 LHS	Eir chamber located along Rathmines Road Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 085	Eir	A4515 LHS	Eir chamber located along Rathmines Road Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 086	Eir	A4585 LHS	Eir chamber located along Rathmines Road Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 087	Eir	A4610 RHS	Eir chamber located along Rathmines Road Lower.	Proposed Eir chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 088	Eir	A4680 RHS	Eir chamber located along Rathmines Road Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 089	Eir	A4760 LHS	Eir chamber located along Richmond Street South.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 090	Eir	A4790 LHS	Eir chamber located along Richmond Street South.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 091	Eir	A4800 LHS	Eir chamber located along Richmond Street South.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 092	Eir	A4970 LHS	Eir chamber located along Harrington Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 093	Eir	A4980 LHS	Kiosk located along Harrington Street.	Proposed Kiosk relocation for telecom utility.
R12 - UT – 094	Eir	A5030 LHS	Eir chamber located along Camden Street Upper.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 095	Eir	A4980 RHS	Eir chamber located along Harcourt Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 096	Eir	A5090 RHS	Kiosk located along Camden Street Upper.	Proposed Kiosk relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 097	Eir	A5105 RHS	Eir chamber located along Camden Street Upper.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 098	Eir	A5100 LHS	Eir chamber located along Camden Street Upper.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 099	Eir	A5110 LHS	Eir chamber located along Camden Street Upper.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 100	Eir	A5175 LHS	Eir chamber located along Camden Street Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 101	Eir	A5210 LHS	Eir chamber located along Camden Street Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 102	Eir	A5210 RHS	Eir chamber located along Camden Street Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 103	Eir	A5250 LHS	Eir chamber located along Camden Street Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 104	Eir	A5340 LHS	Kiosk located along Camden Street Lower.	Proposed Kiosk relocation for telecom utility.
R12 - UT – 105	Eir	A5350 RHS	Eir chamber located along Camden Street Lower.	Proposed Eir chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 106	Eir	A5345 RHS	Eir chamber located along Camden Street Lower.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 107	Eir	A5345 RHS	Kiosk located along Camden Street Lower.	Proposed Kiosk relocation for telecom utility.
R12 - UT – 108	Eir	A5410 RHS	Eir chamber located along Wexford Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 109	Eir	A5470 RHS	Eir chamber located along Wexford Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 110	Eir	A5475 RHS	Eir chamber located along Wexford Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 111	Eir	A5510 RHS	Eir chamber located along Wexford Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 112	Eir	A5490 LHS	Eir chamber located along Wexford Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 113	Eir	A5515 RHS	Eir chamber located along Wexford Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 114	Eir	A5530 RHS	Eir chamber located along Wexford Street.	Proposed Eir chamber relocation for telecom utility.

Reference No.	**Utility Provider**	**Chainage**	**Asset/Apparatus Impacted**	**Description of Works**
R12 - UT – 115	Eir	A5535 RHS	Eir chamber located along Wexford Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 116	Eir	A5550 RHS	Eir chamber located along Redmond’s Hill.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 117	Eir	A5570 RHS	Eir chamber located along Redmond’s Hill.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 118	Eir	A5580 RHS	Eir chamber located along Redmond’s Hill.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 119	Eir	A5600 RHS	Eir chamber located along Redmond’s Hill.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 120	Eir	A5630 RHS	Eir chamber located along Redmond’s Hill.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 121	Eir	A5635 RHS	Eir chamber located along Redmond’s Hill.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 122	Eir	A5705 LHS	Eir chamber located along Redmond’s Hill.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 123	Eir	A5800 RHS	Kiosk located along Aungier Street.	Proposed Kiosk relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R12 - UT – 124	Eir	A5800 RHS	Eir chamber located along Aungier Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 125	Eir	A5925 RHS	Eir chamber located along Aungier Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 126	Eir	A5940 RHS	Eir chamber located along Aungier Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 127	Eir	A5970 LHS	Eir chamber located along Aungier Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 128	Eir	A5980 RHS	Eir chamber located along South Great George’s Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 129	Eir	A5980 LHS	Eir chamber located along South Great George’s Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 130	Eir	A6150 RHS	Kiosk located along South Great George’s Street.	Proposed Kiosk relocation for telecom utility.
R12 - UT – 131	Eir	A6150 RHS	Eir chamber located along South Great George’s Street.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 132	Eir	A6150 RHS	Eir chamber located along South Great George’s Street.	Proposed Eir chamber relocation for telecom utility.

Reference No.	**Utility Provider**	**Chainage**	**Asset/Apparatus Impacted**	**Description of Works**
R12 - UT – 133	Eir	A6155 RHS	Kiosk located along South Great George’s Street.	Proposed Kiosk relocation for telecom utility.
R12 - UT – 134	Eir	H0900 LHS	Eir chamber located along Harold’s Cross Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 135	Eir	H1060 RHS	Eir chamber located along Harold’s Cross Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 136	Eir	H1030 LHS	Eir chamber located along Harold’s Cross Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 137	Eir	H1450 LHS	Eir chamber located along Harold’s Cross Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 138	Eir	H1450 RHS	Eir chamber located along Harold’s Cross Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 139	Eir	H1455 RHS	Eir chamber located along Harold’s Cross Road.	Proposed Eir chamber relocation for telecom utility.
R12 - UT – 140	Eir	H1540 RHS	Eir chamber located along Harold’s Cross Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 001	Eir	J0560 – J0615 LHS	Ducting along northern side of R137 Templeogue Road.	Proposed diversion length of 50m for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R10 - UT – 002	Virgin Media	J0530 – J0615 LHS	Ducting along northern side of R137 Templeogue Road.	Proposed diversion length of 74m for telecom utility.
R10 - UT – 003	Eir	J0590 RHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 004	Eir	J0595 RHS	Kiosk located along R137 Templeogue Road.	Proposed Kiosk relocation for telecom utility.
R10 - UT – 005	Eir	J0605 RHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 – UT 006	Eir	J0650 LHS	Eir chamber located along Wellington Lane.	Proposed Eir chamber relocation for telecom utility.
R10 – UT 007		J0650 LHS	Telecom chamber located along Wellington Lane.	Proposed Telecom chamber relocation for telecom utility.
R10 - UT – 008		J0650 LHS	Telecom chamber located along Wellington Lane.	Proposed Telecom chamber relocation for telecom utility.
R10 - UT – 009	Eir	J0680 RHS	Telecom chamber located along Wellington Lane.	Proposed Telecom chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R10 - UT – 010	Eir	J0760 – J0815 LHS	Ducting along northern side of R137 Templeogue Road.	Proposed diversion length of 55m for telecom utility.
R10 - UT – 011	Virgin Media	J0780 – J0815 LHS	Ducting along northern side of R137 Templeogue Road.	Proposed diversion length of 36m for telecom utility.
R10 - UT – 012	Eir	J0990 RHS	Kiosk located along R137 Templeogue Road.	Proposed Kiosk relocation for telecom utility.
R10 - UT – 013	Eir	J1050 LHS	Kiosk located along R137 Templeogue Road.	Proposed Kiosk relocation for telecom utility.
R10 - UT – 014	Eir	J1055 LHS	Kiosk located along R137 Templeogue Road.	Proposed Kiosk relocation for telecom utility.
R10 - UT – 015	Eir	J1065 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 016	Eir	J1065 RHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 017	Eir	J1150 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 – UT -018	Eir	J1148 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R10 - UT – 019	Eir	J1250 RHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 020	Eir	J1415 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 021	Eir	J1416 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 – UT - 022	Cignal Infrastructure Ltd	J1423 LHS	Cignal Infrastructure kiosk located along R137 Templeogue Road.	Proposed Cignal Infrastructure kiosk relocation for telecom utility.
R10 – UT - 023	Eir	J1428 LHS	Eir chamber located along Cypress Grove Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 024	Eir	J1425 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 025	Cignal Infrastructure Ltd	J1425 LHS	Cignal Infrastructure telecom mast and kiosk located along R137 Templeogue Road.	Proposed Cignal Infrastructure telecom mast and kiosk relocation for telecom utility.
R10 - UT – 026		J1423 RHS	Telecom chamber located along R137 Templeogue Road.	Proposed Telecom chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R10 - UT – 027	Eir	J1440 RHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 028	Eir	J1450 RHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 029	Eir	J1475 LHS	Telecom Kiosk located along R137 Templeogue Road.	Proposed Telecom Kiosk relocation for telecom utility.
R10 - UT – 030	Eir	J1520 RHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 031	Eir	J1540 RHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 032	Eir	J1465 – J1530 LHS	Cables along northern side of R137 Templeogue Road.	Proposed diversion length of 84m for telecom utility.
R10 - UT – 033	Eir	J1570 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 034	Eir	J1550 – J1635 LHS	Ducting along northern side of R137 Templeogue Road.	Proposed diversion length of 82m for telecom utility.
R10 - UT – 035	Eir	J1620 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R10 - UT – 036	Eir	J1675 – J1840 RHS	Ducting along southern side of R137 Templeogue Road.	Proposed diversion length of 165m for telecom utility.
R10 - UT – 037	Eir	J1715 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 038	Eir	J1730 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 039	Eir	J1705 – J1840 LHS	Ducting along northern side of R137 Templeogue Road.	Proposed diversion length of 135m for telecom utility.
R10 - UT – 040	Eir	J1780 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 041	Eir	J2030 RHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 042	Eir	J2070 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 043	Eir	J2160 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 044	Eir	J2140 LHS	Eir chamber along eastern side of Templeville Road.	Proposed Eir chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R10 - UT – 045	Eir	J2185 LHS	Eir chamber located along Templeville Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 046	Eir	J2160 RHS	Kiosk located along Templeville Road.	Proposed Kiosk relocation for telecom utility.
R10 - UT – 047	Eir	J2180 RHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 048	Eir	J2179 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 049	Eir	J2180 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 050	Eir	J2300 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 051	Eir	J2320 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 052	Eir	J2340 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 053	Eir	J2410 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.

Reference No.	Utility Provider	Chainage	Asset/Apparatus Impacted	Description of Works
R10 - UT – 054	Eir	J2465 LHS	Eir chamber located along R137 Templeogue Road.	Proposed Eir chamber relocation for telecom utility.
R10 - UT – 055		J2465 LHS	Telecom chamber located along R137 Templeogue Road.	Proposed Telecom chamber relocation for telecom utility.

11 Waste Quantities

11.1 Introduction

The majority of the waste arising from the Proposed Scheme will accumulate from excavation related activities and demolition works due to proposed public domain street works. A waste calculator was developed for the Proposed Scheme to quantify and classify the likely material types in accordance with TII GE-ENV-01101 and the European Waste Catalogue waste codes.

Excavation waste will arise from the following activities:

- Excavation of existing pavements and carriageways;
- Construction and reconstitution of cycleways, pathways, road widening and urban realm improvements;
- Alteration of roundabouts to signalised junctions;
- Utility diversions and / or protections.

Waste material resulting from these activities will include concrete (waste code 17 01 01), bitumen/ asphalt (waste code 17 06 02), and soil and stones (waste code 17 05 04). The waste quantities associated with the excavation of soil and stones were further broken down into the likely TII material specification to establish an understanding of the volume of materials that could potentially be reused/recycled.

Demolition waste will arise from the following activities:

- Removal of street furniture including bus shelters, bins, gates, fences, railings and walls;
- Removal of roadside infrastructure including traffic signals, road signs, safety barriers, street lighting poles and ESB/Eir poles; and
- Removal of trees.

Waste materials resulting from these activities will include masonry brick/blocks (waste code 17 01 02), metal (waste code 17 04 07), plastic (waste code 17 02 03), wood (waste code 17 02 01) and glass (waste code 17 02 02).

In developing the waste estimate quantities, a number of assumptions were required to undertake the assessment which have been outlined in Section 11.2.

11.2 Waste Calculation Assumptions

The following tables provide an overview of the various material weights and densities that have been applied to calculate the overall material waste estimate quantities for the Proposed Scheme.

Table 11.1: Street Furniture Unit Weights

Item	Material	Assumed nominal weight	Notes
Timber arising from trees	Timber/ Wood	100 kg per tree	Average value per tree across the entire route
Vegetation (e.g. hedges, shrubs, leaves and branches)	Organic	N/A	Organic material from hedges, shrubs, leaves and branches have not been quantified. It is assumed that this material will be collected and mulched before removal from site to organic treatment facility. Therefore, the quantity of organic waste will be minimal and not significant for the assessment.
Walls	Masonry/ Bricks	1.5m height 0.3m width	Nominal assumed dimensions for purposes of assessment
Gates	Metal	100 kg/unit	Nominal assumed average weight per gate over scheme
Metal railings	Metal	15 kg/m	Nominal assumed average weight per railing over scheme
Fencing	Metal	40 kg/m	Nominal assumed average weight per railing over scheme
Traffic Signals	Metal	68 kg per 4m pole 15kg per traffic signal head Assumed 2 heads per pole	Source: Siemens Helios General Handbook Issue 18. Nominal assumed average scenario per signal over scheme length
Traffic Signs	Metal	20kg per 3m pole 0.75 m sign height 0.01 m sign thickness	Nominal assumed average scenario per traffic sign over scheme length
Lighting poles	Metal	100 kg per 8m pole	Nominal assumed average scenario over scheme length
ESB/Eir poles	Timber/wood	250 kg per 9m pole	Nominal assumed average scenario over scheme length
Bus stops	Plastic	365 kg per bus stop	JCDecaux and NTA (2017) Reliance Bus Shelter information
	Metal	2400 kg per bus stop	JCDecaux and NTA (2017) Reliance Bus Shelter information
	Glass	54 kg per bus stop	JCDecaux and NTA (2017) Reliance Bus Shelter information

Item	**Material**	**Assumed nominal weight**	**Notes**
Litter bins	Metal	60 kg per bin	Omos specification. Nominal assumed average scenario over scheme length
Safety barrier	Metal	20 kg/m	Nominal assumed average scenario over scheme length
Cabinets	Metal	85 kg	ESB (2008). National Code of Practice for Customer Interface 4th Edition. Available online: https://www.esbnetworks.ie/docs/default-source/publications/national-code-of-practice.pdf (Accessed on 6 May 2021)
Benches	Metal	32kg	Lost Art (2016). Benches: Product information operation and maintenance instructions. Available online: https://www.lostart.co.uk/pdf/lost-art-limited-product-information.pdf (Accessed on 6 May 2021)
	Wood	8kg	
Cameras	Metal	35 kg	2b Security Systems (2021) PTZ-7000 Long range IP PTZ camera. Available online: https://www.2bsecurity.com/product/long-range-ptz-camera/ (Accessed on 6 May 2021)
Cast Iron Bollard	Metal	50 kg	Furnitubes (2013) Cast Iron Bollards: Product Brochure. Available online: https://www.furnitubes.com/uploads/assets/brochures-2013/furnitubes-e-008-01-13-cast-iron-bollard-brochure.pdf (Accessed on 6 May 2021)
Non-Assigned Bollard	Metal	40kg	Furnitubes (2013) Cast Iron Bollards: Product Brochure. Available online: https://www.furnitubes.com/uploads/assets/brochures-2013/furnitubes-e-008-01-13-cast-iron-bollard-brochure.pdf (Accessed on 6 May 2021)
Stainless Steel Bollard	Metal	30kg	Furnitubes (2013) Cast Iron Bollards: Product Brochure. Available online:

Item	Material	Assumed nominal weight	Notes
			https://www.furnitubes.com/uploads/assets/brochures-2013/furnitubes-e-008-01-13-cast-iron-bollard-brochure.pdf (Accessed on 6 May 2021)
Vehicle Restraint Bollard	Metal	130 kg	Furnitubes (2013) Cast Iron Bollards: Product Brochure. Available online: https://www.furnitubes.com/uploads/assets/brochures-2013/furnitubes-e-008-01-13-cast-iron-bollard-brochure.pdf (Accessed on 6 May 2021)
Bike Railings/hand rails	Metal	16 kg	Dublin City Council (2016) Construction Standards for Road and Street Works in Dublin City Council
Gully grates	Metal	40 kg	Pam Saint- Gobain (2016). Ductile Iron Access Covers and Gratings: Product selection and specification guide. Available online: https://www.saint-gobain-pam.co.uk/sites/pamline_uk/files/access_covers_and_gratings_product_guide_0.pdf (Accessed on 6 May 2021) Greater Dublin Region (2012) Greater Dublin Regional Code of Practice for Drainage works. Available online: (https://www.sdcc.ie/en/download-it/guidelines/greater-dublin-regional-code-of-practice-for-drainage.pdf (Accessed on 6 May 2021)
Chamber covers and frame	Metal	50kg	Pam Saint- Gobain (2016). Ductile Iron Access Covers and Gratings: Product selection and specification guide. Available online: https://www.saint-gobain-pam.co.uk/sites/pamline_uk/files/access_covers_and_gratings_product_guide_0.pdf (Accessed on 6 May 2021) Greater Dublin Region (2012) Greater Dublin Regional Code of Practice for Drainage works. Available online:

Item	Material	Assumed nominal weight	Notes
			(https://www.sdcc.ie/en/download-it/guidelines/greater-dublin-regional-code-of-practice-for-drainage.pdf (Accessed on 6 May 2021)
Manholes	Metal	50kg	Pam Saint- Gobain (2016). Ductile Iron Access Covers and Gratings: Product selection and specification guide. Available online: https://www.saint-gobain-pam.co.uk/sites/pamline_uk/files/access_covers_and_gratings_product_guide_0.pdf (Accessed on 6 May 2021) Greater Dublin Region (2012) Greater Dublin Regional Code of Practice for Drainage works. Available online: https://www.sdcc.ie/en/download-it/guidelines/greater-dublin-regional-code-of-practice-for-drainage.pdf (Accessed on 6 May 2021)

Table 11.2: In-situ Pavement and Earthworks Densities

Material	Densities (tonnes/m3)	Notes
Soil	2.2	Professional judgement (Dublin boulder clay), laboratory testing - Nominal assumed average scenario over scheme length
Bitumen containing material	2.4	Professional judgement (Engineering Designers) - Nominal assumed average scenario over scheme length
Concrete	2.4	Professional experience (Bath Inventory - Version 2.0 (2011)) - Nominal assumed average scenario over scheme length
Granite	2.7	https://pubs.usgs.gov/of/1983/0808/report.pdf - Nominal assumed average scenario over scheme length

Material	Densities (tonnes/m3)	Notes
Paving stones (assumed concrete or natural stone)	2.4	Professional judgement (Engineering Designers) Nominal assumed average scenario over scheme length
Granular material	1.6	Nominal assumed average scenario over scheme length

Table 11.3: Utilities Material Excavation Assumptions

Asset type	Assumed nominal average trench width (m)	Assumed material spec. (TII)	Assumed nominal average trench depth under pavement layer (m)	Notes
Drainage Pipe Bedding Excavation Assessment (assumed at 1.2m cover i.e. obvert at 0.35m under capping layer of road)	0.9	Class 2/4/U1 Cohesive subgrade material	1.25	Irish Water (2020) Water Infrastructure Standard Details: Connections and Developer Services. Available online: https://www.water.ie/connections/Water-Standard-Details.pdf (Accessed on 6 May 2021)
Foul Sewer Pipe Bedding Excavation Assessment (assumed at 1.2m cover i.e. obvert at 0.35m under capping layer of road)	0.9	Class 2/4/U1 Cohesive subgrade material	1.25	Irish Water (2020) Water Infrastructure Standard Details: Connections and Developer Services. Available online: https://www.water.ie/connections/Water-Standard-Details.pdf (Accessed on 6 May 2021)
Potable water Pipe Bedding Excavation Assessment (assumed at 1.2m cover i.e. obvert at 0.35m under capping layer of road)	0.9	Class 2/4/U1 Cohesive subgrade material	1.25	Irish Water (2020) Water Infrastructure Standard Details: Connections and Developer Services. Available online: https://www.water.ie/connections/Water-Standard-Details.pdf (Accessed on 6 May 2021)
Road Pavement Excavation (extra over in addition to road widening allowances e.g.	0.9	Bitumen (surface+binder and base)	0.35	Irish Water (2020) Water Infrastructure Standard Details: Connections and Developer Services. Available online:

Asset type	Assumed nominal average trench width (m)	Assumed material spec. (TII)	Assumed nominal average trench depth under pavement layer (m)	Notes
transverse trenching)				https://www.water.ie/connections/Water-Standard-Details.pdf (Accessed on 6 May 2021)
		Class 1/2 Granular Subbase material	0.3	Irish Water (2020) Water Infrastructure Standard Details: Connections and Developer Services. Available online: https://www.water.ie/connections/Water-Standard-Details.pdf (Accessed on 6 May 2021)
		Class 6 Granular Capping material	0.2	Irish Water (2020) Water Infrastructure Standard Details: Connections and Developer Services. Available online: https://www.water.ie/connections/Water-Standard-Details.pdf (Accessed on 6 May 2021)
Electric/Power bedding excavation Assessment (assumed at 0.75m cover under footpath i.e. obvert at 0.55m under subbase layer of footpath/cycle track)	0.5	Class 2/4/U1 Cohesive subgrade material	0.925	ESB (2008) Standard Specification for ESB MV/LV Network Duction (Minimum Standards). Available online: https://www.esbnetworks.ie/docs/default-source/publications/summary-of-standard-specification-for-esb-networks-mvlv-ducting.pdf?sfvrsn=f34b33f0_4 (Accessed on 6 May 2021)
Comms bedding Excavation Assessment (assumed at 0.75m cover under footpath i.e. obvert at 0.55m subbase layer of footpath)	0.5	Class 2/4/U1 Cohesive subgrade material	0.925	ESB (2008) Standard Specification for ESB MV/LV Network Duction (Minimum Standards). Available online:

Asset type	Assumed nominal average trench width (m)	Assumed material spec. (TII)	Assumed nominal average trench depth under pavement layer (m)	Notes
				https://www.esbnetworks.ie/docs/default-source/publications/summary-of-standard-specification-for-esb-networks-mvlv-ducting.pdf?sfvrsn=f34b33f0_4 (Accessed on 6 May 2021)
Street Lighting/Comms/ Traffic Excavation Assessment (assumed at 0.6m cover under footpath i.e. obvert at 0.4m subbase layer of footpath)	0.5	Class 2/4/U1 Cohesive subgrade material	0.56	South Dublin County Council (2016) Public Lighting Specification. Available online: https://www.sdcc.ie/en/services/transport/public-lighting/sdcc-public-lighting-specification.pdf (Accessed on 6 May 2021)
Gas Excavation Assessment (assumed at 0.6m cover i.e. obvert at 0.4m under subbase layer of footpath)	0.45	Class 2/4/U1 Cohesive subgrade material	0.7	Gas Network Ireland (2018) Guidelines for Designers and Builders- Industrial and Commercial (Non-domestic) Sites. Available online: https://www.gasnetworks.ie/Guidelines-for-Designers-and-Builders-Industrial-and-Commercial-Sites.pdf (Accessed 6 May 2021)

Table 11.4: Footpath and Verge Widening Excavation Assumptions

Layer	Assumed Layer thickness (m)	Assumed material spec. (TII)
Footpath surface treatment due to all works (remove and replace)	0.1	Concrete
Footpath sub-layer excavation due to Full Depth Construction (FDC) widening (material under footpath)	0.1	Granular material- Class 1/2 Granular Subbase material
	0.75	Soil and stones- Class 2/4/U1 Cohesive subgrade material
Verge and sub-layer excavation due to FDC widening (material under verge)	0.3	Soil and stones- Class 5 Topsoil material

Layer	Assumed Layer thickness (m)	Assumed material spec. (TII)
	0.55	Soil and stones- Class 4/U1 Cohesive subgrade material
Verge and sub-layer excavation due to footpath widening (material under verge)	0.3	Soil and stones- Class 5 Topsoil material
	0	Soil and stones- Class 4/U1 Cohesive subgrade material
Road surface treatment due to road markings and utilities trench reinstatement (mill & re-sheet)	0.05	Bitumen containing material - Bitumen (surface)
Road sub-layer excavation due to FDC (material under road)	0.3	Bitumen containing material - Bitumen (binder and base)
	0.3	Class 1/2 Granular Subbase material
	0.2	Granular material - Class 6 Granular Capping material
	0	Soil and stones- Class 2/4/U1 Cohesive subgrade material

11.3 Waste Estimate Summary

The majority of the waste arising from the Proposed Scheme accumulates from excavation related activities and demolition works due to proposed public domain street works. The waste produced as a result of the Proposed Scheme has been summarised below along with an outline of how this waste will be managed.

In line with current practice in Ireland, surplus materials and wastes from the Proposed Scheme will be managed as follows:

- Where feasible, naturally occurring excavated material will be reused within construction in the Proposed Scheme in accordance with Article 2 of the Waste Directive Regulations, Waste Framework Directive and Section 3 of the Waste Management Act 1996, as amended;
- Where practicable, excavation material will be used as engineering and landscaping material within the Proposed Scheme where practicable and on other projects requiring the types of materials generated. Reuse of topsoil and excavated material within the Proposed Scheme is proposed where practicable. The material will also be subject to testing to ensure it is suitable for its proposed end use;

- Article 28 (End-of-Waste) (EPA 2020) criteria may be met by the excavation material, should such facilities become available by the time of commencement of construction of the Proposed Scheme, ensured that the material will meet the acceptance criteria set out in Article 28 of the Waste Directive Regulations;
- All excavation wastes requiring removal from site for recycling or recovery will be delivered to facilities which are authorised under the Waste Management Act 1996 (i.e. which hold a Certificate of Registration, Waste Facility Permit or EPA Licence). Examples of recycling / recovery activities for excavation material may include:
  - Processing of stone to produce construction aggregate;
  - Backfilling of quarries; and
  - Raising land for site improvement or development.
- There is no crushing and screening of material planned for the Proposed Scheme;
- All wastes removed from site will be delivered to recovery or disposal facilities holding a Certificate of Registration, Waste Facility Permit or EPA Waste Licence; and
- All wastes removed from site will be transported by the holder of the appropriate waste collection permit, granted in accordance with S.I. No. 820/2007 - Waste Management (Collection Permit) Regulations 2007.

It will be the responsibility of the appointed contractor to secure agreements for acceptance of surplus excavation materials from the Proposed Scheme in authorised and regulated facilities, in accordance with the Waste Management Act 1996 and associated regulations.

11.3.1 Demolition

Table 11.5 shows the estimated quantity and type of waste that will be generated by demolition activities in connection with the Proposed Scheme along with how much of this material could potentially be reused or recovered.

Table 11.5: Estimated Demolition Waste Types and Quantities

Waste Type	Approximate Waste and Material Quantity (tonnes)	Potential Recoverable/ Reusable Material	Recoverable/ Reusable Quantities (tonnes)
Concrete, bricks, tiles and similar	1,900	100%	1,900
Metals	760	100%	760
Segregated wood, glass and plastic	90	100%	90
Total	**2,750**		**2,750**

Potentially 100% of material generated from the demolition phase of the Proposed Scheme could be considered for reuse for construction within the Proposed Scheme or in other construction projects in accordance with Article 27 of the Waste Directive Regulations. It will be the responsibility of the appointed contractor to review feasibility of reuse of materials and ensure that the necessary testing is undertaken to demonstrate compliance with Article 27, as appropriate.

Where feasible, street and roadside infrastructure such as bus stops, lighting poles, traffic signals, and signs will be reused within the Proposed Scheme and will not become a waste. The appointed contractor will be responsible for ensuring compliance with all relevant legislation.

Materials will require on-site segregation by waste classification and if not suitable for onsite or offsite reuse, will be delivered to an authorised recycling or recovery facility. Where street furniture is a waste, it may be necessary to separate elements at source such as lightbulbs from luminaires and metals from other components and deliver these separately to suitable authorised recycling or recovery facilities.

Where metal railings and gates are removed, typically these have inherent value due to their metal content. These will be source-segregated and delivered for metal recycling to an authorised waste facility. Some example facilities which are currently authorised to accept metal and electronic waste include:

- Irish Lamp Recycling Co. Ltd, Woodstock Industrial Estate, Kilkenny Road, Athy, Co. Kildare; and
- Hammond Lane Metal Company, Pigeon House Road, Dublin 4, Dublin

The least preferable option is disposal to an authorised facility which will only take place when all viable opportunities for reuse and recycling have been investigated by the appointed contractor for feasibility and ruled out.

Prior to commencing construction, the appointed contractor will undertake vegetation clearance and street furniture removal. Limited demolition will be undertaken as part of the construction works for the Proposed Scheme.

11.3.2 Excavation

Table 11.6 shows the estimated quantity and type of waste that will be generated by the excavation activities of the Proposed Scheme.

Table 11.6: Summary of Excavation Material Type and Quantities

Waste Type	Approximate Waste and Material quantity (tonnes)
Bituminous mixtures	20,000
Concrete, bricks, tiles and similar	10,000
Class 1/2 Granular Subbase material from footway and road	3,000
Class 6 Granular Capping material from road widening	1,000

Waste Type	Approximate Waste and Material quantity (tonnes)
Class 2/4/U1 Cohesive subgrade material (made ground material under footpath/road	27,000
Class 4/U1 Cohesive subgrade fill material (made ground material under verge)	2,000
Class 5 topsoil material (surface material from verge)	1,000
Total	**64,00**

It is estimated that a total of 64,000 Tonnes of material will be excavated as part of the construction works. Due to the nature of the works in an urban environment there are limited opportunities to achieve a cut/fill balance of materials that could be more readily accommodated on a greenfield project where earthworks embankments/ bunds are more common.

Where material is excavated, it is envisaged that the contractor will seek to reuse or recycle it, where practicable, within the Proposed Scheme through implementation of the measures set out below for each waste type identified within Table 11.6. To further establish an understanding of how soil and stone waste materials could potentially be reused/recovered, they have been further broken down into the likely TII material specification and class.

Excavated materials such as capping, subbase, bituminous and concrete materials could be reused or recycled in line with TII specifications:

- Capping, subbase, bituminous and concrete materials could be reused or recycled in fill and capping materials (e.g. 6A, 6B, 6C, 6F, 6G, 6H ,6I, 6M, 6N) providing they comply with the Specification for Road Works Series 600 – Earthworks (CC-SPW-00600);
- Subbase, bituminous and concrete materials could be reused or recycled in subbase or base materials (e.g. Granular Material Type A to Clause 803) providing they comply with the Specification for Road Works Series 800 – Unbound and Cement Bound Mixtures (CC-SPW-00800); and
- Subbase and bituminous materials could be recycled in base or binder materials (e.g. Asphalt Concrete base and binder products to Clause 3 or Low Energy Bound Mixtures to Clause 8.1) providing they comply with Road Pavements – Bituminous Materials (CC-SPW-00900).

It is assumed that some of the granular subbase and capping materials will contain excessive cohesive material due to the excavation process and therefore unsuitable for direct reuse. This excess material could be sent to a suitable recovery facility and reused as Class 2 general fill or Class 4 landscape fill material, depending on excavation methods employed by the contractor and existing ground conditions.

Excavated cohesive subgrade material is likely to be unacceptable for direct reuse for pavement construction, however, this material can be tested for quality and contamination and could potentially be reused as Class 2 general fill or Class 4 landscape fill under the provisions of Article 27.

Material which meets the necessary acceptance criteria may be delivered to an authorised soil recovery facility. Material which requires recycling will be sent to an authorised waste facility and may be used in accordance with Article 28 of the European Communities (Waste Directive) Regulations 2011 - S.I. 126 of 2011 as amended. Article 28 sets the criteria which must be complied with and the EPA must use to determine, when a waste reaches “end of waste” status and becomes a material. Large quantities of this type of material is unlikely to be reused on site due to the nature of the works in an urban environment with limited embankments / earthworks bunds being constructed. Therefore, excavated cohesive subgrade material may be recovered and used on future projects in the industry.

Topsoil material could be reused in new landscaped areas. It is assumed that some of this material will be contaminated with unsuitable material during the excavation process and therefore will be sent to a suitable recovery facility and reused as Class 2 general fill or Class 4 landscape fill, along with the excavated cohesive subgrade material.

Future design stages will undertake additional site investigations to inform the detailed pavement design and associated excavation quantity assessment.

11.3.3 Municipal Waste

It is anticipated that there will be approximately 250, up to 300 at peak, construction staff employed over the Construction Phase of the Proposed Scheme. Small volumes of general municipal wastes will be generated by construction staff during the Construction Phase (e.g., from offices and welfare facilities). Segregation facilities will be provided on the construction site to ensure that recovery and recycling of such wastes is maximised.

11.3.4 Operational Phase

Operational waste may arise as a result of carriageway maintenance which will be undertaken at regular intervals, or as necessary. This will primarily consist of bitumen containing material due to maintenance of carriageway pavement. Only waste generated from the areas where road widening and narrowing, undertaken as part of the Proposed Scheme, have taken place will be considered in this assessment, as routine maintenance, and associated waste generated, would be carried out on the existing road irrespective of the Proposed Scheme. It is important to note that maintenance operations will be undertaken by the relevant Local Authority.

It is envisaged that bitumen containing material will be reused within new carriageway construction as far as practicable and in accordance with all applicable legislation. Bitumen containing materials which are not incorporated into the Proposed Scheme are likely to be reused where feasible off site as a by-product in accordance with Article 27, of the Waste Framework Directive. Bitumen containing materials may be recycled in accordance with the provisions of an Article 28 (End of Waste) decision by the EPA (EPA 2020).

The quantity of bitumen containing material generated, over the assumed lifetime of the Proposed Scheme (60 years), will increase by approximately 8,590 tonnes.

Therefore, there will be an increase in maintenance needs during operation of the Proposed Scheme, in comparison to required maintenance of the existing carriageway. This is due to an overall widening of the carriageway.

12 Traffic Signs, Signals and Communications

12.1 Introduction

The existing signage and road markings along the extents of the Proposed Scheme will be modified to clearly communicate information, regulatory and safety messages to the corridor's users. In addition, the existing lighting and communication equipment along the Proposed Scheme has been reviewed and proposals developed to upgrade where necessary.

12.2 Traffic Signage Strategy

A preliminary traffic signage design has been undertaken to identify the requirements of the Proposed Scheme, whilst allowing for further design optimisation at the detailed design phase. A combination of Information, Regulatory and Warning signs have been assessed taking consideration of key destinations/centres; intersections/decision points; built and natural environment. In line with DMURS, the signage proposals have been 'kept to the minimum requirements of the Traffic Sign Manual (TSM) to avoid sign congestion within the Proposed Scheme corridor.

A review of the existing regulatory and warning signs in the vicinity of the Proposed Scheme was carried out to identify unnecessary repetitive and redundant signage to be removed. This includes rationalising signage structures by better utilising individual sign poles and clustering signage together on a single pole.

On review, the following features of the proposed scheme will alter the traffic patterns in this area:

- The proposed bus gate at Templeogue Road near the junction with Fergus Road (Inbound direction only);
- The proposed one-way inbound for general traffic along Rathgar Road;
- The proposed one-way outbound for general traffic along Richmond Street South;
- The proposed one-way outbound for general traffic along Wexford Street and Camden Street; and
- The proposed bus gate at Rathmines Road Lower near the junction with Lissenfield.

Traffic management measures in the form of turn bans have also been devised to minimise traffic impacts on roads adjacent to the proposed core bus corridor due to any rerouting of traffic (which may occur due to the priority given on the bus corridor scheme to pedestrians, cyclists and buses).

Turning bans and other traffic management measures will also be implemented on the route to direct traffic away from either the Proposed Scheme corridor (to maximise bus journey time reliability) or to limit use of side streets as a short-cut route by through traffic. Refer to Section 4.16 for further information

These changes are outlined within the Traffic Signs and Road Marking drawing series in Appendix B, which outlines the associated signage requirements.

12.3 Traffic Signage and Road Markings

12.3.1 Traffic Signage General

A preliminary assessment was undertaken which involved an assessment of major road traffic signage, including requirements for all information signs (TSM Chapter 2), regulatory signs (TSM Chapter 5), warning signs (TSM Chapter 6), and road markings (TSM Chapter 7).

On review of the existing traffic signage, it is determined that the main changes to regulatory signage will be the proposed introduction of turning bans from or to the Proposed Scheme as indicated within the Traffic Signs and Road Markings drawing series in Appendix B.

In addition to the signs identified above, the existing signs within the Proposed Scheme are being revised to accommodate the change in road cross-section communicating the following:

- Information Signs to include geographical information signs, signs indicating facilities, road layout signs, traffic calming signs and cycle network signs;
- Regulatory signage –e.g. parking regulation signs, bus lanes, pedestrian and cycle facilities;
- Warning signs – e.g. Stop and Yield Ahead.

As stated in TSM Chapter 1, in urban areas the obstruction caused by posts located in narrow pedestrian footpaths will be minimised, ensuring that pedestrians are unimpeded by any such signage infrastructure. Therefore, where practicable, signs are to be placed on single poles, or larger signs will be cantilevered from a post at the back of the footpath using H-frames where necessary. Passively safe posts will be introduced where practicable to eliminate the need for vehicle restraint systems.

12.3.2 Gantry Signage

No gantry signage exists along the route, and the development of the Proposed Scheme did not identify the requirement for any new gantry signage.

12.3.3 Road Markings

A preliminary design of road markings has been undertaken in accordance with TSM Chapter 7 and the BCPDGB.

Refer to the Traffic Signs and Road Markings drawing series contained within Appendix B. This exercise also included the preliminary road marking design of the following items:

- Bus Lanes
- Cycle tracks: The pavement will be marked according to best practice guidelines such as DMURS and the National Cycle Manual with particular attention given to junctions. Advance Stacking Locations (ASLs) have been designed, where practicable, to provide a safer passage for cyclists at signal-controlled junctions for straight ahead or right turn movements; and
- Pedestrian crossings will be incorporated to connect the network of proposed and existing footpaths. Wider pedestrian crossings will be provided in locations expected to accommodate a high number of pedestrians.

12.4 Public Lighting

A high-level review of the existing lighting provision along the extent of the route has been carried out to understand the impact of the proposed scheme on lighting columns and associated infrastructure. A number of existing columns are proposed to be relocated or replaced to accommodate the Proposed Scheme, as shown on the Street Lighting drawings within Appendix B.

12.4.1 Existing Lighting

Light Emitting Diode (LED) lanterns will be the light source for any new or relocated public lighting provided.

The lighting design involves works on functional, heritage and contemporary lighting installations, on a broad spectrum of lighting infrastructure along the Proposed Scheme. This will include, but not exclusively, luminaires supplied by underground and overhead cable installations and those located on ESB Infrastructure.

In locations where road widening and/or additional space in the road margin is required, it is proposed that the public lighting columns be replaced and relocated to the rear of the footpath, and the existing lighting columns removed once the new facility is operational.

Where significant alterations are proposed to the existing carriageways, the preliminary street lighting design ensures that the current standard of public lighting is maintained or improved.

For existing columns that have specific aesthetic requirements, the intent for the replacement of such columns will include:

- Replacing the existing heritage columns and brackets with identical replica columns and brackets;
- Replacing existing luminaires with approved LED heritage luminaires; and

- Ensuring that the electrical installation is compliant with the latest version of the National Rules for Electrical Installations, I.S. 10101.

12.4.2 New Lighting

All new public lighting will be designed and installed in accordance with the specific lighting and electrical items set out the following National Standards and guides, including but not limited to:

- Local Authority Guidance Specifications;
- EN 13201: 2014 Road Lighting (all sections);
- ET211:2003 'Code of Practice for Public Lighting Installations in Residential Areas';
- BS 5489-1 'Code of practice for the design of road lighting';
- TII Publications: Specification for Road Works, Series 1300 & 1400;
- TII Publications Standard Construction Details, Series 1300 & 1400;
- IS EN 40 – Lighting Columns;
- Institution of Lighting Professionals "GN01 Guidance Notes for Reduction of Obtrusive Light".

All new lighting will aim to minimise the effects of obtrusive light at night and reduce visual impact during daylight. Lighting schemes will comply with the 'Guidance notes for the Reduction of Light Pollution' issued by the Institution of Lighting Professionals (ILP).

12.4.3 Lighting at Stops

The Proposed Scheme will include for the provision of lighting in covered areas, open areas and passenger waiting areas.

The location of the lighting columns will be dictated by the output from the fitting to adhere to the required uniformity and illuminance required for the specific lighting class for the associated road. The columns positioned at bus stops will ensure adequate clearances from moving vehicles.

12.5 Traffic Signals

12.5.1 Above Ground Infrastructure

The Preliminary design shows the proposed locations of above ground infrastructure. This is included in the Junction Systems Design drawings in Appendix B.

Above ground infrastructure will include:

Traffic Signal Poles

All traffic signal equipment has been designed in accordance with Chapter 9 of the Department of Transports Traffic Signs Manual. The Traffic Signs Manual clearly defines the requirements and positioning of traffic signal heads, detection equipment, and associated traffic signal poles.

Traffic signal modelling, including LinSig models, has been used to determine the signal head configuration to achieve the required phasing and staging of the traffic signals. This contributed to the determination of the design and positioning of the traffic signal heads.

Single height Traffic Signal poles typically 3m (as measured from the ground) have predominantly been proposed on the Proposed Scheme to mount traffic signal heads, push button units, and other equipment.

Cantilever Traffic Signal Poles

Cantilever poles will be installed on multi-lane approaches where there is a potential for a high sided vehicle, including buses, to block the clear visibility of the primary traffic signal of vehicles in the outer lanes. They will also be installed at locations where a median island is not available to mount a second primary, required to control separate streams on a particular arm of a junction.

Cantilever poles may also be used to provide a mounting structure for secondary signals, where a median is not available and a position on opposing primary pole is outside the required line of sight.

Roadside Cabinets

Most equipment locations will require a roadside cabinet to house and protect electronic, electrical and communications equipment. Due to Health and Safety, design, space, operational and maintenance constraints it is often necessary to separate these cabinets in accordance with their function. Typically, a junction will have cabinets for:

- Traffic Signal Control Cabinets;
- Fibre Breakout Cabinets; and
- Electricity supply Metering, Mini and Micro pillars

Cabinets are generally positioned to allow for ease of access by maintenance personnel and to minimise their impact on the receiving environment. When accessing cabinets, maintenance personnel will require a clear view of the associated equipment and of approaching vehicles, pedestrians, and cyclists. Cabinets are often position at the back of footpaths, to minimise the impact on the effective width of the footpath. They are often clustered together at a junction to minimise the amount of cabling between cabinets and to allow maintenance personnel to quickly shift operations from one cabinet to another.

In all cases the consideration of the siting of such roadside equipment will prioritise the access for pedestrians and cyclists in the area and balance the aesthetics of the urban realm with maintenance requirements.

12.5.2 Underground Infrastructure

The Proposed Scheme includes for a continuous underground ducting network to provide the necessary communications for devices including traffic signals and CCTV. Where practicable the Proposed Scheme shall utilise existing ducting and chambers to provide this continuity. Below ground infrastructure will include:

Ducts

Each device, mounting structure, and cabinet will have associated underground infrastructure including ducts for:

- **Power Cables** – installed equipment will require a power supply to function, this is facilitated by a ducting connection between the electricity supply point and equipment location. This connection is normally a single power supply duct.
- **Communication Cables** – to facilitate the provision of fibre optic cable along the scheme it will be necessary to provide a telecommunication ducting network consisting of two communication ducts, with chambers at 180m centres, along one side of the carriageway. This longitudinal ducting will be continuous along the length of the scheme, with local duct spurs to connect to cabinets and devices.
- **Device Cables** – devices will require cabling between field equipment and control equipment. For example, a ring of six ducts will be provided at each junction to allow for cabling between the traffic signal controller and the traffic signal poles. It is necessary when designing the ducting provision that sufficient spare capacity is provided to allow for changes to the field equipment, deployment of additional equipment, or damage to the ducting provision.

Chambers

Chamber will be required at the termination points of ducts, at regular intervals along ducts (180m), at changes in direction, and at breakout points for devices.

The position of chambers will be designed to be away from carriageways, pedestrian and cycle desire lines, and tactile paving. It is important when positioning chambers that they can be access in a safe manner, without the need for extensive traffic and pedestrian management.

Individual chambers will be designed and sized with consideration given to the number of ducts and cables that will be routed through the chamber, and the need to provide maintenance loops of cables within the chambers.

Unless prior agreement is in place, chambers will not be shared between users.

Foundations

All cabinets, poles and mounting structures will require a foundation or mounting frame to be constructed to allow for their installation.

It is envisaged that for traffic signal poles, 5m -8m CCTV poles, cantilever signal poles and other lightweight mounting structures that retention sockets will be installed to allow for the easy installation, maintenance and replacement of structures.

For larger structures, such a high CCTV masts, bespoke mass concrete foundations will be designed for incorporation into the works.

Cabinet mountings will be designed and constructed in accordance with the manufactures and local authorities' standard details, including the incorporation of required vaults, chambers, earthing rods and mats.

12.5.3 Traffic Signal Priority

Public transport priority will be provided through a number of passive and active means. The means of passive priority are discussed elsewhere in this document and are based on the design of the geometry, signing and road markings of the junctions. These include measures such as bus gates and bus lanes. Active priority will be facilitated through the detection of the public transport vehicle and communicating their presence to the Traffic Signal Controller for the implementation of measures on site.

The Local Authorities utilise different controllers and adaptive Urban Traffic Control systems. The systems can operate in several modes including adaptive, linked, vehicle actuated, scheduled plans and fixed time modes. Dublin City Council use Sydney Coordinated Adaptive Traffic System (SCATS) traffic signal controllers. South Dublin County Council use Split Cycle Offset Optimisation Technique (SCOOT) traffic signal controllers.

Detection will be based on the use of several different technologies, working in concert to provide comprehensive detection solutions. The detection types will include:

- Embedded Inductive loop detectors – induction detectors will be cut into the road surface at discrete positions around the junction to detect vehicles approaching, or departing from, the junction. The position and number of detectors will be dependent on the lane configuration and the type of traffic signal controller at the junctions. These embedded induction detectors will require ducting, chambers, and carriageway loop pots, to route the cables associated with the detector to the traffic signal controller.
- Specialised induction detectors – these can be utilised to detect cyclists on particular approaches to junctions. These detectors use a concentrated induction pattern to detect the passage of cyclists.

Above ground detection, including:

- Optical Detection – where it is impractical to install embedded inductive loop detectors into the carriageway, optical detection may be installed. Using these devices, a virtual detector is set up in the field of view that trigger alerts to the traffic signal controller.

  Optical detectors are generally installed on existing traffic signal poles, or cantilever traffic signal masts, to provide a clear view of the approach. Additional poles may need to be installed to provide the optimum field of view for particular approaches.
- Microwave/Radar Detection – Radar detection is used for pedestrian crossings, pedestrian wait areas, and cycle detection. Similar to the optical detection, virtual detection zones are set up in the radar field of view that trigger alerts to the traffic signal controller. Radar detectors are generally installed on existing traffic signal poles, or cantilever traffic signal masts, to provide a clear view of the approach. Additional poles may need to be installed to provide the optimum field of view for particular approaches.
- Push Button Units will be installed on traffic signal poles at pedestrian and cycle crossing points to allow the user to manually alert the traffic signal controller of their presence.

Additional inputs from the Automatic Vehicle Location System (AVLS) and Dedicated Short Range Communications (DSRC) devices can be provided to notify the Traffic Signal Controller of the presence of particular vehicles.

The Traffic Signal Controllers will detect the presence of vehicles, including identification of particular vehicles classes, and use this data to determine the timing to be applied to the junction in the current and upcoming cycles, including the provision of priority to particular traffic signal phases as programmed into the traffic signal plans.

12.6 Communications

Communications will be used to connect on-street devices with the appropriate traffic control rooms. The communications will take the form of:

- Fibre Optic Cable network.
- All local authorities operate fibre optic cable networks. It is envisaged that each of these networks will be extended along the length of the Proposed Scheme to provide high bandwidth/low latency communication to Traffic Signal Controllers, CCTV Cameras, and other apparatus deployed on the Proposed Scheme. Longitudinal ducting, provisionally two communications ducts, is required along the length of the Proposed Scheme with access chambers at 180m centres.
- Fibre breakout cabinets will be provided at each Traffic Signal Controller, or CCTV camera.

- Microwave Wireless Point-to-Point Links - Where it is not practicable to install ducting for fibre optic cable, or there is a need to provide a high bandwidth/low latency communication to a remote site or cell, point-to-point microwave communications will be provided to facilitate the communications link.
- Cellular Subscriber Networks (3G/4G/5G) - Cellular communications will be provided to low bandwidth devices such as RTPI and Variable Messages Signs (VMS).

12.7 Traffic Monitoring

The preliminary design proposes a comprehensive closed-circuit television (CCTV) camera deployment along the length of the Proposed Scheme at key locations including junctions. These cameras will enable the monitoring of traffic flows along the route and provide rapid identification of any events that are causing, or are likely to cause, disruption to bus services on the route and to road users in general.

The preliminary design for the CCTV locations has been prepared based on the use of high-definition cameras with a fibre-optic based communications network for the transmission of video. Additionally, a mains power source will be required at each location where a camera is installed. The cameras may be fixed position or pan, tilt and zoom (PTZ) depending on the most suitable option for a given location as well as general operational preferences for fixed or PTZ

Poles, between 5m - 8m, will be provided at each signalised junction, unless it is directly adjacent to another observed junction, and as such all approaches are covered by that CCTV. These CCTV poles will be erected using a retention socket as a foundation.

Higher CCTV masts may be provided at locations where longer fields of view are required, or where there is a need to mount wireless communications devices at positions to enable clear line of sight between linked devices. These CCTV masts will require a bespoke mass concrete foundation.

CCTV poles will be placed at positions, within the junction, to minimise the impact of solar glare, and to maximise the field of view of the CCTV. In all cases the consideration of the siting of such roadside equipment shall prioritize the health and safety for pedestrians and cyclists, access for pedestrians and cyclists in the area and the aesthetics of the street urban landscape.

12.8 Real-Time Passenger Information

RTPI will be provided at all of the proposed bus stops. This will comprise a “live” display identifying the estimated arrival time of each bus at the stop.

12.8.1 RTPI Display Positioning and Mounting

The RTPI display, where present, is typically located adjacent to the shelter on the same side as approaching buses so that people waiting at the stop can simultaneously view both the display and the oncoming buses.

Figure **12.1** below illustrates this.

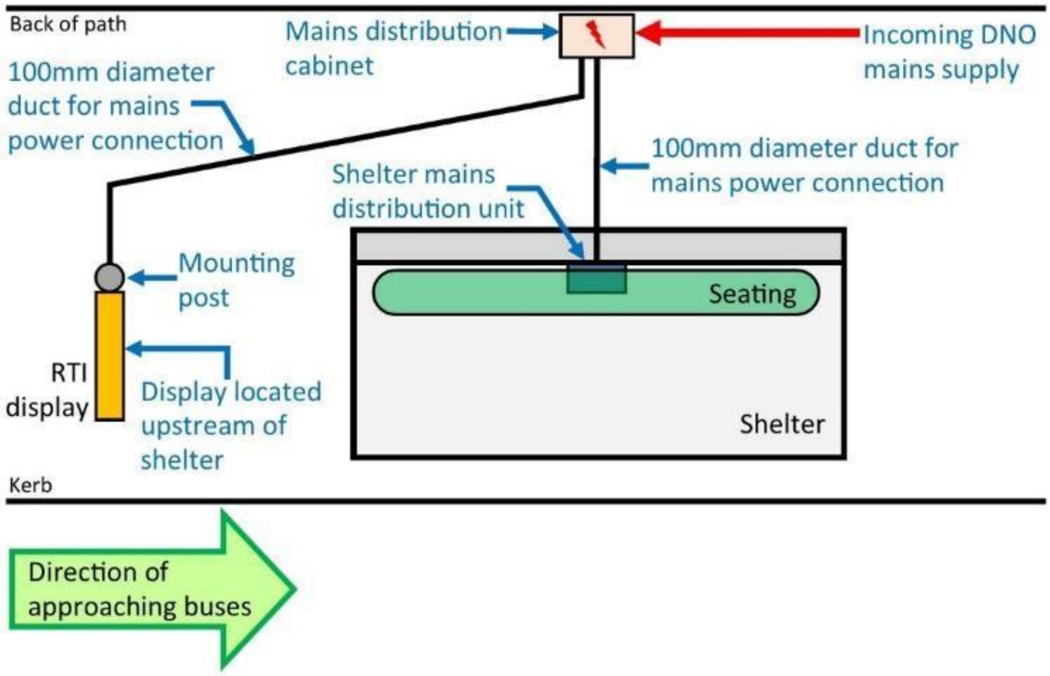


Figure 12.1: Typical layout for bus stop with RTPI display

The display is often placed around 4-5m from the shelter to maintain pedestrian access to the shelter while also enabling a clear view of the display from within the shelter. However, although this is considered the optimum position for a display, the precise location of it will be dictated by other site-based factors such as pedestrian and cyclist access (both to/from the stop and for those passing by) as well as requirements for other bus stop facilities such as waste bins, cycle storage and signage. Other physical restrictions (e.g. narrow footway, other street furniture, walls, and buildings) may also influence the exact location of the display at each stop.

12.8.2 Power Supply for RTPI Display and Bus Shelter

The stand-alone design of the proposed RTPI display means that a physical link between the display and the bus shelter is not required. However, the display will nonetheless require a connection to a mains power supply. This can be shared with the supply to the bus shelter, as shown in **Figure 12.1** from a mains distribution cabinet or feeder pillar located at the bus stop, where the mains service provider (DNO) will terminate its incoming connection. This cabinet /pillar will provide mains power to both the RTPI display and the shelter given the bus shelter needs a mains power supply.

The bus shelter will commonly include a mains power distribution unit for all of the equipment in the shelter that requires mains power - usually lighting and/or advertising. Most often this distribution unit is located under the seating, although it can vary according to the shelter design.

The shelter installer will provide a connection from this unit to the cabinet/pillar containing the mains power supply for the bus stop, as shown in **Figure 12.1**.

12.8.3 Data Communications for RTPI Display

The majority of RTPI systems currently in operation now use the mobile phone (GPRS/3G/4G) network as the method of data communication between each display and the central (“back office”) bus location/passenger information system. This comprises a small mobile network comms device (including the SIM card) installed within the RTPI display housing. It is assumed for the purpose of this design that such connectivity will be used for provision of RTPI on the Proposed Scheme with the mains power for the display - as described above – also providing power for this comms device. In this case no ducting will be required for data comms at the bus stop and the only physical connection to the display (i.e. ducting and cabling) will therefore be as described above for mains power.

12.9 Roadside Variable Message Signs

Consideration was also given to the inclusion of roadside Variable Message Signs (VMS) to provide traffic information to road users.

Existing VMS signs, at the below locations, are proposed to be relocated to a suitable location within the proposed junction/street layout:

- At the junction of Rathmines Road Upper/Rathgar Road;
- At the junction of Camden Street Upper/Charlotte Way;
- On Camden Street Lower outside of the Fresh store.

12.10 Safety and Security

The requirement for a pleasant, safe and secure environment for passengers waiting at Bus Stops and undertaking their journeys is a key component of the proposed public transport service. This is facilitated by the provision of:

- RTPI – Each stop will be provided with Real Time Passenger Information showing the estimated time of arrival of subsequent buses; and
- Public Lighting – each stop will have public lighting designed to ensure the safe operation of the stops in all lighting conditions and to enhance the sense of security at the stops.

12.11 Maintenance

All traffic signal, CCTV, and communications equipment shall be designed and located to be accessed and maintained frequently. All equipment shall be accessible without disrupting pedestrian, bicycle, or vehicle traffic and without the use of special equipment.

Apparatus will be designed and located to allow for easy access and the safe maintenance of the scheme into the future. This will include the provision of:

- Use of retention sockets, where applicable, for the erection of Traffic Signal, CCTV, Above Ground Detection, and other equipment mounting poles to allow for the ease of installation, maintenance and replacement;
- The use of lightweight equipment poles, where appropriate, such as cantilever signal poles. Consideration will be given to the selection of products that allow for maintenance activities to be undertaken from ground level, such as tilt down poles or poles with wind-down mechanisms;
- Placement of poles and retention sockets within 7m of chambers to e provide ease of installation and replacement of cables;
- Locating chambers away from pedestrian desire lines, and areas of tactile paving. This is to provide for a reduced impact of Traffic Management.
- On longitudinal duct runs, chambers to be placed at 180m centres to allow for the ease of installation and replacement of cables;
- Safe areas to be provided for the access and parking of maintenance vehicles; and
- Locating controller, and other, cabinets in positions that allow for safe access and clear visibility of the operation of the junction.

13 Land use and Accommodation Works

13.1 Summary of Land Use

The land use along the Proposed Scheme comprises a mix of residential and commercial properties. The various land uses are described in the sections below. The extent of the impact due to the Proposed Scheme on a landowner's holding is shown on the Compulsory Purchase Order maps.

The following is a description of the land use along the Proposed Scheme within the four scheme sections.

Section 1: Tallaght Road to Rathfarnham Road

The Tallaght to Terenure section commences on the Tallaght Road, east of the M50 interchange in a largely suburban area.

The Proposed Scheme follows the R137 along Tallaght Road and Templeogue Road until Terenure Cross, passing the amenity areas of Templeogue and Terenure Village and the Templeogue Tennis Club. There are no physical interventions proposed within Templeogue Village. The lands adjacent to this section of the Proposed Scheme, outside of the two villages, are largely suburban.

In this area, permanent land take is required from adjacent residential properties to accommodate widening required for the Proposed Scheme, resulting in the need to relocate boundary walls and gates at these properties. In this section temporary land take will be needed at these properties to construct new boundaries walls.

A list of these properties and the type of land take required is shown in Table 13.1.

Temporary land take is required within this section to facilitate:

- Footpath works and urban realm enhancement around a historic stone arch on Templeogue Road;
- Amendments at the entrance to Cheeverstown;
- Road widening and boundary works on Templeogue Road at some properties between Cypress Grove Road and Templeogue Village; and
- Footpath and cycle track improvement works through Bushy Park opposite Terenure College.

Section 2: Nutgrove Avenue to Terenure Road North – Grange Road, Rathfarnham Road

The Rathfarnham to City Centre section commences at the junction of Grange Road and Nutgrove Avenue. The Proposed Scheme continues citybound passing Rathfarnham Castle and through the amenity areas in Rathfarnham Village. This section of the Proposed Scheme is largely flanked by residential areas, with some commercial properties in Rathfarnham Village.

The Proposed Scheme continues through the junction with Dodder Park Road before crossing the River Dodder and travelling along Rathfarnham Road into Terenure Village, where it joins Section 1 of the Proposed Scheme. Again, this section of the Proposed Scheme is largely surrounded by residential lands until entering Terenure Village.

To accommodate the road layout, it is proposed to utilise limited land take from private properties in the Rathfarnham Wood development and green space in Rathfarnham Castle Park.

Along Rathfarnham Road, permanent land take is required from properties to accommodate widening required for the Proposed Scheme, resulting in the need to relocate boundary walls and gates at these properties. In this section temporary land take will be needed at these properties to construct new boundaries walls.

A list of these properties and the type of land take required is shown in Table 13.1.

Temporary land take is required within this section to facilitate:

- Footpath and cycle track works at the junction of Rathfarnham Wood/Nutgrove Avenue/Grange Road;
- Road widening and boundary works to properties within Rathfarnham Wood;
- Road widening and boundary works along Rathfarnham Castle grounds;
- Amendments at the entrance to Village Green;
- Road widening and boundary works at the petrol station on Rathfarnham Road near Rathfarnham village;
- Road widening and boundary works on Rathfarnham Road at some properties between Main Street Rathfarnham and Terenure Cross;
- Footpath and cycle track improvement works in the green area at the junction of Dodder Park Road / Rathfarnham Road;
- Road widening and boundary works at the laneway to Wasdale House on Rathfarnham Road; and
- Road widening and boundary works at the Terenure Synagogue on Rathfarnham Road.

Section 3: Terenure Road North to Charleville Road – Terenure Road East, Rathgar Road

Section 3 commences in Terenure village at the intersection of Section 1 and 2 of the Proposed Scheme. Between Terenure Road North and St. Joseph’s Church the proposed layout will allow for footpaths to be widened, and provide the opportunity for urban realm improvements.

The Proposed Scheme continues citybound towards the Rathgar Avenue junction. Due to the width constraints along this section of the corridor it is proposed to provide an alternative cycle facility consisting of cycle tracks in each direction along Terenure Road North and Harold’s Cross Road, connecting to the Kimmage to City Centre CBC at Harold’s Cross. An additional alternative cycle facility and quiet street is proposed along Bushy Park Road, Wasdale Park, Wasdale Grove, Victoria Road, Zion Road and Orwell Road to provide a secondary east-west route for cyclists travelling between the Proposed Scheme on Rathfarnham Road and Rathgar Road. A limited amount of land-take will be required on Terenure Road East, between St. Joseph’s Church and Brighton Road.

The Proposed Scheme passes residential areas, a handful of local business fronts and a church along Rathgar Road as it makes its way towards Rathmines. The only land acquisition required on Rathgar Road is to improve the entrance at 125 Rathgar Road.

In this area, primarily along Terenure Road East, permanent land take is required from properties to accommodate widening required for the Proposed Scheme, resulting in the need to relocate boundary walls and gates at these properties. In this section, temporary land take will be needed at these properties to construct new boundaries walls.

A list of these properties and the type of land take required is shown in Table 13.1.

Temporary land take is required within this section to facilitate:

- Road widening and boundary works on Terenure Road East at some properties between Terenure Cross and Brighton Road;
- Amendments at the entrance to 125 Rathgar Road; and
- Amendments at the entrance to Eaton Hall.

Section 4: Charleville Road to Dame Street

Section 4 of the Proposed Scheme starts at the junction of Charleville Road and Rathgar Road in a town centre setting, surrounded by commercial properties and businesses. This environment and surrounding land use continues as the Proposed Scheme travels north towards the City Centre, along Rathmines Road, past various public amenities including a leisure centre, cinema and a shopping centre.

As the Scheme approaches the Canal on Rathmines Road Lower it passes St. Mary’s College and a church as the commercial frontages are swapped for residential properties on either side.

The scheme crosses the canal over La Touche Bridge, adjacent to Portobello College, and Rathmines Road Lower becomes Richmond Street South where the residential road frontages make way for restaurants and shops.

Through Camden Street and past Cuffe Street the scheme passes restaurants, pubs, hotels, and various commercial properties as it approaches Dame Street where the Proposed Scheme ends.

The works within this section sit within the existing road boundary with minimal land take and accommodation works required.

In this area, permanent land take is required from private landings to accommodate the Proposed Scheme.

A list of these properties and the type of land take required is shown in Table 13.1.

Temporary land take is required within this section to facilitate:

- Amendments at the entrance to Lissenfield;
- Relocation of coal holes at 44 and 45 Richmond Street South;

13.2 Summary of Compulsory Land Acquisition

From the commencement of the design of the Proposed Scheme, every effort has been made to minimise compulsory land acquisition. However, there are a number of public and private lands that are required to meet the objectives of the Proposed Scheme.

In total approximately 1.7ha. of land will be required to be permanently acquired, of which approximately 0.87ha. is currently in DCC ownership and 0.58ha. is currently in SDCC ownership, to construct the scheme. There will also be an additional 1.33ha. of land required to be temporarily acquired to allow for construction of boundary treatment and surface tie in work. This includes approximately 0.12ha. which is currently in DCC ownership and 0.9ha which is currently in SDCC ownership.

Reference should be made to the 'Compulsory Purchase Order (CPO) Documents' prepared as part of the planning application for further details.

13.3 Summary of Impacted Landowners/Properties

In order to decide what existing landowners/properties would be affected by the Scheme a desktop study was carried out. This desktop study highlighted any property within 5m of the Proposed Scheme, whether they would be impacted by the proposed infrastructure or otherwise.

This list has then been reduced to landowners/properties being impacted by the Proposed Scheme on the basis of the preliminary design. These landowners/properties haven then received notifications, via email, of the potential impact on their property. The properties being impacted are listed in Table 13.1

Table 13.1: List of affected properties

Address	Permanent Land Take	Temporary Land Take
Lands at Templeogue Arch, adjacent R137 Templeogue Road, Dublin 6W	Y	Y
Entrance to Cheeverstown, R137 Templeogue Road, Dublin 6W	Y	Y
327 Templeogue Road, Templeogue, Dublin 6W, D6WCA36	Y	Y
325 Templeogue Road, Templeogue, Dublin 6W, D6WHD56	Y	Y
323 Templeogue Road, Templeogue, Dublin 6W, D6WXE08	Y	Y
321 Templeogue Road, Templeogue, Dublin 6W, D6WFT93	Y	Y
319 Templeogue Road, Templeogue, Dublin 6W, D6WDE42	Y	Y
317 Templeogue Road, Templeogue, Dublin 6W, D6WXE93	Y	Y
Lands at Ashfield Place, Templeogue Road, Dublin 6W	Y	Y
315 Templeogue Road, Templeogue, Dublin 6W, D6WF765	Y	Y
313 Templeogue Road, Templeogue, Dublin 6W, D6WER28	Y	Y
311 Templeogue Road, Templeogue, Dublin 6W, D6WN276	Y	Y
44 Templeogue Road, Templeogue, Dublin 6W, D6W NH33	Y	Y
45 Templeogue Road, Templeogue, Dublin 6W, D6WNR25	Y	Y
11 Fortrose Park, Templeogue, Dublin 6W, D6WT254	Y	Y

Address	Permanent Land Take	Temporary Land Take
14 Fortrose Park, Templeogue, Dublin 6W, D6WPT72	Y	Y
15 Fortrose Park, Templeogue, Dublin 6W, D6WRW35	Y	Y
Open Space at Bushy Park, Templeogue, Dublin 6W	Y	Y
Open Space adjacent to Rathdown Park, Templeogue, Dublin 6W	Y	
Entrance to Rathfarnham Wood estate, Rathfarnham, Dublin 14	Y	Y
Open Space to the south-east of the junction of Grange Road and Nutgrove Avenue	Y	
Open Space to the south-west of the junction of Grange Road and Nutgrove Avenue	Y	
8 Rathfarnham Wood, Rathfarnham, Dublin 14, D14C1W3	Y	Y
9 Rathfarnham Wood, Rathfarnham, Dublin 14, D14Y0H2	Y	Y
10 Rathfarnham Wood, Rathfarnham, Dublin 14, D14T2P5	Y	Y
11 Rathfarnham Wood, Rathfarnham, Dublin 14, D14X5X4	Y	Y
12 Rathfarnham Wood, Rathfarnham, Dublin 14, D14E4Y1	Y	Y
Lands at Rathfarnham Castle, Rathfarnham, Dublin 14	Y	Y
Private Landing at Moto4u, Rathfarnham, Dublin 14	Y	
Entrance to Village Green, Rathfarnham, Dublin 14		Y
Open space adjacent Dodder View Road at Woodview Cottages, Rathfarnham, Dublin 14		Y

Address	Permanent Land Take	Temporary Land Take
Open space adjacent Spawell, Templeogue, Dublin 6w		Y
Rathfarnham Service Station, Rathfarnham Road, Rathfarnham, Dublin 14	Y	Y
153 Rathfarnham Road, Rathfarnham, Dublin 14, D14F439	Y	Y
151 Rathfarnham Road, Rathfarnham, Dublin 14, D14Y8W3	Y	Y
149 Rathfarnham Road, Rathfarnham Dublin 14, D14PX38	Y	Y
147 Rathfarnham Road, Rathfarnham, Dublin 14, D14K6N6	Y	Y
145 Rathfarnham Road, Rathfarnham Dublin 14, D14F384	Y	Y
143 Rathfarnham Road, Rathfarnham Dublin 14, D14YC56	Y	Y
141 Rathfarnham Road, Rathfarnham, Dublin 14, D14KN28	Y	Y
Open space south-west of Dodder Park Road/Rathfarnham Road junction, Rathfarnham, Dublin 14	Y	
Open space south-east of Dodder Park Road/Rathfarnham Road junction, Rathfarnham, Dublin 14	Y	Y
71 Rathfarnham Road, Terenure, Dublin 6W, D6WHF22	Y	Y
69 Rathfarnham Road, Terenure, Dublin 6W, D6WWR26	Y	Y
67 Rathfarnham Road, Terenure, Dublin 6W, D6WP621	Y	Y
65 Rathfarnham Road, Terenure Dublin 6W, D6WYY48	Y	Y
63 Rathfarnham Road, Terenure, Dublin 6W, D6WYT96	Y	Y

Address	Permanent Land Take	Temporary Land Take
61 Rathfarnham Road, Terenure, Dublin 6W, D6WFD92	Y	Y
59 Rathfarnham Road, Terenure, Dublin 6W, D6WAK70	Y	Y
57 Rathfarnham Road, Terenure, Dublin 6W, D6WHY28	Y	Y
55 Rathfarnham Road, Terenure, Dublin 6W, D6WX314	Y	Y
53 Rathfarnham Road, Terenure, Dublin 6W, D6WT027	Y	Y
51 Rathfarnham Road, Terenure, Dublin 6W, D6WN970	Y	Y
50 Rathfarnham Road, Terenure, Dublin 6W, D6WPF88	Y	Y
48 Rathfarnham Road, Terenure, Dublin, 6W D6WVY84	Y	Y
46 Rathfarnham Road, Terenure, Dublin 6W, D6WF348	Y	Y
44 Rathfarnham Road, Terenure, Dublin 6W, D6WPX79	Y	Y
42 Rathfarnham Road, Terenure, Dublin 6W, D6WNY67	Y	Y
Entrance to Wasdale House and McGlynn Cars, Terenure, Dublin 6W	Y	Y
40 Rathfarnham Road, Terenure, Dublin 6W, D6WA037	Y	Y
38 Rathfarnham Road, Terenure, Dublin 6W, D6WAW74	Y	Y
36 Rathfarnham Road, Terenure, Dublin 6W, D6WW302	Y	Y

Address	Permanent Land Take	Temporary Land Take
34 Rathfarnham Road, Terenure, Dublin 6W, D6WA250	Y	Y
Terenure Synagogue, 32A Rathfarnham Road, Dublin 6W, D6WVE89	Y	Y
Private Landing outside Terenure Enterprise Centre, 17 Rathfarnham Road, Dublin 6W	Y	
80 Earls Court, Terenure Road East, Dublin 6.	Y	Y
78 Terenure Road East, Terenure, Dublin 6, D06X785	Y	Y
76A Annesley Lodge, Terenure Road East, Terenure, Dublin 6	Y	Y
76 Terenure Road East, Terenure, Dublin 6, D06Z785	Y	Y
74 & 74A Terenure Road East, Terenure, Dublin 6, D06 CA44	Y	Y
9 Town Houses, Terenure Rd East, Dublin 6, D06DY89	Y	Y
8 Town Houses, Terenure Rd East, Dublin 6, D06P3Y2	Y	Y
7 Town Houses, Terenure Rd East, Dublin 6, D06A3T9	Y	Y
6 Town Houses, Terenure Rd East, Dublin 6, D06F7V2	Y	Y
5 Town Houses, Terenure Rd East, Dublin 6, D06N9W4	Y	Y
4 Town Houses, Terenure Rd East, Dublin 6, D06W2A0	Y	Y
3 Town Houses, Terenure Rd East, Dublin 6, D06Y4A7	Y	Y
2 Town Houses, Terenure Rd East, Dublin 6, D06N2V0	Y	Y
1 Town Houses, Terenure Rd East, Dublin 6, D06A2Y9	Y	Y

Address	Permanent Land Take	Temporary Land Take
69 Terenure Rd E, Terenure, Dublin 6, D06 P6C6	Y	Y
67 Terenure Rd E, Terenure, Dublin 6, D06 HP60	Y	Y
65 Terenure Rd E, Terenure, Dublin 6, D06YR84	Y	Y
63 Terenure Rd E, Terenure, Dublin 6, D06EW73	Y	Y
61 Terenure Rd E, Terenure, Dublin 6, D06HP60	Y	Y
59 Terenure Rd E, Terenure, Dublin 6, D06N1K6	Y	Y
Laneway adjacent 59 Terenure Road East, Dublin 6	Y	Y
62 Terenure Road E, Terenure, Dublin 6	Y	Y
Beaumont House / 60 Terenure Road E, Terenure, Dublin 6	Y	Y
58 Terenure Rd E, Terenure, Dublin 6	Y	Y
56 Terenure Rd E, Terenure, Dublin 6	Y	Y
54 & 52 Terenure Rd E, Terenure, Dublin 6	Y	Y
Entrance to 125 Rathgar Road, Rathfarnham, Dublin 6	Y	Y
Entrance to Lissenfield, Rathmines, Dublin 6		Y
Private Landing outside 34-35 Richmond Street South, Dublin 2	Y	
Private Landing outside 12 Richmond Row, Dublin 2	Y	
Private Landing outside 36-37 Richmond Street South, Dublin 2	Y	
Private Landing outside 38 Richmond Street South, Dublin 2	Y	

Address	Permanent Land Take	Temporary Land Take
Private Landing outside 44 Richmond Street South, Dublin 2	Y	
Private Landing outside 45 Richmond Street South, Dublin 2	Y	
Private Landing at 48 Harrington Street, Dublin 8	Y	
Private Landing at 12 Camden Street Upper, Dublin 2	Y	
Private Landing outside 61 Camden Street Lower, Dublin 2	Y	
Private Landing outside 62 Camden Street Lower, Dublin 2	Y	
Private Landing outside 63 Camden Street Lower, Dublin 2	Y	
Private Landing outside 64 Camden Street Lower, Dublin 2	Y	
Private Landing outside 65 Camden Street Lower, Dublin 2	Y	
Private Landing outside 66 Camden Street Lower, Dublin 2	Y	
Private Landing outside 67 Camden Street Lower, Dublin 2	Y	
Private Landing outside 68 Camden Street Lower, Dublin 2	Y	
Private Landing outside 69 Camden Street Lower, Dublin 2	Y	
Private Landing outside 70 Camden Street Lower, Dublin 2	Y	
Private Landing outside 71 Camden Street Lower, Dublin 2	Y	
Private Landing outside 72-73 Camden Street Lower, Dublin 2	Y	
Private Landing outside 83-83A Camden Street Lower, Dublin 2	Y	
Private Landing outside 84 Camden Street Lower, Dublin 2	Y	
Entrance to Eaton Hall		Y

13.4 Demolition

It is envisaged that demolition works will be primarily limited to the demolition of boundary walls along the Proposed Scheme. It is noted however that in several specific locations, due to widening of the roadway into adjacent gardens, that existing garden sheds will be required to be demolished. The sheds to be demolished are located within the following properties:

- 10 Rathfarnham Wood, Rathfarnham, Dublin 14, D14T2P5;
- 11 Rathfarnham Wood, Rathfarnham, Dublin 14, D14X5X4;
- 14 Fortrose Park, Templeogue, Dublin 6W, D6WPT72; and
- 15 Fortrose Park, Templeogue, Dublin 6W, D6WRW35.

The demolition works shall be in accordance with the specific demolition items set out the following National Standards and guides:

- I.S EN 1991-1-6:2005 – Actions on Structures: General Actions – Actions During Execution (Including National Annex)
- BS 6187:2011 – Code of practice for full and partial demolition
- BS 5228 – Code of practice for noise and vibration control on construction and open sites – Part 1: Noise
- BS 5228 – Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration

All reasonable precautions to prevent pollution of the site, works and the general environment including streams and waterways to be taken.

All demolition waste to be segregated and, where practicable, sent for recycling. All in accordance with guidelines as set out by the National Construction and Demolition Waste Council (NCDWC).

A waste management plan following guidelines as set out by the NCDWC shall be produced outlining the proposals with respect to waste recycling, segregation and details of landfill proposals with target percentage of each element. The following legislation should be noted:

- Protection of the Environment Act 2003.
- Waste Management (Amendment) Act 2001.
- Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste.
- EU Council Decision on Waste Acceptance (2003/33/EC).
- WMA Amendment Act (#2) 2001.
- Protection of the Environment Act No. 27 2003.
- Best practice Guidelines on the preparation of Waste Management Plans for Construction and Demolition Waste
- Department of Environment, Heritage and Local Government July 2006

13.5 Summary of Accommodation Works and Boundary Treatment

This section outlines the proposed design of the accommodation works along the Proposed Scheme. All directly impacted landowners have been written to and follow-up telephone calls offered to each directly impacted landowner. A number of meetings and telephone calls have taken place with directly impacted landowners.

All requests made by the directly impacted landowners and the general public have been evaluated and, where it was deemed appropriate, in the context of not impacting on the objectives of the Proposed Scheme, have been included in the preliminary design.

The proposed accommodation works consist of relocated boundary walls and gates, and the regrading of driveways and adjacent grassed areas, where deemed necessary. Where driveways are proposed to be regraded, a maximum gradient of 5% in accordance with Recommendations for Site Development Works for Housing Areas, Dept. of the Environment and Local Government, 1998 has been adopted, where practicable.

Where boundary walls are being relocated and the existing access is less than 3.6m in width, the maximum width of new accesses will be 3.6 m, with the new driveway tying in with the existing driveway at the temporary land acquisition boundary. The proposed maximum width is consistent with Dublin City Council's 'Parking Cars in Front Gardens' document.

Where cellars and private landings are affected by the Proposed Scheme pre-construction and post construction surveys will be performed by the appointed contractor. It will be determined during the detailed design stage if strengthening works are required to any existing structures, impacted by the Proposed Scheme.

To maintain the character and setting of the Proposed Scheme, the approach to undertaking the new boundary treatment works along the corridor is replacement on a 'like for like' basis in terms of material selection and general aesthetics, unless otherwise noted on the drawings. Final details of boundary walls, gates, driveways and grassed areas where affected, will be agreed between the directly impacted landowners and the NTA. Final details of boundary walls, gates and driveways will be agreed between the affected landowners and NTA during the accommodation works negotiations.

14 Landscape and Urban Realm

14.1 Overview of Landscape and Urban Realm

Urban Realm refers to the everyday street spaces that are used by people to shop, socialise, play, and use for activities such as walking, exercise or to commute to/from work. The Urban Realm encompasses all streets, public spaces, junctions and other rights-of-way, whether in residential, commercial or civic use. Well-designed urban realm contributes to the identity of localities and enhances the everyday lives of local communities and those passing through. It typically relates to the space between buildings to which the public has free access and may include seating, trees, planting and other features that enhance the experience for all.

Successful urban realms or public open space tend to have certain characteristics including:

- being welcoming and appealing;
- having a distinct identity;
- being pleasant and safe; and
- are easy to move through.

Guidance

In addition to the overarching aims and objectives for the design of Landscape and Urban Realm, the South Dublin County Development Plan 2022-2028, the Dún Laoghaire-Rathdown Development Plan 2022-2028 and the Dublin City Development Plan 202 –2028 include a range policies and objectives that have been considered in developing landscape and urban realm proposals. The objectives and concepts contained in the *BusConnects Urban Realm Concept Designs* (https://busconnects.ie/wp-content/uploads/2021/01/busconnects-urban-realm-concept-designs.pdf) have also been referenced as a basis for the proposals.

South Dublin County Development Plan 2022-2028

The South Dublin County Development Plan 2022-2028 is the county level planning framework applicable to the section of the Proposed Scheme south of the River Dodder.

- Chapter 3 Natural, Cultural and Built Heritage sets out policies and objectives in relation to the protection and enhancement of built heritage and architectural conservation, landscapes, natural heritage sites, public rights of way, Tree Preservation Orders (TPO’s), cultural heritage and sites of geological heritage.
- Chapter 4 sets out policies and objectives in relation to appropriate development, enhancement and protection of green infrastructure networks, including green infrastructure in urban areas, watercourse network, public open space hierarchy and landscape setting and sustainable urban drainage systems (SuDS).

- Chapter 5 details objectives related to placemaking and urban design including best practice principles.
- Chapter 7 Sustainable Movement includes for policies and objectives in relation to public transport, walking and cycling and strategic cycle networks.

Dún Laoghaire-Rathdown County Development Plan 2022-2028

The Dún Laoghaire-Rathdown County Development Plan 2022-2028 is the county level planning framework applicable to a small section of the Proposed Scheme at Nutgrove Avenue.

- Chapter 5 details objectives related to transport and mobility including policy objective T6 which relates to the delivery of a quality bus network.
- Chapter 8 Green Infrastructure and Biodiversity sets out appropriate development, enhancement and protection of green infrastructure networks.
- Chapter 10 sets out policies and objectives in relation to Environmental Infrastructure and Flood Risk.

Dublin City Development Plan 2022-2028

The Dublin City Development Plan 2022-2028 is the county level planning framework applicable to the section of the Proposed Scheme north of the River Dodder.

- Chapter 9 Sustainable Environmental Infrastructure and Flood Risk includes Policy SI22 to use SuDS in all new developments where appropriate, as set out in the Greater Dublin Regional Code of Practice for Drainage Works.
- Chapter 10 Green Infrastructure and recreation includes Objective GI08 to support the implementation of the Dublin City Biodiversity Action Plan 2021-2025 and reflects the Strategic Objectives of Ireland’s National Biodiversity Plan (Actions for Biodiversity 2017-2021)
- Chapter 10 Green Infrastructure also includes the Dublin City Tree Strategy 2016-2020 incorporating a set of policies for the long-term promotion and management of public trees in Dublin and Objective GI40 to identify opportunities for new tree planting.

Dublin City Tree Strategy 2016-2020

A set of policies for the long-term promotion and management of public trees in Dublin.

“Within the city, trees clean the air, provide natural flood defences, mask noise and promote a general sense of wellbeing”.

Dublin City Biodiversity Action Plan 2021-2025

Covers all areas of the City including roadsides and footpaths and reflects the Strategic Objectives of Ireland’s National Biodiversity Plan (Actions for Biodiversity 2017-2021)

- Strengthen the knowledge base of decision makers to protect species and habitats;
- Strengthen the effectiveness of collaboration between all stakeholders for the conservation of biodiversity in the greater Dublin region;
- Enhance opportunities for biodiversity conservation through green infrastructure and promote ecosystem services in appropriate locations throughout the City; and,
- Develop greater awareness and understanding of biodiversity and identify opportunities for engagement with communities and interest groups.

14.2 Consultation with Local Authority

Consultation has taken place with SDCC and DCC during the design process to understand the Landscape and Urban Design objectives of the Local Authority in the context of the Proposed Scheme.

14.3 Landscape and Character Analysis

The landscape and urban realm proposals are derived from analysis of the existing urban realm, including existing street and public space character, heritage features, boundaries, tree planting and vegetation, and the range of contemporary and heritage materials in use that inform the quality and character of different parts of the overall route.

This analysis identified the range of character areas along different parts of the route informed by adjacent land uses fronting onto the route; the character and heritage of buildings including any protected structures and private gardens or grounds; the nature and presentation of any boundary walls, railings or hedgerows; existing street trees or vegetation and the nature and quality of streetscape materials.

This analysis provided an understanding of the existing character areas along the route and facilitated detailed and iterative consideration as to the integration of the Proposed Scheme. This analysis informed design changes to the initial proposals so as to avoid adverse impacts of existing streetscape character, and also identified opportunities for enhancement and creation of new spaces along the route. Character analysis also informed the development of mitigation proposals where public or private property would be directly impacted by the Proposed Scheme.

14.4 Arboricultural Survey

14.4.1 Scope of Assessment

An Arboricultural Impact Assessment Report (AIAR), included in Appendix D was prepared based on a detailed tree survey along the proposed scheme corridor and following the requirements of BS5837:2012 *Trees in relation to design demolition and construction – Recommendations.*

The AIAR documents the nature, quality and condition of existing trees along and adjacent to the route and identifies the likely direct and indirect impacts of the proposed development on such trees. It then makes recommendations as to trees that should and/or will need to be removed and identifies trees in relative proximity to the proposed works and construction wayleaves that should be protected during construction, with suitable mitigation measures, as appropriate. The identified trees to be removed, and the Arboricultural Method Statement sets out how retained trees are to be successfully protected.

The AIAR includes the following:

- Description of the site/route and summary of the trees surveyed;
- Summary of any statutory or non-statutory designations affecting trees within the survey area;
- A brief summary of trees to be removed;
- Outline guidance for the design team and any key considerations, or issues which need to be addressed;
- Schedule and corresponding drawings of surveyed trees and key;
- Recommendations for tree works and incursions related to the proposed development; and
- Tree Protection Plans.

14.5 Hardscape

Throughout the design process, a palette of materials has been developed to create a consistent yet locally relevant design response appropriate to different locations along the route. The proposed materials are based on the existing materials and treatments along various parts of the route to match existing material treatments, while also identifying areas of opportunity for enhancement through the use of higher quality materials. Material palettes are described by reference to different typologies appropriate to different sections of the route.

14.5.1 Material Typologies

The proposed material typologies employed in the preliminary design are described as:

- Poured in-situ concrete pavement - Used extensively on existing footpaths. Concrete pavements can be laid with or without a kerb, can have neatly trowelled edges and textured surface for a clean, durable, slip resistant surface;
- Asphalt footpath – Used locally on existing footpaths and will tie in with other sections of public realm. Laid with a road kerb, can have a smooth finish or textured aggregate surface, provides a strong flexible slip resistant surface;
- Precast concrete unit paving - Concrete paving slabs and bricks available in a wide variety of sizes, colours and finishes to provide an enhanced public

realm. Can be used with matching concrete kerbs or with salvaged natural stone kerbs as appropriate;

- Natural stone paving - Employed for high quality urban realm areas, mostly in city centre locations. This typology represents new or re-used natural stone paving and kerbs and is used to create enhanced public spaces for major urban realm interventions;
- Stone or Concrete setts - Proposed for distinguishing features such as pedestrian crossing points, raised tables and parking/set-down areas;
- Self-binding gravel - Proposed for pedestrian pathways that are off-road and leading through informal landscaped areas; and
- No change - At some locations, the proposed scheme does not necessitate any alteration to the alignment of the existing footpath or roadway. These include established and more recently constructed sections of streetscape.

Detailing

The design considers re-use of existing high-quality and natural stone kerbs so as to maintain streetscape character, reduce construction costs and maximise sustainability.

Pedestrian crossings at side streets will be raised where practicable and will be distinguished using stone or concrete setts as appropriate to the locality.

In some locations, existing street trees have disturbed or damaged footpath surfaces. The footpath around such trees will be replaced where appropriate with self-binding gravel so as improve the vitality of the trees and ensure accessible pedestrian facilities.

Sustainable Drainage Systems (SuDS) will be incorporated within hardscape areas to locally manage surface water run-off and reduce demand for piped surface water drainage infrastructure.

Informal footpaths through landscaped areas that are set back from the main carriageway will be formed using self-binding gravel as an alternative to asphalt or concrete.

Where private or commercial property boundaries are realigned, boundary walls and railings will be reinstated to match the existing and may be extended to other properties along the same street to enhance streetscape character.

Existing street furniture such as seating will be relocated within the revised streetscape and new street furniture will be provided at locations where opportunity sites have been identified to establish or enhance public spaces.

Hardscape works will be complemented by soft landscaping including trees, hedgerows, native planting, ornamental planting, amenity grass areas and species rich grasslands as appropriate. Soft landscaping will enhance the amenity value and visual character of streets and spaces, mitigate the loss of existing trees, and enhance ecological value along the route.

14.6 Softscape

Softscape refers to existing trees including street trees and groups of trees or woodland areas, new tree planting, hedgerows, ornamental planting and amenity grasslands. Softscape plays an important role in ensuring that streets and public spaces are attractive and healthy spaces for the local community, but also in providing better air quality, managing surface water run-off and in maintaining and creating habitats.

14.6.1 Planting Strategy

The planting strategy has been developed in response to the objectives of the Proposed Scheme and as set out in both the South Dublin County Council Development Plan 2016 –2022 and the Dublin City Development Plan 2016 – 2022. The planting strategy is also in response to landscape and urban realm opportunities arising from the Proposed Scheme to integrate new infrastructure within the existing local context and to enhance the visual and amenity value of streets and spaces.

The overarching planting strategy is to retain established trees and vegetation wherever practicable for their arboricultural, amenity and biodiversity value.

The Arboricultural Survey described in Section 14.4 above identified trees and groups of trees along the route and provided a detailed schedule of the characteristics, vitality and quality of trees. The Arboricultural Impact Assessment Report (AIAR) was prepared by overlaying the Proposed Scheme General Arrangement with the tree survey so as to identify trees or groups of trees that might be impacted by the scheme. The AIAR includes recommendations for the retention, removal or management of trees and identifies trees that will be impacted by virtue of the Proposed Scheme. It also sets out tree protection measures for trees adjacent to the Proposed Scheme that might otherwise risk damage during construction.

The planting strategy includes replacement of street trees and groups of trees that may be impacted by the Proposed Scheme, but also the introduction of new tree planting and street trees within other spaces and along streets. Reinforcement of green infrastructure along the route will improve the overall amenity, character and appeal of the route corridor and localities along it, as well as enhancing biodiversity.

In addition to trees and street trees, other vegetation is also proposed along the route including hedgerows, ornamental planting and amenity grassland, shrub and meadow grass areas. These will be utilised to reinstate property boundaries altered by the Proposed Scheme.

Throughout the design process, collaboration between the Landscape and Urban Realm designers and the Drainage Engineers has sought to adopt Sustainable Drainage Solutions (SuDS) to manage storm water run-off. SuDS features have been considered along the route and incorporated within suitable landscape areas in the form of rain gardens, bioretention areas, filter drains, swales, tree pits and permeable paving.

Refer to Table 14.1 for Tree and Woodland/Tree Group Schedule for an overview of the net increase in tree planting along the route that will result from the Proposed Scheme and Table 14.2 for Proposed Tree Planting Species. Each table included at the end of this Chapter.

Refer to Table 14.3 for Schedule of Proposed Planting Areas, Table 14.4 for Proposed Hedgerow Species, Table 14.5 for Proposed Native Planting Species, and Table 14.6 for Proposed Ornamental Planting Species.

Plant species have been chosen to provide biodiversity benefits and the tables note the various benefits for wildlife.

14.6.2 Typical Planting Typologies

A range of general planting typologies are incorporated into the Proposed Scheme as appropriate to localities and character areas along the route. In some instances, planting is focussed on reinstatement and repair of existing woodland or tree group areas that will be impacted to facilitate construction of new footpaths, cycle tracks and road infrastructure. In other cases, planting is focussed on enhancing the amenity, green infrastructure and biodiversity along the route and in providing distinctive and attractive places for people to gather and relax.

New Street Trees

A range of urban street tree species (Figure 14.1) have been incorporated into the overall route design depending on location and whether trees are to be planted in grass verges or in tree pits within paved urban environments as appropriate, and also to ensure diversity of species and provide habitats for urban wildlife.

Typically, trees will be semi-mature and have a tree girth of 14/16 cm or 16/20 cm and where appropriate, selected for having a clear stem height to facilitate visual permeability. These sizes have been chosen to provide the best initial impact on the streetscape whilst ensuring trees are young and compact enough to establish well. The full range are included in Table 14.1 and Table 14.2.

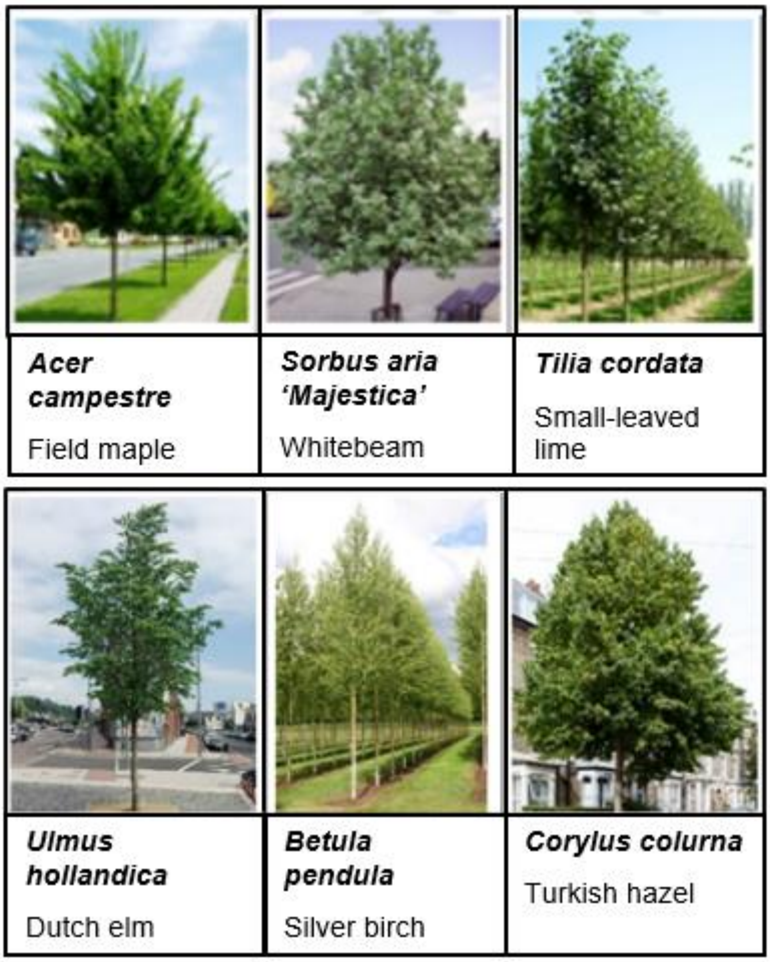


Figure 14.1: Street tree types

New Woodland Areas and Tree Groups

The Proposed Scheme includes a range of existing mature and immature woodlands areas. Some of these will be impacted where the existing carriageway will be widened or cycling infrastructure will be provided. It is proposed to reinstate construction working areas and also to replant the edges of impacted woodland areas, so as to reinstate the streetscape or roadway character. Additionally, there are areas of land within the corridor that are presently in grass or scrub, and new woodlands areas will be established in these locations to offset the loss of woodlands elsewhere and to provide more consistent presentation along carriageway edges.

Woodland tree planting will typically comprise bare-root native tree species including *Alnus glutinosa* (Black Alder), *Salix aurita, Salix cinerea oleifolia, Salix caprea*, *Salix petrandra* (Willow sp.), *Betula pendula* (Silver Birch), *Pinus sylvestris* (Scots Pine*), Crataegus monogyna* (Hawthorn), *Quercus petraea* (Sessile Oak), *Prunus spinosa* (Blackthorn) and *Viburnum opulus* (Guelder Rose).

Elsewhere along the Proposed Scheme, there are smaller areas of existing and proposed woodlands and tree groups that will be retained, reinstated or established in order to provide appropriate landscaping connectivity and design interventions at a range of different spaces, including carriageway boundaries, new landscape spaces arising from junction reconfiguration, reinforcement of established vegetation areas, and also establishing new public realm and landscape opportunity areas. Tree species will be determined by location and will comprise either native woodland trees as set out above, or selected street trees as set out in Table 14.2. Additionally, understory planting, long grass and swathes of bulbs will be provided to reinforce the character of landscaped areas along the scheme corridor.

A number of different landscaped central median areas exist along the scheme, including those within high-capacity dual carriageway and smaller scale medians within suburban and urban settings. Landscaping proposals respond to the different localities and may include grass planting, hedgerows and trees as appropriate in medians within the larger scale roadways, and grasses, ornamental planting, hedgerows and trees within the suburban and urban medians.

Boundary Planting

The Proposed Scheme is bounded by a wide range of established private, commercial, institutional and public land boundaries. While the design development has sought to avoid impacts on such boundaries, the Proposed Scheme will nonetheless require both temporary and permanent access to lands beyond the carriageway boundary.

Impacted property boundaries will be reinstated following construction. In some instances, boundaries will be re-built along their original alignments. In other cases, boundaries will be re-built on a new setback alignment. In general, property boundaries will be reinstated on a ‘like for like’ basis, including any walls, piers, fences, railings, gates, driveway finishes and private landscaping.

Private grounds that are utilised in part for construction access will be reinstated following completion of the works to match the existing landscaping of the property. Where private grounds are reduced by virtue of permanent land take required for the scheme, the remaining grounds will be reinstated to match the landscape and character of the existing grounds in consultation with the property owner.

14.7 Proposed Landscape and Landscape and Urban Realm Design

This section outlines the landscape and urban realm proposals along the Proposed Scheme. The landscape design is presented on a series of 1:500 scale Landscaping General Arrangement Drawings in Appendix B that include the combined hard and soft landscaping proposals for the entire route. These drawings included the general arrangement of the proposed layout and identify in particular:

- Existing trees and woodland/tree group areas;

- Tree and woodland/tree group felling;
- The location and extent of existing hard landscaping surfaces to be retained;
- The location and extent of new hard landscaping surfaces to be formed using different materials;
- proposed trees and woodland/tree groups;
- Proposed grass verges, amenity areas and species rich grass land;
- Proposed ornamental planting, native planting and hedgerows; and,
- Sustainable Urban Drainage (SuDS) infrastructure.

Additionally, along the scheme corridor, a number of Urban Realm Opportunity Sites have been identified where existing spaces can be enhanced or new spaces created. These are included and further illustrated in the descriptions in the following sections as appropriate.

Codes of Practice and Recommendations

All tree planting works will be undertaken in accordance with the following British Standard Codes of Practice:

- BS 3936-1:1992 Nursery stock specification for trees and shrubs
- BS 3998:2010 Tree work.

Recommendations:

- BS 4043:1989 Recommendations for Transplanting Root-Balled Trees
- BS 4428:1989 (Section 7)
- BS 8545:2014 Trees: from nursery to independence in the landscape – Recommendations.

Mitigation Measures

Mitigation measures are an inherent part of the multi-disciplinary design proposals and have been considered iteratively throughout the design process. Mitigation measures are informed by understanding existing conditions including the range of land uses, the nature and quality of existing built and landscape features and dimensional constraints and other opportunities. That information is used to identify the optimum integration of initial and evolving design proposals for carriageways, streetscapes, infrastructure including pedestrian and cycle facilities.

Mitigation includes minimising adverse impacts on private and public property and landscapes through avoidance and reduction; identifying opportunities to create improvements along streets and at other public spaces; and seeking opportunities to mitigate unavoidable impacts of trees, landscapes and property through reinstatement and new planting. Underlying landscape and public realm design and mitigation is the concept of Placemaking that seeks to ensure that streets, public spaces and amenities are developed to create attractive and safe places for people to use as destinations and for commuting.

Mitigation, as an integral part of the design process, includes:

- Reinstatement of impacted built or other features on a ‘like for like’ basis so as to restore established streetscape and spatial character;
- Upgrading the condition and/or quality of built elements to restore or enhance overall character and amenity;
- Introduction of new and reconfigured public spaces and streetscapes to provide more coherent, attractive and useable public realm;
- Planting new street trees, woodland/tree groups and other landscaping to offset any unavoidable impacts on existing landscape features along the Proposed Scheme; and
- Enhancing the sustainability of public spaces through improving biodiversity and introduction of Sustainable Drainage Systems (SuDS) wherever practicable.

14.7.1 Section 1: Tallaght Road to Rathfarnham Road

Existing Character: This is the start of the route and is characterised as an outer high-capacity urban dual carriageway connecting from the M50 and reducing in width at Cypress Grove Road to run along the more compact and traditional suburban streetscape of Templeogue Village. It then continues along the established residential streetscape of Templeogue Road with adjoining educational and parkland grounds to arrive in Terenure Village at the junction of Rathfarnham Road. This section is characterised by substantial areas of trees, both on street and within adjoining gardens and grounds, providing a distinctive and established setting.

Design Proposals: The outer dual carriageway sections will incorporate continuous two-way or cycle tracks each direction as well as upgraded pedestrian facilities, with rationalisation of the larger junctions to replace roundabouts with signalised junctions with better pedestrian crossing facilities and increased areas of landscape and public realm incorporating additional soft landscaping that will enhance the amenity of these areas.

The designated areas of the Proposed Scheme will incorporate the mid-18th century stone archway at Templeogue Road. The old archway is part of the wider planned Baroque landscape of Templeogue House Demesne, and is designated as a Protected Structure (SDD RPS 244). Following conservation and repair works, soft and hard landscaping with tree planting, the old archway will be opened to the public and will substantially contribute to the character of the area through the reintegration of this historic landmark into the urban realm. Proposals include a high-quality paving scheme which is sympathetic to the aesthetic of the arch. Areas of seating and ornamental planting will be provided to enhance sense of place and provide opportunities for passive recreation (refer to Figure 14.2).

Figure 14.2: The Old Archway at Templeogue Road

Templeogue Road varies in width and will require realignment of a number of private property boundary to establish bus and cycle facilities along the street. Realigned boundaries will be rebuilt along the new alignment and landscaping re-established so that higher quality footpaths will be continuous either side of the village and will incorporate new street tree planting.

The existing junction with Springfield Road will be rationalised to eliminate slip lanes and to create pocket park areas at each corner of the revised junction with increased soft landscaping and tree planting as well as better quality pedestrian and amenity facilities. Cycle traffic and pedestrians along Templeogue Road will be catered for off road within the perimeter of Bushy Park and along Rathdown Drive where a more attractive and safer environment for cyclists and pedestrians can be provided.

Approaching Terenure Village where the streetscape is more compact and defined by continuous building frontage, all modes will re-join the street. Inbound cyclists will share a short length of bus lane and the outbound cycle track will be improved to provide safer and more legible facilities leading into the village area (Refer to Figure 14.3).

Figure 14.3: Terenure Village

14.7.2 Section 2: Nutgrove Avenue to Terenure Road North – Grange Road, Rathfarnham Road

Existing Character: This part of the route starts at the junction of Grange Road and Nutgrove Avenue and presents as a wide and poorly defined areas with vehicular dominance. Grange Road then runs between established private dwellings on one side and the grounds of Rathfarnham Castle on the other. Grange Road is a busy route for all modes of transport and vehicular dominance undermines any sense of security for cyclists and pedestrians. While the modern stone wall boundary to the grounds of Rathfarnham Castle has a backdrop of mature mixed woodland within the castle grounds, the streetscape itself is narrow with few features of value.

Grange Road becomes Rathfarnham Road which was built as a Rathfarnham Village bypass and is characterised as wide and vehicular dominated road infrastructure, although later developments have established frontages onto the road. There is some street tree planting within a central median and along footpaths. At the northern end of Rathfarnham Village, the road joins the original Main Street from the village and an attractive public space with hard and soft landscaping is present as an entrance to the traditional village streetscape.

The next section of Rathfarnham Road is characterised by 20th century residential dwelling on both sides with, front gardens and increasingly steep driveways as the roadway falls to meet the Dodder River further north.

At Dodder Park Road, the streetscape opens up to the parkland of the Dodder Park which is a notable attractive feature in the townscape, however, the road corridors are wide and vehicle dominated with limited pedestrian and cycle permeability. Beyond the bridge, the road narrows and rises again, and is characterised by earlier 20th century private dwelling with mature landscaped front gardens and steep driveways along both sides.

The residential character of the street gradually transitions to a more compact and varied character approaching Terenure Village, with retail, commercial and community buildings signalling the village core at the junction with Templeogue Road.

Design Proposals: The Grange Road junction is to be rationalised to reduce the overarching vehicular dominance, providing opportunity for additional landscape areas that will enhance pedestrian amenity and public realm. Further north, Grange Road will be widened, requiring encroachment into the grounds of Rathfarnham Castle however the realigned boundary will facilitate planting of street trees in the new footpath to soften and enhance the appearance of the existing roadway and to provide a sense of separation between pedestrian space and roadway.

The existing poor-quality boundary wall will be replaced with a new boundary wall finished in roughcast render, which will be more in keeping with the construction of the castle. The impacted woodland will be replanted with native species and the existing playground will be integrated with the new planting and setback wall alignment (refer to Figure 14.4).

Figure 14.4: Rathfarnham Castle

Similarly, the junction at Butterfield Avenue will be rationalised to introduce better pedestrian and cycle facilities with widened footpaths facilitating provision of additional landscaping and tree planting.

At the junction of Rathfarnham Road and Main Street, the existing public realm will be retained and enhanced.

Rathfarnham Road, either side of the Dodder River, will require encroachment into private front gardens and also localised raising of the road levels so as to reduce the gradient of adjoining driveways. There will be loss of existing trees and vegetation, both on street and with front garden boundaries, however, the proposals include for reinstatement of garden boundaries and landscaping and the provision of new street trees along the public footpath.

Leading into Terenure Village, the roadway will be rationalised to provide continuous pedestrian and cycle facilities which will upgrade the appearance and integrity of the public realm. New tree planting will be incorporated to replace existing trees felled and the overall quality of the public realm will be upgraded as it leads into the village core beyond.

14.7.3 Section 3: Terenure Road North to Charleville Road – Terenure Road East, Rathgar Road

Existing Character: Terenure Road East is characterised by its traditional village context, however, there is a disproportionate provision of vehicular space at the expense of pedestrians. East of the village core, the road becomes a distinctive established residential street with period dwellings set back from the road behind mature landscaped front gardens including notable large specimen trees, before continuing to join the centre of Rathgar Village.

Rathgar Village is a traditional village comprising typically two storey terraced buildings including shops arranged tightly around adjoining junctions. The distinctive Christ Church and its landscaped grounds create a strong focal point at the junction of Rathgar Road and Highfield Road. The village core is heavily dominated by vehicular traffic and pedestrian provision in minimal.

Rathgar Road is similar in character to Terenure Road East presenting individual and terraced dwellings set back behind private gardens incorporating varying degrees of landscaping that alternately render the streetscape enclosed or more open along its length.

Design Proposals: Terenure Road East will incorporate wider footpaths within the village core and reduced carriageways so as to enhance pedestrian facilities. Widened footpaths will be built using quality material commensurate with that of the built context of the village so as to enhance the character of the village locality.

Immediately east of the village, Terenure Road East will be widened and this will require encroachment into private properties, including associate tree felling and realignment of boundary walls and gates. New tree planting will be provided post construction to mitigate the loss of existing trees.

Further east, the majority of intervention are related to re-allocation of existing carriageway in order to provide dedicated bus lanes and physical changes comprising rebuilding of kerbs and upgrade of footpaths to match those existing.

At Rathgar Village, the carriageway at the adjoining junction is to be rationalised to reduce vehicular space and to provide additional pedestrian and public realm space. The slip lane from Highfield Road in will be removed and this will facilitate the provision of a greatly increased public realm amenity space, with hard and soft landscaping along the shop frontages, that will incorporate seating, tree planting and low-level planting to encourage passive amenity. Medians will be introduced and will incorporate low level planting to further reduce the apparent width of the carriageways. Pavement and kerbs will be re-built using high quality materials sympathetic to the form of the surrounding traditional buildings and the character of the village setting. Importantly, the emerging design avoids impacting the boundary of Christ Church and the mature trees within the grounds and the distinctive focal point of the village will be retained as existing (refer to Figure 14.5).

Proposals along Rathgar Road relate to re-allocation of the existing carriageway in order to provide dedicated continuous footpaths and cycle tracks along both sides of the street, establish wider zones for pedestrians and cyclists, and a reduction in the perceived carriageway width.

Figure 14.5: Rathgar Village

14.7.4 Section 4: Charleville Road to Dame Street

Existing Character: Rathmines Village is located at the end of Rathgar Road and represents a transition to the increasing urban and ultimately city centre context. Like the other village localities along the route, Rathmines is heavily dominated by vehicular traffic and at the expense of high volumes of pedestrians. The village is characterised by mostly traditional terraced red brick buildings comprising mixed uses and varying considerable in form and height. A continuous ground floor retail frontage establishes a busy village environment, and the Swan Shopping Centre is located towards the northern part of the village but set back behind the primary building frontage.

Further north, Rathmines Road is a clearly defined street comprising terraced traditional dwellings, contemporary mixed used developments, and a range of community, education and sports facilities. The distinctive Church of Mary Immaculate Refuge of Sinners, or Rathmines Church, is the most striking building along the street and its copper dome is visible on the skyline from many locations across the city.

Rathmines Road crosses the Grand Canal and leads to the urban streets of South Richmond Street, Camden Street, Redmond’s Hill, Aungier Street and South Great George’s Street which are all characterised by mostly traditional terraced buildings with ground floor retail but are of modern regeneration at various locations along the route. These streets vary in width and have high volumes of traffic.

The Cuffe Street flats at the junction of Cuffe Street provides a break in the strong building line and substantial mature trees within the lands afford a borrowed landscape to the adjoining streetscape.

Design Proposals: Rathmines village will be re-configured and rationalised to reduce the overall carriageway widths, remove slip lanes and provide substantial additional public realm space that will incorporate high quality hard and soft landscaping interventions to establish a much stronger and more appealing pedestrian environment in the core of the village. Materials will be high quality reflecting those of the existing built context, and pavements will be rebuilt to unify the core of the village in a manner that reinforces its distinct local character (Refer to Figure 14.6).

Figure 14.6: Rathmines Village, Rathgar Road and Rathmines Upper Road Junction

Along Rathmines Road, a bus-gate is proposed which will eliminate general through traffic and thereby reduce the overall vehicular demand and provide opportunities for improving pedestrian and cycle facilities along the road. The wider pavements and cycle tracks will combine visually to substantially widen the pedestrian zone along both side of the street and to reduce the perception of carriageway to the minimum. New footpaths and cycle tracks will be built using high quality materials to enhance the character and presentation of the streetscape and to provide greater pedestrian facilities and amenity that will in turn underpin the vitality of the retail and services business along the street. There will be some new street tree planting together with localised soft landscaping interventions to soften and add diversity and amenity to the streetscape. A bus gate at Military Road and Richmond Hill will substantially reduce traffic volumes along Rathmines Road and contribute to the establishment of a much stronger pedestrian streetscape.

North of the Grand Canal, changes will mostly relate to the re-allocation of roadway to widen footpaths where practicable and to upgrade the build quality of footpaths and kerbs using high quality materials that will improve streetscape presentation and pedestrian amenity. As the street varies locally in width, there are locations where new street trees will be introduced to soften the streetscape and provide and provide localised passive amenity spaces along the busy street. Additionally, the localised variations in width will facilitate the provision of loading bays to serve the retail and commercial uses together with localised on-street parking

14.7.5 Tables of Plant Species

The following table documents the plant species as part of the Proposed Scheme.

Table 14.1: Tree and Woodland/Parkland Tree Group Schedule

Templeogue / Rathfarnham to City Centre Scheme Core Bus Corridor Scheme

Trees	
Existing Tree to be removed	**169**
New Trees to be planted (comprising as follows:)	**400**

Species - Scientific name	Common names in English	Size	Qty.	Qty. 10%	Genus	Qty.	Qty. 20%	Family	Qty.	Qty. 30%
Acer Platanoides 'Crimson King'	Purple norway maple	16/20	15	4%	*Acer*	83	20%	*Sapindaceae*	83	21%
Acer campestre 'Elegant'	Field maple	16/20	24	6%						
Acer campestre 'Elsrijk'	Field maple	16/20	18	5%						
Acer rubrum	Red maple	16/20	26	7%						
Alnus glutinosa	Common alder	14/16	5	1%	*Alnus*	5	1%	*Betulaceae*	68	17%
Corylus colurna	Turkish hazel	16/20	13	3%	*Corylus*	13	3%			
Betula pendula	Silver birch	14/16,16/20	32	8%	*Betula*	35	9%			
Betula albosinensis 'Fascination'	Chinese silver birch	16/20	3	1%						
Carpinus betulus 'Frans Fontaine'	Hornbeam	16/20	1	0%	*Carpinus*	15	4%			
Carpinus betulus 'Fastigiata'	Hornbeam	16/20	14	4%						
Pinus sylvestris	Scots pine	16/20	15	4%	*Picea*	15	4%	*Pinaceae*	15	4%
Crataegus monogyna 'Stricta'	Hawthorn	14/16	9	2%	*Crataegus*	9	2%	*Rosaceae*	124	31%
Malus 'Rudolph'	Crab apple	14/16	5	1%	*Malus*	5	1%			
Sorbus aria 'Majestica'	Whitebeam	14/16	22	6%	*Sorbus*	44	11%			
Sorbus aucuparia 'Streetwise'	Rowan	14/16	16	4%						
Sorbus aucuparia 'Fastigiata'	Rowan	14/16	4	1%						

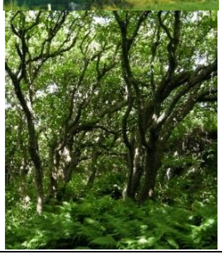
Species - Scientific name	Common names in English	Size	Qty.	Qty. 10%	Genus	Qty.	Qty. 20%	Family	Qty.	Qty. 30%
Sorbus hupehensis	Chinese rowan	14/16	2	1%						
Prunus avium 'Plena'	Wild cherry	14/16	22	5%	*Prunus*	45	11%			
Prunus cerasifera 'Nigra'	Cherry plum	14/16	2	1%						
Prunus padus	Bird cherry	14/16	21	5%						
Pyrus calleryana 'Chanticleer'	Callery pear	16/20	21	5%	*Pyrus*	21	5%			
Ginkgo biloba	Maidenhair tree	16/20	15	4%	*Ginkgo*	15	4%	*Ginkgoaceae*	15	4%
Cercis Canadensis 'Forest Pansy'	Redbud	14/16	2	1%	*Cercis*	2	1%	*Fabaceae*	21	5%
Gleditsia triacanthos 'Street Keeper'	Honey locust	16/20	6	1%	*Gleditsia*	19	5%			
Gleditsia triacanthos 'Skyline'	Honey locust	16/20	13	3%						
Platanus x acerifolia	London plane	16/20	7	2%	*Platanus*	7	2%	*Platanaceae*	7	2%
Quercus palustris 'Fastigiata'	Pin oak	16/20	6	1%	*Quercus*	12	3%	*Fagaceae*	12	3%
Quercus robur 'Fastigiata Koster'	Common oak	16/20	6	1%						
Tilia cordata 'Green Spire'	Small-leaved lime	16/20	14	3%	*Tilia*	29	7%	*Malvaceae*	29	7%
Tilia cordata 'Rancho'	Small-leaved lime	16/20	15	4%						
Ulmus 'New Horizon'	Elm	16/20	26	6%	*Ulmus*	26	7%	*Ulmaceae*	26	6%
		Total	**400**			400			400	

Woodland / Tree Groups

Existing Woodland / Tree Groups to be removed	No. features	**1**	*Total Area*	*0.23 ha.*
New Woodland / Tree Groups to be planted	No. features	**1**	*Total Area*	*0.08 ha.*

Table 14.2: Proposed Tree Planting Species, noting Benefit for Wildlife

Scientific name **Common name**	**Size**	**Qty.**	**Criteria for use**	**Photo**
Acer Platanoides 'Crimson King' Purple Norway Maple	16/20	15	Leaves deep purplish-crimson all summer, turning orange in autumn. Low maintenance architectural tree Feature accent element. Attractive to a number of invertebrates and pollinating insects.	 
Acer campestre 'Elegant' Field maple	16/20	24	Compact and elegant ascending structure of the branches. Intense yellow and orange autumn colour. A good avenue tree for use on green belts, road verges, streets, housing estates and squares. Tolerates air pollution and resists drought. Attractive to a number of invertebrates and pollinating insects. Fruits are eaten by small mammals.	 

Scientific name Common name	Size	Qty.	Criteria for use	Photo
Acer campestre 'Elsrijk' Field maple	16/20	18	Upright oval to widely conical shaped, dense crown. Intense yellow and orange autumn colour. Suitable for narrow streets. Tolerates air pollution and resists drought. Attractive to pollinating insects.	 
Acer rubrum Red Maple	16/20	26	Medium-sized tree with a spherical to conical crown, dense and closed. Feature accent in urban environment. Low maintenance architectural tree. Bright red autumn colour. Acid soils will give the best autumn colour. Tolerates air pollution and resists drought. Attractive to pollinating insects.	 
Alnus glutinosa Common alder / Black alder	14/16	5	Irish native tree. Ideal tree for planting in wet and mixed woodland and forest ages. Tolerates most coastal sites. A very good soil-enhancing tree due to its nitrogen-fixing capabilities. Poor tolerance to hard surfaces.	 

Scientific name **Common name**	**Size**	**Qty.**	**Criteria for use**	**Photo**
			Alder trees support over 80 different types of insects. Attractive to a number of invertebrates pollinating insects.	
Corylus colurna Turkish hazel	16/20	13	Extremely tolerant of exposure and paved areas which make it a perfect candidate for urban planting. Seasonal interest is provided by elegant long yellow catkins in spring, clusters of edible nuts in frilly cups and good yellow autumn foliage colour. Low maintenance architectural tree. Generally, disease free. Attractive to a number of invertebrates and pollinating insects. It produces and drops nuts in large beaked husks that are popular with wildlife, especially squirrels.	 
Betula pendula Silver birch	14/16 16/20	32	Irish native tree. Intense yellow autumn colour with striking white, pink, or peeling brown bark. Important tree for reforestation projects and soil protection. Birch trees support over 200 different types of insects. Catkins are a good food source for a variety of birds.	 

Scientific name **Common name**	**Size**	**Qty.**	**Criteria for use**	**Photo**
Betula albosinensis 'Fascination' Chinese silver birch / Chinese red-barked birch	16/20	3	Low maintenance architectural tree. Golden yellow autumn colour with striking white or peeling red, brown bark. Tolerant of a wide range of conditions and soil types. It's an outstanding addition to any landscape, particularly good when planted in groups.	
Carpinus betulus 'Frans Fontaine' Hornbeam	16/20	1	Uniquely upright and dense foliage. 'Frans Fontaine' is the narrowest of all the Carpinus. Ideal for narrow streets and avenues. The autumnal colours are a varied mixture of yellows and oranges. The tough tree is suitable for many locations. Attractive to a number of invertebrates. Seeds eaten by birds. Can provide a dense nesting cover.	

Scientific name **Common name**	**Size**	**Qty.**	**Criteria for use**	**Photo**
Carpinus betulus 'Fastigiata' Hornbeam	16/20	14	Uniquely upright and dense foliage. Ideal for narrow streets and avenues. The autumnal colours are a varied mixture of yellows and oranges. The tough tree is suitable for many locations.	 
Pinus sylvestris Scots pine	16/20	15	Irish native tree. Best suited in parks, gardens, heath land, woodlands and coastal areas. Low maintenance architectural tree. Creates habitats for native Irish fauna, including many bird species and squirrels.	 
Crataegus monogyna ‘Stricta’ Hawthorn	14/16	9	Irish native tree. Because of its columnar growth this tree is suitable for narrow streets and small gardens. White flowers in late spring followed by conspicuous red berries in autumn. Tolerant of exposed locations such as windy and coastal sites.	 

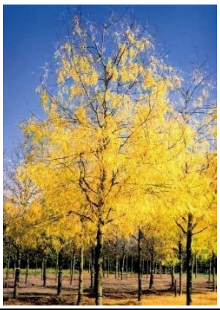
Scientific name **Common name**	**Size**	**Qty.**	**Criteria for use**	**Photo**
			It provides food for more than 150 different insect species. Attractive to pollinating insect.	
Malus 'Rudolph' Crab apple	14/16	5	A great choice for colour and year-round interest. Small ornamental tree that starts off by growing vertically. Used as an avenue tree because of the small fruit. Attractive to a number of invertebrates and pollinating insects. Many species of birds and mammals eat fruit and disperse the seeds.	
Sorbus aria 'Majestica' Whitebeam	14/16	22	Forms a compact, broad, pyramidal crown. Stands up well to hard surfaces 'Majestica' is a good avenue and street tree. Tolerant of atmospheric pollution and dry conditions. Attractive to a number of invertebrates and pollinating insects. Berries provide a valuable food source for birds.	

Scientific name **Common name**	**Size**	**Qty.**	**Criteria for use**	**Photo**
Sorbus aucuparia 'Streetwise' Rowan	14/16	16	Irish native tree. Ideal for tighter urban locations with a very neat upright habit. Tolerant of atmospheric pollution and dry conditions. Attractive to pollinating insects. It produces an important berry crop for wildlife.	 
Sorbus aucuparia 'Fastigiata' Rowan	14/16	4	Irish native tree. Grows in a narrow upright fashion. Ideal for tighter urban locations with a very neat columnar habit. Tolerant of atmospheric pollution and dry conditions. Attractive to pollinating insects. It produces an important berry crop for wildlife.	 

Scientific name **Common name**	**Size**	**Qty.**	**Criteria for use**	**Photo**
Sorbus hupehensis Chinese rowan	14/16	2	Round headed shape. White or white tinged pink fruits and glorious red autumn colour. Feature accent element on urban squares and parks. It is one of the faster growing rowans.	 
Prunus avium 'Plena' Double-flowered wild cherry	14/16	22	Irish native tree. Double flowered wild cherry, produces no fruit. Rounded and regularly branched closed crown. Feature accent element on urban squares, parks and avenues. Attractive to a number of invertebrates and pollinating insects. Berries provide a valuable food source for birds.	 

Scientific name **Common name**	**Size**	**Qty.**	**Criteria for use**	**Photo**
Prunus cerasifera 'Nigra' Black cherry plum	14/16	2	Ornamental tree with a round, dense, spreading head and dark purplish-black branches and twigs. Feature accent element on urban squares, parks and avenues. Great for attracting native wildlife.	 
Prunus padus Bird cherry	14/16	21	Irish native tree. Popular native hedge plant commonly used in mixed native hedgerows. Attractive to a number of invertebrates and pollinating insects. Berries provide a valuable food source for birds.	 

Scientific name Common name	Size	Qty.	Criteria for use	Photo
Pyrus calleryana 'Chanticleer' Callery pear	16/20	21	Narrow conical to ovoid, half-open crown. Perfect for avenue planting due to its slender form. Great for attracting native wildlife.	 
Ginkgo biloba Maidenhair tree	16/20	15	The World's Oldest Tree Species. Intense yellow autumn colour. Feature accent element on urban parks and avenues. Pests and diseases free. Resistant to air pollution.	 
Cercis Canadensis 'Forest Pansy' Redbud	14/16	2	Large deciduous shrub or small, often multi-stemmed or standard tree with purple, heart-shaped leaves which turn yellow in autumn before falling. Grown mainly for striking foliage effects. Feature accent element on urban parks and squares. Attractive to pollinators.	 

Scientific name **Common name**	**Size**	**Qty.**	**Criteria for use**	**Photo**
Gleditsia triacanthos 'Street keeper' Honey locust	16/20	6	Suitable for urban streets with ascending branches and a narrowly pyramidal growth habit. Vivid yellow autumn colour. Feature accent element on urban parks and avenues. Resistant to drought and pollution.	 
Gleditsia triacanthos ‘Skyline’ Honey locust	16/20	13	Suitable for urban streets with ascending branches and a narrowly pyramidal growth habit. Vivid yellow autumn colour. Feature accent element on urban parks and avenues. Resistant to drought and pollution.	 
Platanus x acerifolia London plane	16/20	7	A large tree for a large space. Coherence with existing planting scheme. Tolerates air pollution and resists drought and heavy pruning. Great for attracting native wildlife.	 

Scientific name **Common name**	**Size**	**Qty.**	**Criteria for use**	**Photo**
Quercus palustris 'Fastigiata' Pin oak	16/20	6	Columnar, half-open crown. Perfect for avenues and narrow streets planting due to its slender upright habit. Low maintenance architectural tree. Oak trees provide food and shelter to over 450 species of insects. Attractive to a range of invertebrates and are important for insect eating birds. Acorns are eaten by a variety of birds and mammals.	 
Quercus robur 'Fastigiata Koster' Common oak	16/20	6	Irish native tree. Tall narrow pyramidal version of the Common Oak. Ideal for growing along an avenue or where space is at a premium. Oak trees provide food and shelter to over 450 species of insects. Attractive to a range of invertebrates and are important for insect eating birds. Acorns are eaten by a variety of birds and mammals.	 
Tilia cordata 'Green Spire' Small-leaved lime	16/20	14	Pyramidal, later oval to ovoid, half-open crown. Coherence with existing planting scheme. Popular choice for urban planting. Tolerates air pollution and resists heavy pruning. Attractive to many invertebrates and pollinating insects.	 

Scientific name **Common name**	**Size**	**Qty.**	**Criteria for use**	**Photo**
Tilia cordata ‘Rancho’ Small-leaved lime	16/20	15	Narrow conical, later narrow ovoid, half-open crown. Coherence with existing planting scheme. Popular choice for urban planting. Tolerates air pollution and resists heavy pruning. Attractive to many invertebrates and pollinating insects.	 
Ulmus 'New Horizon' Elm	16/20	26	Fast-growing tree with dense pyramidal crown. High resistance to Dutch elm disease (DED). Tolerant of urban conditions. Support over 80 different types of insects. The early flowers of elm are visited by many insects and the seeds are valued by red squirrels.	 

Table 14.3: Schedule of Proposed Planting Areas

Planting Type	**Length (m) / Area (m^2)**
Hedgerow	126.4 m
Native Planting	0 m2
Ornamental Planting	932 m2
Grass Verge and Amenity Areas	9,212 m2
Species Rich Grassland	7,300 m2
Proposed SUDS	1,460 m2

Table 14.4: Ornamental Planting Species, noting Benefit for Wildlife

Latin name	Common name	Benefit
Buxus sempervirens	Common Box	Attractive to pollinators. Can provide a dense nesting cover.
Ceanothus species	Lilac Bush	Provide nectar and pollen for butterflies, bees and other pollinators in their dense flower clusters in spring.
Cornus sanguinea	Dogwood	The flowers produce a scent that is attractive to many species of invertebrates. The berries are eaten by some species of birds.
Corylus avellana	Hazel	Reddish-brown nuts in a green husk are seen on hazel in the late summer and autumn; but these are generally eaten quickly by birds and mammals.
Crataegus monogyna	Hawthorn	Provides a source of nectar and berries providing food for birds including thrushes. If allowed to grow dense it will provide good nesting opportunities for birds.
Euonymus europaeus	Spindle	Spindle produces flowers that provide a good source of food for bees and other insects. The fruits attract aphids which in turn attract insect-eating birds.
Ilex aquifolium	Holly	The berries are greatly enjoyed by birds and mammals. Holly also plays a crucial part in the life cycle of the beautiful butterfly the holly blue, which lays eggs on holly leaves in spring and is a frequent visitor to gardens in town. Requires male and female plants to produce berries.

Latin name	**Common name**	**Benefit**
Ligustrum vulgare	Privet	Wild privet is the preferred choice for wildlife and may provide nesting sites for blackbirds and other species. Left to grow a little less tidily than many gardeners allow, the structure will become more open and also offer nesting opportunities for many more species. Good for bees and butterflies.
Pyracantha coccinea	Scarlett Firethorn	Very valuable to birds as a source of food and as a nesting site. Also, a good security plant due to the thorns.
Rosa species	Roses	Provides nectar for bees and butterflies. Hips are valuable for small birds and mammals.
Salix aegyptiaca	Musk Willow	Winter-flowering shrub pollinated by bees and other insects.
Sambucus nigra	Common Elder	Provides flowers for insects and berries for birds.
Sarcococca confusa	Sweet Box	Flowering in winter, followed by black berries eaten by birds.
Viburnum spp	Viburnum	Excellent for attracting hoverflies and are a good source of nectar for bees. The shiny berries provide a food source for birds and mammals alike.

Table 14.5: Proposed Native Planting species, noting Benefit for Wildlife

Latin name	**Common name**	**Benefit**
Cornus sanguinea	Dogwood	The flowers produce a scent that is attractive to many species of invertebrates. The berries are eaten by some species of birds.
Corylus avellana	Hazel	Reddish-brown nuts in a green husk are seen on hazel in the late summer and autumn; but these are generally eaten quickly by birds and mammals.

Latin name	Common name	Benefit
Crataegus monogyna	Hawthorn	Provides a source of nectar and berries providing food for birds including thrushes. If allowed to grow dense it will provide good nesting opportunities for birds.
Euonymus europaeus	Spindle	Spindle produces flowers that provide a good source of food for bees and other insects. The fruits attract aphids which in turn attract insect-eating birds.
Hypericum androsaemum	Tutsan	Flowers attract insects especially bees while the berries are eaten by birds and small mammals.
Ilex aquifolium	Holly	The berries are greatly enjoyed by birds and mammals. Holly also plays a crucial part in the life cycle of the beautiful butterfly the holly blue, which lays eggs on holly leaves in spring and is a frequent visitor to gardens in town. Requires male and female plants to produce berries.
Ligustrum vulgare	Privet	Wild privet is the preferred choice for wildlife and may provide nesting sites for blackbirds and other species. Left to grow a little less tidily than many gardeners allow, the structure will become more open and also offer nesting opportunities for many more species. Good for bees and butterflies.
Rosa species	Roses	Provides nectar for bees and butterflies. Hips are valuable for small birds and mammals.
Salix aegyptiaca	Musk Willow	Winter-flowering shrub pollinated by bees and other insects.
Sambucus nigra	Common Elder	Provides flowers for insects and berries for birds.
Thymus species	Thyme	The rose-purple flowers grow in long, whorled, upright spikes and are very attractive to bees, hoverflies and butterflies.
Viburnum spp	Viburnum	Excellent for attracting hoverflies and are a good source of nectar for bees. The shiny berries provide a food source for birds and mammals alike.

Table 14.6: Ornamental Planting Species, noting Benefit for Wildlife

Latin name	Common name	Benefit
Abelia chinensis	Bee Bush or Chinese Abelia	Attractive to pollinators. Flowering in October.
Ajuga reptans	Bugle	Bugle is excellent for ground cover under shrubs since it prefers semi-shade, and is attractive to a wide range of insects.

Latin name	Common name	Benefit
Anemone nemorosa	Wood Anemone	Provides a good early source of pollen and nectar for bees and other insects.
Armeria maritima	Thrift, Sea Pink	Attractive to pollinators.
Aster novi-belgii	Michaelmas Daisy	Attractive to a range of bees, butterflies, moths and birds.
Aubrieta deltoidea	Purple Rock-cress	Provides a good early food source for bees and adds colour to edges of flower beds, prefers full sunlight.
Bergenia purpurascens	Elephant’s Ear or Purple Bergenia	Attractive to pollinators.
Campanula glomerata	Clustered Bellflower	Attractive to pollinators.
Clematis vitalba	Clematis ‘Old Man’s Beard’	Provides nectar for bee and butterflies.
Conopodium majus	Pignut	Attractive to pollinators.
Crocus tommasinianus	Early Crocus	As a winter-flowering, provides a good early source of pollen and nectar for bees and other insects.
Cynoglossum officinale	Hound’s Tongue	Attractive to pollinators.
Digitalis purpurea	Foxglove	Attractive to pollinators.
Filipendula vulgaris	Dropwort	Attractive to pollinators.
Galanthus nivalis	Common Snowdrop	As a winter-flowering, provides a good early source of pollen and nectar for bees and other insects.
Hedera helix	Ivy	Provides a late nectar source and cover / hibernating sites for many species of invertebrates.
Humulus lupulus	Hop	Provides nectar for bee and butterflies.

Latin name	Common name	Benefit
Hyacinthoides non-scripta	Bluebell	Provides a source of pollen and nectar for bees and other insects. Ensure that suppliers do not provide either Spanish bluebell or the hybrid between this and Bluebell (or any other hybrids) and have not stripped native bluebells from the wild.
Hypericum perforatum	Perforate St John’s Wort	Attractive to pollinators.
Jasminus officinale	Summer Jasmine	Night-scented. The scent from jasmine at night can attract bats.
Lathyrus pratensis	Meadow Vetchling	Attractive to pollinators.
Leucanthemum vulgare	Ox-eye Daisy	Attractive to pollinators.
Linaria vulgaris	Common Toadflax	Attractive to pollinators.
Lonicera periclymenum	Honeysuckle	The flowers of the Honeysuckle attract night flying moths and other insects which in turn can provide food for bats. Honeysuckle can provide nest sites for small garden bird species while the bark is often used in nest building by species including the House Sparrow.
Lunaria biennis	Honesty	Attractive to butterflies.
Malva moschata	Musk Mallow	Attractive to pollinators.
Matthiola longipetala	Night-scented Stock	Night-scented. Emits a pleasant scent in the evening and through the night attracting night-flying pollinators and insects and therefore bats.
Mahonia species	Mahonia	Flowering occurs in autumn, winter and early spring benefiting winter-active pollinators (like bumblebees or some hoverflies). Flowers produce abundant nectar. Berries are eaten by birds.
Monarda didyma	Bergamot	Provides a good source of pollen and nectar.

Latin name	Common name	Benefit
Nicotiana	Tobacco Plant	Attractive to night pollinators like moths (beneficial for bats).
Oenothera biennis	Evening Primrose	Particularly attractive to night flying insects (therefore can attract bats).
Persicaria bistorta	Common Bistort	Attractive to pollinators.
Rudbeckia hirta	Black-eyed Susan	Attractive to pollinators. Flowering in October.
Silene vulgaris	Bladder Campion	Attractive to pollinators.
Thalictrum flavum	Meadow Rue	Attractive to pollinators.
Viola riviniana	Dog Violet	Flowers from April to June and is attractive to bees and other insects.

15 How Are We Achieving the Objectives

This section sets out the manner in which the Proposed Scheme described herein will achieve the following Objectives as set out:

- Enhance the capacity and potential of the public transport system by improving bus speeds, reliability and punctuality through the provision of bus lanes and other measures to provide priority to bus movement over general traffic movements;
- Enhance the potential for cycling by providing safe infrastructure for cycling, segregated from general traffic wherever practicable;
- Support the delivery of an efficient, low carbon and climate resilient public transport service, which supports the achievement of Ireland's emission reduction targets;
- Enable compact growth, regeneration opportunities and more effective use of land in Dublin, for present and future generations, through the provision of safe and efficient sustainable transport networks;
- Improve accessibility to jobs, education and other social and economic opportunities through the provision of improved sustainable connectivity and integration with other public transport services; and
- Ensure that the public realm is carefully considered in the design and development of the transport infrastructure and seek to enhance key urban focal points where appropriate and feasible.

Currently, bus priority is characterised by discontinuity. Bus priority is only provided along certain sections and a number of pinch-points cause significant delays which result in a negative impact on the performance of the bus service as a whole. Within the extents of the Proposed Scheme route, bus lanes are currently provided on only approximately 15% and 44% of route outbound and inbound respectively.

Issues related to frequency, reliability and a complex network have persisted for many years and will continue to do so without further intervention. As such, there are a number of high frequency public bus services along the routes to be improved by the Proposed Scheme (including the 14, 15, 15a, 15b, 16, and 140 bus routes). In addition to this there are multiple other bus services which run along this corridor intermittently, providing interchange opportunities with other bus services, DART stations and the Luas Green Line. Many of these services suffer from journey time unreliability, particularly in peak times, due to the lack of bus priority provision.

In addition to the level of service improvements the Proposed Scheme would facilitate for existing bus services, the ongoing Dublin Area Bus Network Redesign will see continued investment in bus services into the future, which will also be afforded similar journey-time reliability and therefore improve their attractiveness as an alternative to private car usage.

Without the interventions of the Proposed Scheme there would likely be an exacerbation of the issues which informed the need for the Proposed Scheme itself. The capacity and potential of the public transport system would remain restricted by the existing deficient and inconsistent provision of bus lanes and the resulting sub-standard levels of bus priority and journey-time reliability. Thus, the unreliability of bus services would continue. As such the Proposed Scheme is actively enhancing the capacity and potential of the public transport system, and supports the delivery of an efficient, low carbon and climate resilient public transport service, which supports the achievement of Ireland’s emission reduction targets.

In terms of the need to improve facilities for cyclists along the route of the Proposed Scheme, the design intent is that segregated facilities should be provided where practicable to do so. Within the extents of the Proposed Scheme there are segregated cycle tracks provided on only approximately 18% and 13% of the route outbound and inbound respectively, mandatory cycle lanes provided on only approximately 23% and 6% of the route outbound and inbound respectively, while advisory cycle lanes are provided on only approximately 23% and 27% of the route outbound and inbound respectively. The remaining extents have no dedicated cycle provision or cyclists must cycle within the bus lanes provided.

The Proposed Scheme is implementing safe, segregated infrastructure throughout and as such is greatly enhancing the potential for cycling.

Within the extents of the Proposed Scheme there are a number of amenities, village and urban centres which experience high pedestrian usage including Terenure Village, Rathmines Village, and the Camden Street area. In order to improve accessibility to jobs, education and other social and economic opportunities through the provision of an integrated sustainable transport system, there needs to be a high-quality pedestrian environment, including specifically along the route of the Proposed Scheme. There are a number of uncontrolled crossings along the route of the Proposed Scheme, particularly at side roads which are generally of poor standard, including lack of provision for the mobility and visually impaired. There are multiple incidences of ‘patch repairs’ along footpaths that in some instance has led to undulating, uneven surfaces caused by settlement of patch repair material. This is often a hazard to pedestrians, particularly the mobility impaired. A number of submissions were also received as part of the non-statutory consultation in which members of the public indicated specific locations where the existing provision is unsafe for pedestrians – many of which are proposed to be addressed by the Proposed Scheme.

Along with these interventions, the proposals include significant improvements to the pedestrian environment, both along links and at both signalised and priority junctions and crossings. As such the Proposed Scheme will improve accessibility to jobs, education and other social and economic opportunities not only through improvement to the public transport network and cycling infrastructure but through improvements to the pedestrian environment.

The Landscape and Urban Realm proposals for the Proposed Scheme are based on an urban context and landscape character analysis of the route.

The proposals have been informed through discussions with the NTA, local authorities and stakeholders. The proposals have been developed alongside the other technical teams so that the preliminary landscape design is integrated into the overall Proposed Scheme design.

The overall landscape and public realm design strategy for the Proposed Scheme was developed to create attractive, consistent, functional, and accessible places for people alongside the core bus and cycle facilities. It aims to mitigate any adverse effects that the proposals may have on the streets, spaces, local areas and landscape through the use of appropriate design responses. In addition, opportunities have been sought to enhance the public realm and landscape design where practicable.

The Proposed Scheme encourages local journeys to be taken through active travel modes by:

- The provision of safe and efficient sustainable transport networks;
- Improved infrastructure for walking and cycling;
- Improved public realm; and
- Improved connectivity to facilities which have been developed for the mobility and visually impaired.

The Proposed Scheme as described enables compact growth, regeneration opportunities and more effective use of land in Dublin, for present and future generations.

It is therefore considered that the design of the Proposed Scheme wholly achieves the objectives set out herein. In doing so it fulfils the aim of the Proposed Scheme in providing enhanced walking, cycling and bus infrastructure on key access corridors in the Dublin region, enabling the delivery of efficient, safe, and integrated sustainable transport movement along these corridors.

Appendix A

Designer’s Risk Assessment

Appendix B

Preliminary Design Drawings

Appendix B1: Site Location Map and Site Location Plan

Appendix B2: General Arrangement

Appendix B3: Mainline Plan and Profile

Appendix B4: Typical Cross-sections

Appendix B5: Landscaping General Arrangement

Appendix B6: Pavement Treatment Plans

Appendix B7: Fencing and Boundary Treatment

Appendix B8: Traffic Signs and Road Markings

Appendix B9: Street Lighting

Appendix B10: Junction Systems Design

Appendix B11: Proposed Surface Water Drainage Works

Appendix B12: IW Foul Sewer Asset Alterations

Appendix B13: ESB Asset Alterations

Appendix B14: GNI Asset Alterations

Appendix B15: IW Water Asset Alterations

Appendix B16: Telecommunications Asset Alterations

Appendix B17: Combined Existing Utilities Records

Appendix C

Deviations / Departures / Relaxations from Standards

Appendix D

Arboricultural Impact
Assessment Report

Appendix E

Ground Investigation Report

Appendix F

Not Used

Appendix G

Parking Survey Report

Appendix H

Bus Stop Review Report

Appendix I

Accessibility Audit Report

Appendix J

Not Used

Appendix K

Drainage Design Basis Document

Appendix L

Junction Design Report

Appendix M

Quality Audit

Appendix M1: Quality Audit Report

Appendix M2: Road Safety Audit Report

Appendix N

Flood Risk Assessment

Appendix O

Preliminary Design Report
Guidance Booklet

Appendix P

Templeogue Arch – Structural Appraisal and Outline Recommendations for Repair