

**Chapter 04**  
Proposed  
Scheme  
Description

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## 4. Proposed Scheme Description

### 4.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) provides a description of the Ringsend to City Centre Core Bus Corridor Scheme (hereafter referred to as the Proposed Scheme).

Article 5(1)(a) of the EIA Directive<sup>1</sup> requires that the EIAR contains:

*'a description of the project comprising information on the site, design, size and other relevant features of the project;...'*

Section 50(2)(b)(i) of the Roads Act 1993 (as amended) states that that the EIAR shall contain the following information:

*'a description of the proposed road development comprising information on the site, design, size and other relevant features of the development;.....'*

The layout of the chapter begins with the Proposed Scheme Overview (Section 4.2). This is followed by sections describing the Design Iteration process (Section 4.3) and the overall Design Principles applied to the Proposed Scheme (Section 4.4). Following this, there is a detailed description of the Proposed Scheme (Section 4.5) and a Section describing the key infrastructure elements associated with the Proposed Scheme (Section 4.6). These Sections should be read in their entirety in order to gain a full understanding of the Proposed Scheme and its associated key infrastructure elements.

### 4.2 Proposed Scheme Overview

The Proposed Scheme has an overall length of approximately 4.3km (2 x 1.6km along the River Liffey Quays and 1.1km cycle route through Ringsend and Irishtown to Sean Moore Road) and is routed along the north and south quays of the River Liffey, linking the city centre with the Docklands and an onward cycling connection to Ringsend and Irishtown, all within the County of Dublin and within the Dublin City Council (DCC) administrative area. The Proposed Scheme includes priority for buses along the entire length of the north quays from Talbot Memorial Bridge to the 3Arena at the Tom Clarke East Link Bridge, consisting of dedicated bus lanes in both directions, which will require the relocation of both pairs of Scherzer Bridges along the north quays. Bus priority will also be achieved on the south quays through the provision a new opening bridge across the River Dodder (via the Dodder Public Transport Opening Bridge (DPTOB)) as well as the provision of intermittent sections of bus lane to ensure bus priority on the approach to all major junctions. Full bus lane provision on the south quays is not considered necessary in the context of the layout of the traffic cells and existing one-way restrictions, which prevent congestion developing. Eastbound buses will use the north quays only between the Customs House and the Samuel Becket Bridge, with eastbound buses proceeding on both quays from this point to the Tom Clarke East Link Bridge. Westbound buses will use the full length of both quays.

Segregated two-way cycle tracks will be provided along the quaysides (campshires) on both sides of the River Liffey. A continuation of the two-way cycle route on the south quays will extent through Ringsend and Irishtown towards Sandymount Strand and the Poolbeg peninsula. The route will run via quiet streets at Pembroke Cottages, across Cambridge Road, then through Ringsend Park as a shared path with pedestrian priority, and a cycle track along the northern side of Strand Street and Pembroke Street in Irishtown to the junction of Sean Moore Road and Beach Road. A spur cycle route will be provided towards the Poolbeg Strategic Development Zone (SDZ) lands via Irishtown Stadium and Bremen Road. Shared use symbols will also be installed along York

<sup>1</sup> Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (hereafter collectively referred to as the Environmental Impact Assessment (EIA Directive))

Road and Pigeon House Road to provide a second alternative route towards the Poolbeg SDZ lands. This road has recently been closed to through traffic and is suitable for shared use.

Pedestrian facilities will be upgraded, and additional controlled and uncontrolled crossings will be provided at side roads, road crossings, and at junctions. In addition, urban realm works will be undertaken at key locations with higher quality materials, planting and street furniture provided to enhance the pedestrian experience. Examples of such works can be seen at the pair of Scherzer Bridges at Custom House Quay and North Wall Quay as well as the junction of North Wall Quay and Excise Walk. Pedestrian Boardwalks are proposed at Excise Walk and also at the former DCC Dublin Docklands offices at Custom House Quay to enhance the pedestrian environment (the latter to be provided on completion of the redevelopment of the offices – see Section 4.5.1.9.3 for further details). The route of the Proposed Scheme is shown in Image 1.1 in Chapter 1 (Introduction & Environmental Impact Assessment Process).

The Proposed Scheme includes a local modification to Mayor Street at Spencer Dock. In order to accommodate proposed turning movement restrictions at the Guild Street / Samuel Beckett Bridge junction for the purposes of provided enhanced bus, cycle and pedestrian priority, it is proposed to open an eastbound traffic lane north of the LUAS between the National Convention Centre Car Park and Park Lane. This will facilitate traffic exiting the car park towards the M50 Port Tunnel.

Table 4.1 summarises the changes which will be made to the existing corridor as a result of the Proposed Scheme.

**Table 4.1: Summary of Changes as a result of the Proposed Scheme**

Features	Existing (km)	Proposed Scheme (km) Length: 4.3km (comprising of 2 x 1.6km along the River Liffey Quays and 1.1km cycle route through Ringsend and Irishtown to Sean Moore Road)
<b>Bus Lanes</b>		
Inbound	0.6	2.35
Outbound	0.5	1.85
<b>Bus Priority through Traffic Management</b>		
Inbound	0.0	0.85
Outbound	0.0	0.65
Total Bus Priority (both directions)	1.1	5.7 (+ 375%)
<b>Bus Measures</b>		
Proportion of Route with Bus Priority Measures	34.0%	89.0%
<b>Cycle Facilities – Segregated</b>		
Inbound	1.9	4.0
Outbound	2.3	4.0
<b>Cyclist Facilities – Non-segregated</b>		
Inbound	0.1	0.3
Outbound	0.8	0.3
Total Cyclist Facilities (both directions)	5.1	8.6 (+69%)
Proportion Segregated (including shared path with pedestrian priority)	82.0%	93%
<b>Other Features</b>		
Number of Traffic Signal Controlled Junctions	11	14
Number of Signal Crossings	37	50
Number of Residential Properties with Land Acquisition	Not applicable	0 Residential

The description of the Proposed Scheme (Section 4.5) is supported by a series of drawings (listed in Table 4.2), which are contained in Volume 3 of this EIAR, and these should be read in conjunction with this chapter.

**Table 4.2: List of Drawings**

Drawing Series Number	Description
BCIDD-ROT-SPW_ZZ-0016_XX_00-DR-CR-9001	Site Location Plan
BCIDD-ROT-GEO_GA-0016_XX_00-DR-CR-9001	General Arrangement
BCIDD-ROT-GEO_HV-0016_ML_00-DR-CR-9001	Mainline Plan and Profile
BCIDD-ROT-GEO_CS-0016_XX_00-DR-CR-9001	Typical Cross Sections
BCIDD-ROT-ENV_LA-0016_ML_00-DR-LL-9001	Landscaping General Arrangement
BCIDD-ROT-PAV_SU-0016_XX_00-M2-CR-9001	Pavement Treatment Plans
BCIDD-ROT-SPW_BW-0016_XX_00-DR-CR-9001	Fencing and Boundary Treatment
BCIDD-ROT-TSM_GA-0016_XX_00-DR-CR-9001	Traffic Signs and Road Markings
BCIDD-ROT-LHT_RL-0016_XX_00-DR-EO-9001	Street Lighting
BCIDD-ROT-TSM_SJ-0016_XX_00-DR-TR-9001	Junction System Design
BCIDD-ROT-DNG_ZZ-0016_XX_00-DR-CD-9001	Proposed Surface Water Drainage Works
BCIDD-ROT-UTL_UD-0016_XX_00-DR-CU-9001	IW Foul Sewer Asset Alterations
BCIDD-ROT-UTL_UE-0016_XX_00-DR-CU-9001	ESB Asset Alterations
BCIDD-ROT-UTL_UG-0016_XX_00-DR-CU-9001	GNI Asset Alterations
BCIDD-ROT-UTL_UW-0016_XX_00-DR-CU-9001	IW Water Asset Alterations
BCIDD-ROT-UTL_UL-0016_XX_00-DR-CU-9001	Telecommunications Asset Alterations
BCIDD-ROT-UTL_UC-0016_XX_00-DR-CU-9001	Combined Existing Utility Records
BCIDD-ROT-STR_ZZ-0016_XX_00-DR-SS-9001	Structures Drawings

### 4.3 Design Iteration

The design of the Proposed Scheme has evolved through comprehensive design iteration, with particular emphasis on minimising the potential for environmental impacts, where practicable, whilst ensuring the objectives of the Proposed Scheme are attained. In addition, feedback received from the comprehensive consultation programme, described in Chapter 1 (Introduction & Environmental Impact Assessment Process), undertaken throughout the options selection and design development process has been incorporated, where appropriate.

Examples of how the design evolved are as follows:

- Both pairs of Scherzer Bridges at George’s Dock and the Royal Canal posed a considerable constraint on the ability to provide full bus priority along the length of the north quays. A number of options were considered to determine how to resolve this (as documented in Chapter 3 (Consideration of Reasonable Alternatives)) culminating in the preferred solution to relocate both pairs of Scherzer Bridges to either side of the existing carriageway in both locations and to provide new replacement carriageway bridges in order to provide full bus priority. This also has benefits in terms of the long-term protection of the Scherzer Bridges;
- In respect to the proposed DPTOB linking Sir John Rogerson’s Quay to Thorncastle Street / York Road, numerous bridge designs were considered (see Chapter 3 (Consideration of Reasonable Alternatives) for further information). A bascule bridge that included an in-river pier that would accommodate a lifting mechanism was considered the preferred design solution as it would limit the risks associated with excavation and construction activities in proximity to existing quay walls as the largest pier with the lifting mechanism would be in the river channel itself; and
- Following significant local opposition to a proposed cycle track alongside Pigeon House Road, the design of the Proposed Scheme was revised following an options assessment process. Two cycle routes were adopted, comprising of a shared on-road facility along Pigeon House Road (which was closed to through traffic in 2020) as well as a dedicated cycling route sharing a widened existing footpath through Ringsend Park to Sean Moore Road. This preferred design provides better safe access for cyclists (and pedestrians) to the entire Poolbeg peninsula than current conditions allow whilst doing so with minimal physical disruption to the existing environment.

## 4.4 Design Principles

The design of the Proposed Scheme was developed with reference to the Preliminary Design Guidance Booklet for BusConnects Core Bus Corridors (PDGB) (NTA 2021) – refer to Appendix A4.1 in Volume 4 of this EIAR. This guidance document was prepared to ensure that a consistent design approach for the Core Bus Corridor Infrastructure Works was adopted based on the objectives of the Proposed Scheme. The project objectives are described in full in Chapter 2 (Need for the Proposed Project).

The purpose of the PDGB is to complement existing guidance documents / design standards relating to the design of urban streets, bus facilities, cycle facilities and urban realm, which includes the following:

- The Design Manual for Urban Roads and Streets (DMURS) (Government of Ireland 2013);
- The National Cycle Manual (NCM) (NTA 2011);
- TII National Road Design Standards;
- The Traffic Signs Manual (TSM) (DoT 2019);
- Guidance on the use of Tactile Paving (UK DfT 2007);
- Building for Everyone: A Universal Design Approach (NDA 2020), and
- Greater Dublin Strategic Drainage Study (GSDSDS) (Irish Water 2005).

An example of the application of the design principles for the Proposed Scheme can be seen in the junction designs of the Proposed Scheme. The design for each junction within the Proposed Scheme was developed to meet the underlying objectives of the project and to align with the geometric parameters and standards. 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 are a number of components in the design development process that have influenced the preliminary junction design 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.

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 possible. 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 wrap-around pedestrian signal stage at the start of the cycle. In some instances, this hasn't been feasible e.g. due to the need to maintain capacity for buses and cyclists. A 'walk with traffic' system is therefore proposed at certain junctions, such as the Samuel Beckett Bridge / Guild Street junction. At these locations, controlled crossing for pedestrians is provided across part of the junction, whilst some of the traffic movements that are not 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.

To minimise pedestrian delays at junctions, it was important that proposed junction cycle times are kept as short as possible. The introduction of bus priority signalling and more regular pedestrian crossing stages at the junctions has required the alteration of the traffic signal sequence compared to existing conditions. This has required the lengthening of the cycle signal; however this has been avoided where practicable. Accessibility for mobility impaired users is a core element of the Proposed Scheme design and it has been informed by the principles of DMURS, Building for Everyone: A Universal Design Approach (NDA 2020), How Walkable is Your Town (NDA 2015), Shared Space, Shared Surfaces and Home Zones from a Universal Design Approach for the Urban

Environment in Ireland (NDA 2012), Best Practice Guidelines, Designing Accessible Environments (Irish Wheelchair Association 2020), Inclusive Mobility (UK Department for Transport 2005), Guidance on the Use of Tactile Paving Surfaces (UK DfT 2007), and BS8300:2018 Volume 1 Design of an accessible and inclusive built environment – External Environment – code of practice. Accessibility is also addressed in Chapter 12 of the PGDB. Further detail on accessibility for mobility impaired users is given in Section 4.6.5.

The Proposed Scheme which has been developed after the consideration of reasonable alternatives and which achieves the aim and objectives for the Proposed Scheme is described in detail in Section 4.5. Further detail on the key infrastructure elements that comprise the Proposed Scheme is provided in Section 4.6.

## **4.5 Description of the Proposed Scheme**

The Proposed Scheme runs along the north and south quays from Talbot Memorial Bridge to the Tom Clarke East Link Bridge and then onto Ringsend and Irishtown and is described in the following geographical sections:

- Section 1: Talbot Memorial Bridge to Tom Clarke East Link Bridge;
- Section 2: Dodder Public Transport Opening Bridge (DPTOB); and
- Section 3: Tom Clarke East Link Bridge to Sean Moore Road.

### **4.5.1 Section 1 – Talbot Memorial Bridge to Tom Clarke East Link Bridge**

#### **4.5.1.1 General Overview of the Proposed Scheme**

This Section of the Proposed Scheme will commence at the Talbot Memorial Bridge and will proceed eastwards along the north and south quays and will conclude on either side of the Tom Clarke East Link Bridge.

Multiple structures, as set out in Section 4.6.8, are proposed along this Section to accommodate the Proposed Scheme. The historic Scherzer Bridges at George's Dock and the Royal Canal will be relocated to either side of the carriageway to facilitate the addition of bus lanes, while two boardwalk structures along the R801 on Custom House Quay and North Wall Quay will be constructed to assist with facilitating pedestrian movement. On the south quays, the DPTOB will be constructed across the mouth of the River Dodder, at its confluence with the River Liffey, to connect Sir John Rogerson's Quay to East Link Road and York Road (see Section 4.5.2 for further details on the DPTOB).

At the northern end of Samuel Beckett Bridge at the junction of R801 North Wall Quay with Guild Street, some eastbound buses may wish to turn right onto the bridge. These buses will be detected on their approach and the bus lane signal will be released in advance of general traffic by a dedicated bus lane signal. This will enable some bus services to turn right from the bus lane on the left side of the traffic lane. These buses will not need to weave right across general traffic to reach the right-turn lane. General traffic in both directions will move in a separate signal stage after the bus stage has finished.

Similar right-turn advance bus lane signals will operate in the eastbound direction at the junctions of Commons Street and Park Lane on R801 North Wall Quay.

Temporary land acquisition is required for Construction Compounds at both sets of Scherzer Bridges as well as along part of Sir John Rogerson's Quay to facilitate works. These lands will be reinstated in line with existing conditions and / or urban realm improvements (as applicable) following the completion of works.

#### **4.5.1.2 Deviations from Standard Cross Sections**

At pinch-points there are short sections of narrow cycle track and footpath that deviate from the standard BusConnects cross-sectional elements as out in Section 4.6.1. Two pedestrian crossings at each end of the Samuel Beckett Bridge are slightly longer than the maximum length in the design standard.

#### 4.5.1.3 Bus Lane Provision

An overview of the bus lane provision as part of the Proposed Scheme is set out in Section 4.6.4. As outlined above in Section 4.2, full bus priority is proposed in both directions along the entire length of the north quays; westbound along the entire length of the south quays; and eastbound along the eastern section of the south quays between the Samuel Beckett Bridge and the Tom Clarke East Link Bridge.

#### 4.5.1.4 Bus Stops

The different types of bus stop (island, shared landing and inline) are described in Section 4.6.4. Of the 20 proposed bus stops within this section of the Proposed Scheme 9 are Inline Bus Stops, 7 are Island Bus Stops, and 4 are Layby Bus Stops. The bus stop locations and types are outlined in Table 4.3 and shown in the General Arrangement series of drawings (BCIDD-ROT-GEO\_GA-0016\_XX\_00-DR-CR-9001) in Volume 3 of this EIAR. Further details of bus stop design is included in the Preliminary Design Guidance Booklet for BusConnects Core Bus Corridors (PDGB) (NTA 2021) – Appendix A4.1 in Volume 4 of this EIAR.

**Table 4.3: Proposed Bus Stop Locations within Section 1 of the Proposed Scheme**

Inbound / Outbound	Bus Stop Name	Bus Stop Number	Chainage	Bus Stop Type	Bus Shelter
<b>Section 1 – Talbot Memorial Bridge to Tom Clarke East Link Bridge (North Quays)</b>					
Westbound	3-Arena	Coach Stop	A-100	Island	No.
Westbound	Central Bank	Coach Stop	A-450	Island	Yes
Westbound	Convention Centre	7398	A-775	Island	Yes
Westbound	Convention Centre	Coach Stop	A-825	Layby	No
Westbound	Guild Street	7397	A-1000	Island	Yes
Westbound	Commons Street	Coach Stop	A-1230	Layby	Yes
Westbound	North Wall Quay	123531	A-1400	Island	Yes
Eastbound	Custom House Quay	2498	A-1540	Inline	Yes
Eastbound	Commons Street	Coach Stop	A-1330	Layby	Yes
Eastbound	Guild Street	2499	A-1230	Inline	Yes
Eastbound	Convention Centre	2501 relocated	A-755	Inline	Yes
Eastbound	Central Bank	Coach Stop	A-460	Inline	Yes
Eastbound	East Wall Road – 3-Arena	7623 / Coach Stop	A-110	Inline	Yes
<b>Section 1 – Talbot Memorial Bridge to Tom Clarke East Link Bridge (South Quays)</b>					
Westbound	Benson Street	New	B-11240	Inline	Yes
Westbound	Diving Bell	New	B-10845	Inline	Yes
Westbound	Lime Street	New	B-10610	Inline	Yes
Westbound	City Quay	New	B-10150	Inline	Yes
Eastbound	Diving Bell	New	B-10860	Island	Yes
Eastbound	Benson Street	New	B-11200	Island	Yes

#### 4.5.1.5 Cycling Provision

The specific proposals for cycling in Section 1 of the Proposed Scheme are described below. Provision for cyclists at signal-controlled junctions are described in Section 4.6.3.5.

There is a good degree of existing cycling provision along this section of the Proposed Scheme with a segregated cycling facility on 50% of the north quays for outbound movements and 69% for citybound movements. On the south quays there is a segregated cycling facility for 100% of the length in the outbound direction, and for 64% inbound towards the city centre. The Proposed Scheme will provide 100% cycling priority in both directions along

the length of both the north and south quays between Talbot Memorial Bridge and the Tom Clarke East Link Bridge by way of provision of two-way segregated cycle tracks. The provision of these segregated cycle tracks will facilitate an extension of the proposed Liffey Cycle Route (see Section 4.6.6.3.3 for more details on the proposed Liffey Cycle Route) while also directly facilitating Cycle Route 5 of the GDA Cycle Network Plan (hereafter referred to as the GDACNP) as well as intersections with a number of other primary cycle routes designated under the GDACNP, namely Cycle Route 1, Cycle Route 13 and Cycle Route SO1/N10.

#### 4.5.1.6 Junctions Information

An overview of the approach to junction review and design is provided in Section 4.6.7. The major, moderate and minor junctions (as defined in the PGDB) within Section 1 – Talbot Memorial Bridge to Tom Clarke East Link Bridge of the Proposed Scheme are outlined in Table 4.4.

**Table 4.4: Junctions within Section 1 of the Proposed Scheme**

Junction Location	Junction Category	Description	Notes
<b>Section 1 – North Quays</b>			
Memorial Road / Custom House Quay / Talbot Memorial Bridge	Major Junction	4 arm signal junction	One-way southbound traffic from the north and over Memorial Bridge. Contra-flow bus lane westbound on Custom House Quay west of the junction. Two-way cycle track on the eastern side of Memorial Bridge. Northbound cycle track on the western side of Memorial Bridge.
Commons Street / North Wall Quay	Minor Junction	3 arm signal junction	Westbound Right-turn bus signal for Bus Éireann services. No right-turn for general traffic with removal of the existing right-turn lane to accommodate continuous westbound bus lane. Alternative access from the north via Seville Place.
Guild Street / North Wall Quay / Samuel Beckett Bridge	Major Junction	4 arm signal junction	No right-turn for general traffic eastbound with removal of the existing right-turn lane to accommodate continuous bus lane. Eastbound Right-turn bus signal for city bus Spine C services to Poolbeg and Orbital Route O. Two-way cycle tracks on the eastern side of Samuel Beckett Bridge and Guild Street and along the Liffey Campshires. Northbound cycle track on the western side of Samuel Beckett Bridge. No left-turns for traffic apart from Samuel Beckett Bridge northbound to improve junction capacity and remove conflicts with cyclists and pedestrians to run in conjunction with traffic.
Park Lane / North Wall Quay	Minor Junction	3 arm signal junction	Westbound Right-turn bus and traffic signals for local access.
New Wapping Street / North Wall Quay	Moderate Junction	3 arm signal junction	Westbound Right-turn traffic signals for HGV access to Dublin Port Terminal 3 on East Wall Road via Sherriff Street.
Castleforbes Road / North Wall Quay	Moderate Junction	3 arm signal junction	No right-turn westbound. Alternative access from the north via Sherriff Street.
North Wall Avenue / North Wall Quay	Moderate Junction	3 arm signal junction	No right-turn westbound. Alternative access from the north via Sherriff Street. Left and right turn lanes removed to accommodate continuous bus lanes.
East Wall Road / North Wall Quay	Major Junction	3 arm roundabout	Roundabout retained pending change by Dublin City Council to a signal junction in a separate scheme.
<b>Section 1 – South Quays</b>			
Talbot Memorial Bridge / City Quay	Major Junction	4 arm signal junction	One-way southbound traffic from the north over Memorial Bridge. No other traffic approaches. Contra-flow bus lane westbound on City Quay through the junction. Two-way cycle track on the eastern side of Memorial Bridge. Northbound cycle track on the western side of Memorial Bridge.
City Quay / Prince's Street South	Minor Junction	Priority junction	No change to the existing junction. Prince's Street South is one-way northbound with no turns permitted from City Quay.
City Quay / Lombard Street East	Moderate Junction	3 arm signal junction	Modified for contra-flow westbound bus lane downstream on City Quay.

Junction Location	Junction Category	Description	Notes
			Central traffic island removed, and pedestrian crossings moved to each arm. Northbound contraflow cycle track on Lombard Street East. Shared crossings for cyclists and pedestrians improved to segregated facilities.
Creighton Street / Sir John Rogerson's Quay	Minor Junction	Priority junction	No change to the existing junction.
Windmill Lane / Sir John Rogerson's Quay	Minor Junction	Priority junction	No change to the existing junction.
Lime Street / Sir John Rogerson's Quay	Minor Junction	Priority junction	No change to the existing junction.
Samuel Beckett Bridge / Sir John Rogerson's Quay / Cardiff Lane	Major Junction	4 arm signal junction	Westbound one-way on western arm. Westbound contra-flow bus lane on eastern arm. Cycle tracks added on Cardiff Lane with links to the cycle tracks on the Campshires and on Samuel Beckett Bridge. One traffic lane removed at Cardiff Lane approach.
Forbes Street / Sir John Rogerson's Quay	Minor Junction	3 arm signal junction	No change to the existing junction.
Asgard Road / Sir John Rogerson's Quay	Minor Junction	Priority junction	No change to the existing junction. Asgard Road South is one-way northbound with no turns permitted from Sir John Rogerson's Quay.
Blood Stoney Road / Sir John Rogerson's Quay	Minor Junction	Priority junction	No change to the existing junction.
Britain Quay / Sir John Rogerson's Quay	Minor Junction	Priority junction	No change to the existing junction.
Benson Street / Sir John Rogerson's Quay	Minor Junction	Priority junction	No change to the existing junction.
Chapman Walk / Sir John Rogerson's Quay	Minor Junction	Priority junction	No change to the existing junction. One-way southbound

#### 4.5.1.7 Parking and Loading Bays

Changes to the parking and loading provisions along Section 1 – Talbot Memorial Bridge to Tom Clarke East Link Bridge as a result of the Proposed Scheme are in Table 4.5 and Table 4.6 respectively.

**Table 4.5: Section 1 - Talbot Memorial Bridge to Tom Clarke East Link Bridge: On-Street Parking Space Change Impact Summary**

Location	Type of Parking	Existing	Proposed	Change
<b>North Quays</b>	Disabled	2	0	-2
	Pay & Display	15	0	-15
	Informal	12	0	-12
	Taxi	5	0	-5
<b>South Quays</b>	Disabled	2	2	0
	Pay & Display	50	15	-35
	Permit	21	13	-8
	Informal	14	14	0
	Taxi	3	0	-3
<b>Approximately adjacent parking within 200m</b>		187	187	0
<b>Total</b>		311	231	-80

**Table 4.6: Section 1 - Talbot Memorial Bridge to Tom Clarke East Link Bridge: Existing and proposed Commercial Loading Bays**

Location	Type of Parking	Existing	Proposed	Change
North Quays	Commercial Loading Bay	27	18	-9
South Quays	Commercial Loading Bay	4	4	0
<b>Total</b>		31	22	-9

#### 4.5.1.8 Structures

##### 4.5.1.8.1 Major Structures

There are a number of proposed structures along the length of the Proposed Scheme, all of which will be located within Section 1, and are as reported in Table 4.7.

**Table 4.7: Summary of Proposed Structures**

Identity	Irish OS Grid	Chainage	Description
George's Dock Replacement Carriageway Bridge	53°20'53.4"N 6°14'56.4"W	A-1435	13m wide and 17.5m long single-span concrete carriageway bridge over the entry / exit channel and associated lock to George's Dock. The existing steel opening Scherzer bridges will be relocated to each side and renovated.
Custom House Quay Boardwalk	53°20'52.0"N 6°14'50.1"W	A-1360	130m long and 4m wide steel frame with wooden decking, supported by steel beams anchored into proposed building foundation.
North Wall Quay Boardwalk	53°20'51.4"N 6°14'37.4"W	A-1125	65m long and 6m wide steel substructure with wooden decking, supported by steel struts anchored into existing quay wall.
Spencer Dock Replacement Carriageway Bridge	53°20'51.3"N 6°14'26.0"W	A-875	13m wide and 13.5m long single-span concrete carriageway bridge over the entry / exit channel and associated lock to George's Dock. The existing steel opening Scherzer bridges will be relocated to each side and renovated.

##### 4.5.1.8.2 Retaining Walls

There is one minor low level retaining wall proposed within this section of the Proposed Scheme at the below location:

- A minor retaining wall (<1m high) will be provided to facilitate the cycle right turn and improved pedestrian crossing arrangement onto Samuel Beckett Bridge from Sir John Rogerson's Quay at chainage B-10675.

#### 4.5.1.9 Landscape and Urban Realm

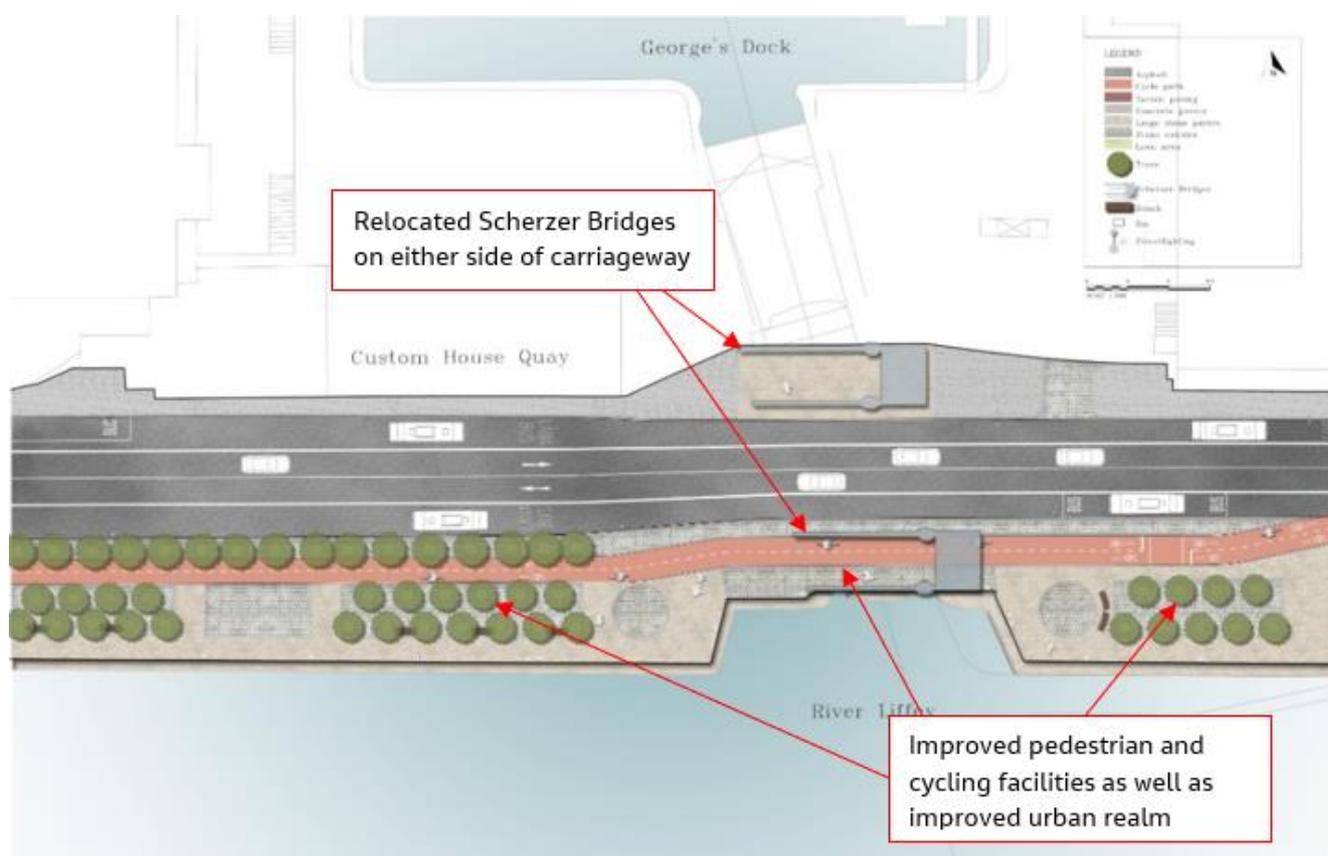
For an overview of the design principles and approach, reference should be made to Section 4.6.12. The following sections provide a description of specific landscape and urban realm design works in Section 1 of the Proposed Scheme.

##### 4.5.1.9.1 North and South Quays (Campshires)

There is high-quality landscaping along the Campshires of the north and south quays to the west of the Samuel Beckett Bridge, and to a lesser extent to the east of the bridge along the north quays, with extensive stands of trees set in stone paving. It is separately proposed by DCC to provide similar landscape treatment along the remaining sections of the quays via the North and South Campshires Public Realm Scheme (see Section 4.6.6.3.1 for further details). The proposed cycle tracks and associated adjustments to the pedestrian facilities in the Proposed Scheme will be integrated into the landscaped environment along the quays. In some places it will be necessary to remove trees, but these will be replaced with an equal number in new positions.

#### 4.5.1.9.2 Scherzer Bridges at George's Dock and Spencer Dock

The area surrounding the historic Scherzer Bridges at George's Dock (Image 4.1) and the Royal Canal at Spencer Dock represent a unique opportunity to implement significant improvements to the urban realm and the status of the bridges, while accommodating improved pedestrian and bicycle circulation. As part of the Proposed Scheme, these bridges will be dismantled and removed from site for careful restoration and repair, and subsequently stored securely until such time that they are reinstated. They will then be returned to new locations on each side of the road adjacent to their current positions. The renovation will ensure the long-term preservation of these visually interesting structures. In their new role, the bridges will carry only light loadings of pedestrians and cyclists instead of the current heavy traffic loading which contributes to fatigue damage. The urban realm will be enhanced by these proposals. A visual representation of these changes can be seen in Figure 17.2 in Volume 3 of this EIAR.



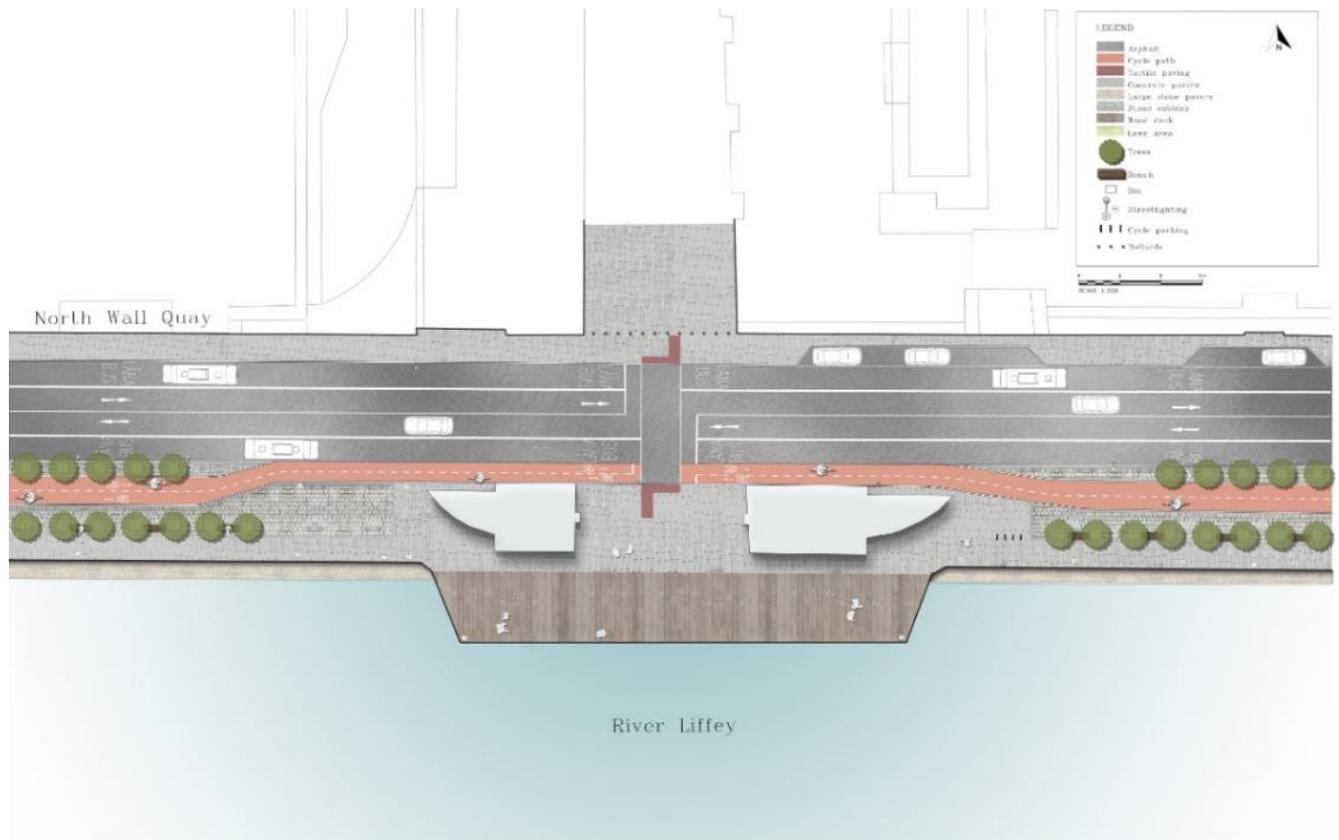
**Image 4.1: Urban Realm at the Historic Scherzer Bridges at George's Dock**

#### 4.5.1.9.3 Custom House Quay Boardwalk

There is an existing building on the Campshire at R801 Custom House Quay (Dublin City Council's Dublin Docklands office) which constrains the space available for pedestrians and cyclists. The Proposed Scheme includes the narrowing of the roadway to achieve a two-way cycle track (2.5m) and footpath (1.8m) between the building and the roadway. DCC proposed to replace this building with new offices and has received planning permission for same as part of its planned Whitewater Rafting Centre. DCC has confirmed its intention to proceed with the offices redevelopment, even if the delivery of the rest of the Whitewater Rafting Centre is deferred. Through engagement with DCC and its architects, it has been agreed that as part of the Proposed Scheme a new public footpath may be routed on the river side of any newly constructed office buildings by the provision of an enhanced 6m wide pedestrian boardwalk. A visual representation of this change can be seen in Figure 17.2 in Volume 3 of this EIAR.

#### 4.5.1.9.4 Excise Walk / North Wall Quay Boardwalk

Another boardwalk is proposed to the rear of two restaurant buildings on the Campshire at the junction of Excise Walk and R801 North Wall Quay (see Image 4.2), where the existing riverside passage is restricted to less than 2m. The roadway is being widened at this location to provide bus lanes in both directions preventing the provision of both a two-way cycle route and a footpath alongside, therefore pedestrians will be directed along the riverside, which will tie-in with the facilities provided upstream and downstream of it. The pedestrian crossing across North Wall Quay in this location will be adjusted and extended to connect to the enhanced riverside pedestrian route.



**Image 4.2: Proposed Boardwalk at Excise Walk / North Wall Quay Boardwalk**

#### 4.5.1.10 Land Acquisition and Use

Temporary land acquisition is required within this Section of the Proposed Scheme at a number of locations, including Construction Compounds at both sets of Scherzer Bridges as well as along Sir John Rogerson's Quay.

Permanent land acquisition is required within this Section at various locations, including at the locations of the relocated Scherzer Bridges and extents of improved pedestrian and cycling facilities along the north and south quays .

The impacts on people and community receptors arising from land acquisition in Section 1 of the Proposed Scheme are addressed in Chapter 10 (Population). Similarly, the impacts on landscape amenity arising from land acquisition in Section 1 of the Proposed Scheme are addressed in Chapter 17 (Landscape (Townscape) & Visual).

### 4.5.2 Section 2 – River Dodder Public Transport Bridge (DPTOB)

#### 4.5.2.1 General Overview of the Proposed Scheme

This Section of the Proposed Scheme consists of a new public transportation opening bridge (DPTOB) over the River Dodder at its confluence with the River Liffey.

The proposed DPTOB will include:

- The construction of approach roads associated with the bridge;
- A new control building for operating the bridge;
- A new club house and facilities for St. Patrick's Rowing Club which will be required to be moved as a result of the Proposed Scheme;
- The provision of a new ESB substation;
- The reclamation of land to the west of Tom Clarke East Link Bridge to facilitate construction works; and
- Landscaping of the area between York Road / Thorncastle Street and the R131 Regional Road over the extent of this Section of the Proposed Scheme.

#### **4.5.2.2 Deviations from Standard Cross Sections**

There is a deviation from the standard BusConnects cross-sectional elements (as set out in Section 4.6.1) on the DPTOB as its purpose is to facilitate public transport only and therefore only bus lanes are accommodated on the bridge. These bus lanes are accompanied by pedestrian footpaths on either side and a two-way cycleway on the northern (east-bound) side.

#### **4.5.2.3 Bus Lane Provision**

An overview of the bus lane provision as part of the Proposed Scheme is set out in Section 4.6.4. As mentioned in Section 4.5.2.2, the purpose of the DPTOB is to facilitate public transport only and therefore only bus lanes are accommodated on the bridge.

#### **4.5.2.4 Bus Stops**

There will be no bus stops on the immediate approach to or on the proposed DPTOB itself.

#### **4.5.2.5 Cycling Provision**

The specific proposals for cycling facilities in Section 2 of the Proposed Scheme are described below. Provision for cyclists at signal-controlled junctions are described in Section 4.6.3.5.

As part of the design of the DPTOB, a two-way segregated cycleway is proposed alongside the eastbound carriageway on the north side of the bridge. This two-way cycle track is a continuation of the two-way cycleway proposed along the length of the south quays from Talbot Memorial Bridge to Tom Clarke East Link Bridge as part of the Proposed Scheme and acts as an important linkage between the cycling facilities proposed in Section 1 and those proposed in Section 3 of the Proposed Scheme (see Section 4.5.3.1 for details of cycling provision in Section 3 of the Proposed Scheme).

#### **4.5.2.6 Junctions Information**

There will be a signalised junction on the eastern tie-in to Tom Clarke East Link Bridge and the R131 East Link Road. There will be a dedicated bus lane for traffic travelling from the East Link Road onto the proposed DPTOB. There will be no right turn onto the proposed bridge provided for traffic travelling from the north from the Tom Clarke East Link Bridge as part of the Proposed Scheme, however DCC may seek to provide such a right turn in future as part of separate works to the Tom Clarke East Link Bridge. A pedestrian and cycle route will be provided to convey pedestrians and cyclists towards Ringsend Park alongside York Road.

The design includes for controlled on-demand access to the relocated St. Patrick's Rowing Club.

#### **4.5.2.7 Parking and Loading Bays**

As Section 2 of the Proposed Scheme comprises a new bridge connection between Sir John Rogerson's Quay and Thorncastle Street / York Road, as such there are no parking or loading bays in this section of the Proposed Scheme.

#### 4.5.2.8 Structures and Buildings

##### 4.5.2.8.1 Major Structures

Section 2 includes one structure - the proposed DPTOB and the adjacent building housing the Control Room for the DPTOB as well as the relocated facilities for St. Patrick's Rowing Club (SPRC), see Section 4.5.2.8.3.

The proposed DPTOB will be a 96m long three span steel bridge which will span from Sir John Rogerson's Quay (adjacent to the Capital Dock development) to the R131 Regional Road adjacent to Tom Clarke East Link Bridge. The bascule span will be a single leaf bascule opening span of length 33m. The central and east span will be continuous, 25.15m and 26.4m in length, respectively. An 11.15m length of bridge made up of the bascule back span and bascule pier will be between the western and central span. The heel back span shall be approximately 9.5m measured from the trunnion to the end of the counterweight.

The bridge deck will be 20.7m wide and carry a two-lane carriageway, cycleway (on the northern side only) and footpaths to either side. The bridge deck will be wholly enclosed with an orthotropic deck plate.

The proposed DPTOB will accommodate an opening section adjacent to Sir John Rogerson's Quay which will facilitate the navigation of larger vessels between the River Liffey and River Dodder / Grand Canal Basin. The passage of smaller craft will be feasible without opening the bridge. The bridge will provide the following minimum clearances for both the raised and lowered positions:

- When the bridge is lowered, a 2.7m high vertical clearance over the River Dodder (above mean high water springs (MHWS) level) over the navigational channel; and
- When the bridge is raised fully to 70° rotation, there will be an unlimited vertical clearance with a 19m wide navigational channel.

The leaf of the bridge will be connected in the lowered position by mechanised nose locks at the west abutment. These locks are designed to align the deck surfaces across the joint and assure the bridge cannot be inadvertently opened until the locks are withdrawn.

##### 4.5.2.8.2 Retaining Walls

Reclaimed land edges will be retained by permanent embedded sheet pile retaining walls.

To the east, the road will climb up to the proposed DPTOB on a formation retained by principal back-to-back retaining walls on pad foundations. To the west, an approximately 19m long approach ramp will run onto Sir John Rogerson's Quay, made up of retaining walls and wingwalls.

##### 4.5.2.8.3 Buildings

The building housing the DPTOB Control Room and the relocated SPRC is a two-storey building, situated to the west of the DPTOB immediately adjacent to the River Liffey (on reclaimed land). The main structure will consist of steelwork framing up to eaves level with masonry infill (cavity wall construction) and structural steelwork trusses to attain the architectural design. The lateral stability of the building will be achieved by means of reinforced concrete stair core and lift shaft, both of which will be located in the central part of the two-storey building. In addition to the boat storage area the building will have general storage, kitchen and changing facilities in addition to an office, function room and gym. The building itself is c. 12m wide (outside of wall to outside of wall at the widest width in the boat storage area), c. 28m long (excluding the control building – south elevation), and c. 13m high (from ground level to crown of roof). The length of the building with the control building included is c. 37m. Along the northern part of the building, an external observation terrace overlooking the river is proposed. The structure for the terrace will consist of an extension of the main steelwork framing elements consisting of a series of cantilever steel beams connected to the main structural frame columns.

The Control Room will be located to the immediate west of the main structure, adjoining it with unobstructed views of the River Liffey, River Dodder and the proposed DPTOB. It is proposed that this structure will be similar in design to the main structure but will be broadly hemisphere in formation, see BCIDD-ROT-STR\_ZZ-0016\_XX\_00-DR-SS-9001.

It should be also noted that it is proposed to construct a new jetty and public slip way to the north of the two-storey building to facilitate direct access to the River Liffey.

Further detail on the design and structural make-up of these structure can be found in the Bridges and Major Retaining Structures Drawings (BCIDD-ROT-STR\_ZZ-0016\_XX\_00-DR-SS-9001) and Figure 17.2 (Photomontages) in Volume 3 of this EIAR.

#### 4.5.2.9 Landscape and Urban Realm

For an overview of the design principles and approach, reference should be made to Section 4.6.12. The following sections provide a description of specific landscape and urban realm design works in Section 2 of the Proposed Scheme.

##### 4.5.2.9.1 The DPTOB

The proposed DPTOB will have a very high-quality architectural finish as may be seen in Image 4.3.



**Image 4.3: Proposed DPTOB**

There will be three linked areas of urban realm included in this Section of the Proposed Scheme (as shown in Image 4.4):

- West bank approaches of the DPTOB: To the south of the approach to the proposed DPTOB, the existing landscaped area of Capital Dock will link to the southern bridge footpath via steps that will provide places to sit, looking south and over the new children's play area. To the north, similar steps will give access to the Sir John Rogerson's Quay Campshire, and will provide a place to sit and look at the river;
- DPTOB itself: The south side of the proposed DPTOB will be dedicated to pedestrians only, with a wide footpath. Fixed seating and planting boxes will back onto an upstand beam / wall, and face south, giving views of the basin, the Aviva Stadium and the Dublin Mountains in the distance. The balustrade will be 1.1m high and is designed to be as transparent as possible, to facilitate views when sitting down. The platform of the bascule pier will be extended southwards to provide a generous planting and seating area.

The north side of the proposed DPTOB will have both a dedicated cycle track and a footpath. The balustrade will be 1.4m high, offering some protection for cyclists from winds along this more exposed side of the bridge. Similarly, the platform of the bascule pier will be extended northwards,

symmetrically to the southern side of the bridge, to provide a generous planting and seating area; and

- East bank approach of the DPTOB: On the eastern side of the proposed DPTOB, the south side will be a generous green area, designed as a mini-park for Ringsend. It will include seating overlooking the Dodder Basin, planting and two areas that can in the future be used as play areas or urban 'keep fit' areas. Existing trees in this area will be retained in the landscape design insofar as possible. Existing parking in this area will be carefully replaced and integrated, as will the vehicular cross route to the SPRC.

The new SPRC building will be located on the north side of the eastern bridge approach. It will be surrounded by hardstanding on three sides, used for the movement of boats, trailers and cars; and for parking for the SPRC. This hardstanding area will give access to the SPRC slipway. To the north of the SPRC, a pedestrian terrace along the river will be accessible only from the SPRC. Within the hardstanding area on the eastern side of the new SPRC building, within an area that is only accessible to the SPRC, the SPRC intend to erect a single flagpole, approximately 16m high.

All the plants and trees selected will be native species, appropriate to the urban and riverine location. The landscaping plan and all associated outdoor furniture will be subject to the approval of the DCC Parks Department and Heritage Officer.

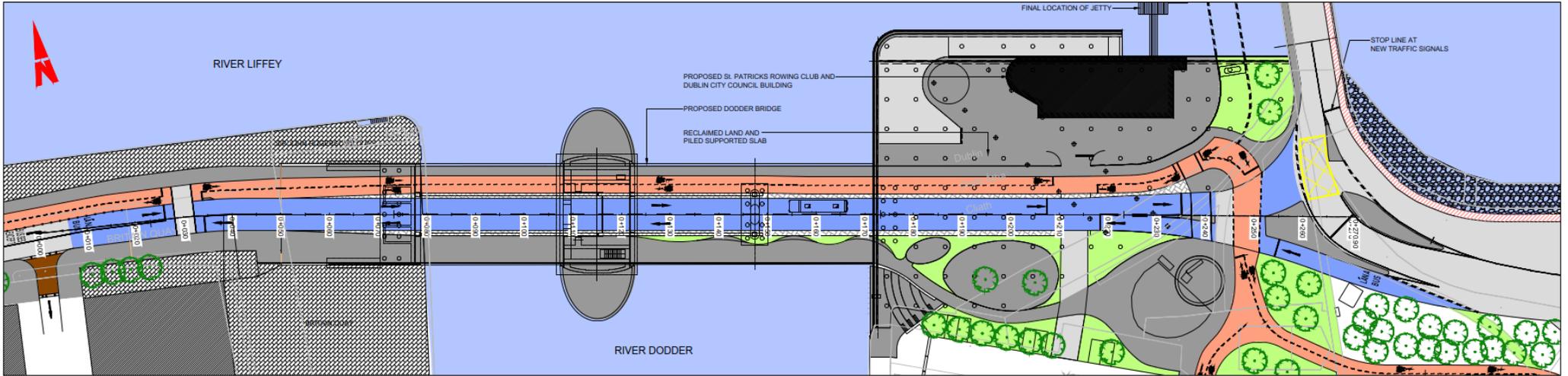


Image 4.4: Landscaping on the Approaches to the Proposed DPTOB

#### 4.5.2.10 Land Acquisition and Use

Temporary land acquisition is required within this Section of the Proposed Scheme at two locations, namely the Construction Compounds at either side of the DPTOB on Sir John Rogerson's Quay and Thorncastle Street / York Road.

Permanent land acquisition is required from either side of the DPTOB, from Capital Dock Park on the western side and Thorncastle Street / York Road and the adjacent amenity area on the eastern side.

The impacts on people and community receptors arising from land acquisition in Section 2 of the Proposed Scheme are addressed in Chapter 10 (Population). Similarly, the impacts on landscape amenity arising from land acquisition in Section 2 of the Proposed Scheme are addressed in Chapter 17 (Landscape (Townscape) & Visual).

### 4.5.3 Section 3 – Tom Clarke East Link Bridge to Sean Moore Road

#### 4.5.3.1 General Overview of the Proposed Scheme

This Section of the Proposed Scheme will commence from the southern end of the Tom Clarke East Link Bridge at the junction with the proposed DPTOB and will proceed to the junction of R131 Sean Moore Road and R802 Beach Road.

No new or upgraded bus facilities will be provided in this section of the Proposed Scheme as it is intended that buses will use the existing facilities along the East Link Road to R131 Sean Moore Road. The provision of new and upgraded cycling facilities are the main works of concern in this section of the Proposed Scheme.

#### 4.5.3.2 Cycling Provision

This section of the Proposed Scheme will comprise the following works along several cycle routes:

- From the southern end of the Tom Clarke East Link Bridge at the junction of the proposed DPTOB, a two way cycle track will extend for 100m to York Road.
- From York Road the cycle route will follow quiet local streets at Pembroke Cottages and Cambridge Park to Ringsend Park, where the existing footpath along the western boundary of the park will be improved to a 4m wide shared path with pedestrian priority;
- From the southern end of Ringsend Park, a segregated cycle track will be provided along Strand Street, Pembroke Street, and R802 Beach Road to R131 Sean Moore Road;
- A branch cycle route from the southern end of Ringsend Park will skirt around Irishtown Stadium to provide a direct connection to the Poolbeg SDZ lands via Bremen Road; and
- A branch cycle route will share the quiet residential streets along York Road and Pigeon House Road to Poolbeg, where Quiet Street Treatment will be provided (in addition to the existing traffic calming measures that are already provided).

The proposed works along the aforementioned routes will facilitate improvements in the provision cycling facilities along a number of GDACNP designated cycle routes, primarily the secondary routes of 1E/N05, 13E/N05, C8 and the Royal Canal and Dodder Greenways.

#### 4.5.3.3 Parking and Loading Bays

Changes to the parking and loading provisions along Section 3 – Tom Clarke East Link Bridge to Sean Moore Road as a result of the Proposed Scheme are shown in Table 4.8.

**Table 4.8: Section 3 - Tom Clarke East Link Bridge to Sean Moore Road: On-Street Parking Space Change Impact Summary**

Location	Type of Parking	Existing	Proposed	Change
Ringsend	Informal	235	233	-2
	Disabled	2	3	+1

Location	Type of Parking	Existing	Proposed	Change
	Formalised Parking (New)	0	2	+2
	Commercial Loading Bay	0	0	0
<b>Total:</b>		237	238	+1

## 4.6 Key Infrastructure Elements

The following sections provide a description of the main infrastructure elements of the Proposed Scheme. The Proposed Scheme has been designed following guidance relating to the design principles for urban streets, bus facilities, cycle facilities and urban realm encapsulated in the PDGB as outlined in Section 4.4.

### 4.6.1 Mainline Cross-Section

Traffic lane widths (including bus lanes) will follow the guidance outlined in DMURS, with the preferred width of traffic lanes on the Proposed Scheme being:

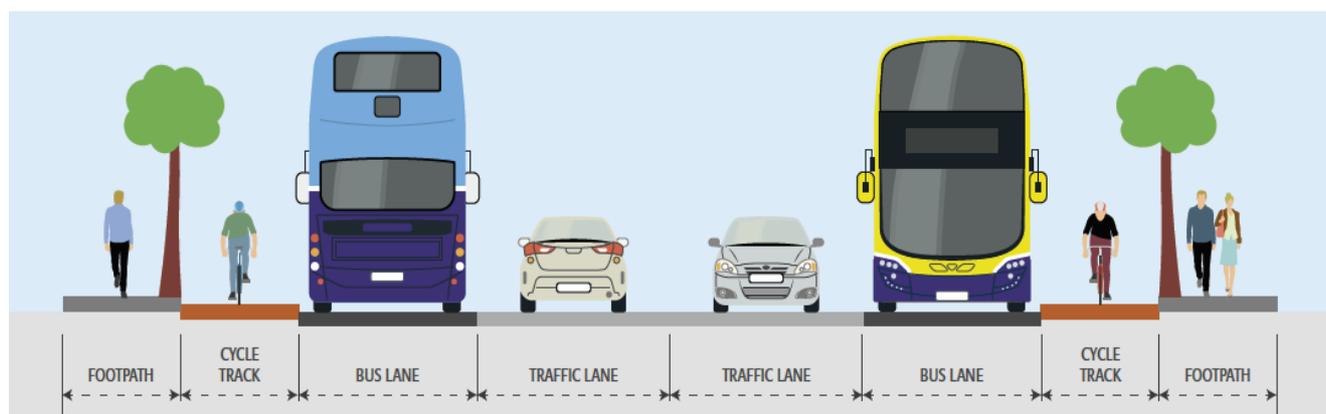
- 3.0m in areas with a posted speed limit < 60km/h; and
- 3.25m in areas with a posted speed limit > 60km/h.

Traffic lane width of 2.75m is permissible but not desirable and should only be permitted on straight road sections with very low HGV percentage and where all desirable minimum width for footpaths, cycle tracks, parking, bus lanes are not achievable without impact on third-party lands, if appropriate taking all design factors into account in the context of the Proposed Scheme objectives.

The desirable minimum width for a single direction, with flow, raised adjacent cycle track is 2.0m. Based on The National Cycle Manual (NCM) this allows for overtaking within the cycle track. The minimum width is 1.5m. The desirable width for a two-way cycle track is 3.25m with a 0.5m buffer between cycle track and the carriageway.

2.0m is a desirable minimum width for footpaths with 1.2m being an absolute minimum width at pinch points.

An example of the typical BusConnects road layout (without multiple traffic lanes in each direction or median) is shown in Image 4.5.



**Image 4.5: Archetypal Road Layout**

The cross-sectional design of the mainline has been developed to achieve the desirable width criteria contained within the PDGB wherever reasonably practicable. Where these criteria are not achievable, for instance due to physical constraints at pinch points, the widths have been reduced as shown within Table 4.9.

**Table 4.9: DMURS Cross Sectional Design Parameters**

Design Element	DMURS (Minimum Standard)	One Step Below (Relaxation)	Minimum Width (Departure)	Permitted Reductions at Constraints
Footpath	2m	<2m	<1.8m	1.2m (over distances <2m as per BusConnects Design Guide in Appendix A4.1 Preliminary Design Booklet in Volume 4 of this EIAR))
Cycle Track	2m	<2m	<1.5m	1.2m (over distances <2m as per BusConnects Design Guide in Appendix A4.1 Preliminary Design Booklet in Volume 4 of this EIAR))
Bus Lane	3m	N/A	<3m	N/A
Traffic Lane	3m	N/A	<3m	2.75m may be adopted for dedicated turning lanes alongside a 3.0m wide general traffic lane.

For the Proposed Scheme the width of the bus lanes and traffic lanes have not been reduced below 3.0m; the nominal width of the footpaths and cycle tracks are at a minimum width or greater.

## 4.6.2 Pedestrian Provision

### 4.6.2.1 Footpath Widths

As stated in Section 4.6.1, 2.0m is the desirable minimum width for a footpath. This width should be increased in areas catering for significant pedestrian volumes where space permits. DMURS defines the absolute minimum footpath width for road sections as 1.8m based on the width required for two wheelchairs to pass each other. Building for Everyone: A Universal Design Approach (NDA 2020), defines acceptable minimum footpath widths at specific pinch points as being 1.2m wide over a two-metre length of path.

In line with the Road User Hierarchy designated within DMURS, at pinch points the width of the general traffic lane should be reduced first, then the width of the cycle track should be reduced before the width of the footpath is reduced.

Throughout the Proposed Scheme footpath widths of two metres or wider have been proposed, with the exception of a limited number of stretches where a width of 1.8m or greater is proposed due to the presence of localised space constraints.

### 4.6.2.2 Pedestrian Crossings

Where possible, DMURS recommends that designers provide pedestrian crossings that allow pedestrians to cross the street in a single, direct movement. To facilitate road users who cannot cross in a reasonable time, the desirable maximum crossing length without providing a refuge island is 18m. This may be increased to 19m as an absolute maximum. This is applicable at stand-alone pedestrian crossings as well as at junctions. At the northern end of the Samuel Beckett Bridge the existing 15m long pedestrian crossing will be extended to 21m long so as to provide separation from the north-south cycle tracks that currently pass through shared spaces at the junction corners. There is an existing 20m long toucan crossing at the southern end of the bridge that will remain unchanged.

Refuge islands should be a minimum width of two metres. Larger refuge islands should be considered by designers in locations where the balance of place and movement is weighted towards vehicle movements, such as areas where the speed limit is 60kph or greater, in suburban areas or where there is an increased pedestrian safety risk due to particular traffic movements. Where a refuge island is provided, straight crossings are desirable, and the refuge island has been designed to be 4m wide or more. At staggered crossings, islands of less than 4m in width may be provided, and these have been designed to have a minimum effective width of 2m between obstacles such as signal poles.

Along the Proposed Scheme pedestrian crossings varying from 2.4m and 4m in width have been incorporated. Larger pedestrian crossing widths have been allocated in areas that are expected to accommodate a high number of pedestrians crossing or at locations where both pedestrians and cyclists share a crossing such as at a Toucan Crossing.

At signalised junctions and standalone pedestrian crossings, the footpath is to 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 footpath level and facilitate unimpeded crossing. Tactile paving is provided at the mouth of each pedestrian crossing and audio units will be provided on each traffic signal push button to assist mobility impaired users. Pedestrian crossings are indicated in the Landscaping General Arrangement drawings (BCIDD-ROT-ENV\_LA-0016\_ML\_00-DR-LL-9001) in Volume 3 of this EIAR.

### **4.6.3 Cycling Provision**

One of the objectives for the Proposed Scheme is to enhance the potential for cycling by providing safe infrastructure, segregated from general traffic wherever practicable. Physical segregation ensures that cyclists are protected from motorised traffic and can bypass vehicular congestion, thus improving cyclist safety and reliability of journey times. 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. Bike racks will generally be provided, where practicable, at Island Bus Stops and key additional locations as noted in the Landscaping General Arrangement drawings (BCIDD-ROT-ENV\_LA-0016\_ML\_00-DR-LL-9001) in Volume 3 of this EIAR.

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

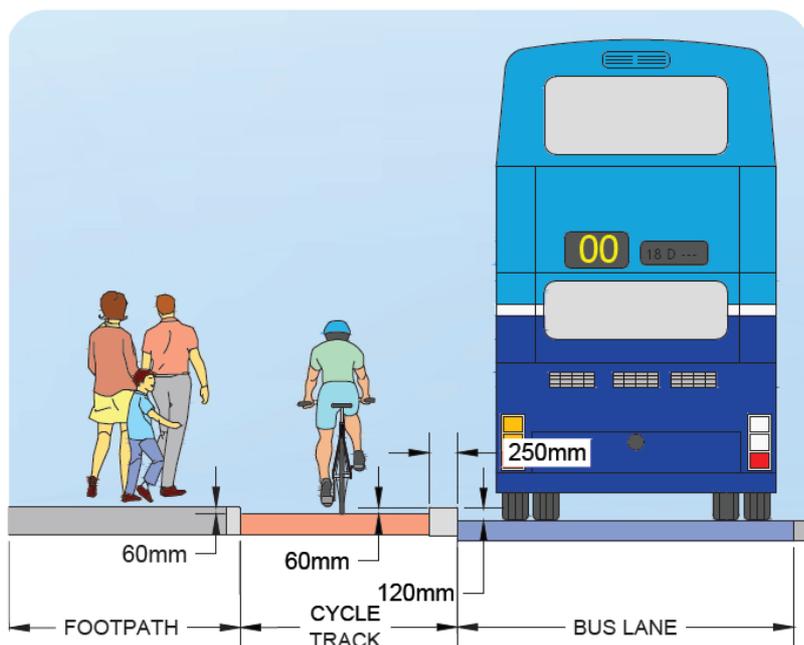
The principal source for guidance on the design of cycle facilities is the National Cycle Manual (NCM) (NTA 2011) and the PDGB.

The desirable minimum width for a single-direction, with-flow, raised-adjacent cycle track is 2m. This arrangement allows for two-abreast cycling, and based on the NCM Width Calculator, this also 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 is also necessary over very short distances to cater for local constraints (e.g., exceptional 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.

#### **4.6.3.1 Cycle Tracks**

A cycle track is a segregated lane dedicated to cycling which is physically separated from the adjacent traffic lane and / or bus lane horizontally and / or vertically, as shown in Image 4.6, taken from the PGDB.



**Image 4.6: Fully Segregated Cycle Track**

The Proposed Scheme will provide fully segregated cycle tracks along the entire length of the north and south quays. On the Ringsend cycle route, there will be a mix of shared quiet street, a shared path in Ringsend Park and a segregated cycled track adjacent to Strand Street, Pembroke Street and Beach Road, respectively, in Irishtown.

#### **4.6.3.2 Cycle Lanes**

Cycle lanes do not have vertical and / or horizontal separation from adjacent traffic lanes. There are no sections of cycle lane proposed as part of the Proposed Scheme, with cycle tracks being preferred where practicable.

#### **4.6.3.3 Quiet Street Cycle Route**

Where Core Bus Corridor roadway widths cannot facilitate cyclists without significant impact on bus priority, alternative cycle routes are explored where appropriate and feasible away from the Proposed Scheme bus route. Such offline options may include directing cyclists along streets with minimal general traffic other than car users who live on the street. Guidance in this regard has been provided within the PDGB, which states:

*'Diversions of proposed cycle facilities on to quieter parallel routes, to avoid localised narrowing of cycle tracks on the main CBC route, is to be considered in the context of the CBC route being listed as a primary cycle route as per the Greater Dublin Area Cycle Network Plan. These diversions, however, may also be considered where appropriate cycle facilities cannot be provided along the CBC route without significant impact.'*

These are called Quiet Streets due to the low volume of only local general traffic users travelling at low speed and are deemed suitable and safe 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.

On the Proposed Scheme, Quiet Street treatment is proposed as described in Section 4.5.3.2 above, and as shown in the General Arrangement Drawings (BCIDD-ROT-GEO\_GA-0016\_XX\_00-DR-CR-9001) included in Volume 3 of this EIAR.

#### **4.6.3.4 Treatment of Constrained Areas**

The width of two-way cycling facilities is generally 3.5m, however, this has had to be reduced to as little as 2.4m in exceptional circumstances. This occurs at the Dublin City Council Docklands offices at Custom House Quay (2.5m) and at the southern end of the Samuel Beckett Bridge (2.4m). The provision of a pedestrian boardwalk upon completion of the redevelopment of this building will allow the widening of the cycle track. In other areas, the minimum width is 3.0m, and this reduction is only provided where anticipated usage is low.

#### **4.6.3.5 Cycle Provision through Junctions**

Junctions have been designed to facilitate a high level of safety, comfort, and priority for sustainable modes of travel (i.e., walking and cycling) and for public transport by prioritising the space and time allocated to these modes within the operation of a junction. This will also accommodate the forecast future year traffic volumes as safely and efficiently as possible within the remaining space and time. This has allowed the BusConnects Infrastructure team to maximise the number of people moving through each junction and to prioritise these sustainable modes of travel. These locations are shown on the General Arrangement drawings (BCIDD-ROT-GEO\_GA-0016\_XX\_00-DR-CR-9001) included in Volume 3 of this EIAR.

### **4.6.4 Bus Priority Provision**

One of the 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. Several measures can be used to achieve this. This is described further in this section.

#### **4.6.4.1 Bus Lanes**

Bus Priority can be achieved by means of providing a dedicated lane within the carriageway for the bus to travel independently from the general traffic. This includes priority through junctions by bringing the bus lane to the junction stop line as per general traffic lanes. This means in some circumstances that left-turning traffic cannot use the bus lane at junctions and instead will be provided with a dedicated left-turn traffic signal phase for the turn movement off the general traffic lane or will be provided with a separate left-turning lane. In general, bus lanes will be a minimum of 3m wide. This is as per the guidance for traffic lane width outlined in DMURS. Larger lane widths are needed in some instances to enable buses to navigate corners, etc. ('swept path'). Bus Lanes are shown on the General Arrangement drawings (BCIDD-ROT-GEO\_GA-0016\_XX\_00-DR-CR-9001) included in Volume 3 of this EIAR.

The primary bus routing will be along the north quays, where 100% bus priority is being provided through provision of fully continuous bus lanes. Bus priority will also be provided along the south quays. This will be achieved through the provision of intermittent sections of bus lane to ensure bus priority on the approaches to all major junctions. Full bus lane provision is not considered necessary in the context of the layout of the traffic cells and existing one-way restrictions, which prevent congestion developing. Eastbound buses will use the north quays only between the Custom House and Beckett Bridge and both quays from there to the Tom Clarke East Link Bridge. Westbound buses will use the full length of both quays.

Specific bus priority measures along the south quays include:

- A westbound bus lane will be provided on City Quay west between Lombard Street East and Moss Street, reducing the existing two-lane eastbound traffic arrangement to one lane. This will enable a contra-flow bus link to George's Quay against the current one-way eastbound traffic flow; and
- A westbound bus lane will be provided on Sir John Rogerson's between Forbes Street and Cardiff Lane to ensure westbound bus priority through the junction at the southern end of Samuel Beckett Bridge.

#### **4.6.4.2 Signal Controlled Priority**

An alternative measure for achieving bus priority at locations where the provision of bus lanes is not possible is the use of Signal Control Priority (SCP). SCP facilitates bus priority by using traffic signals to give buses priority

ahead of general traffic on sections of a route with significant physical constraints or pinch-points impacting on the provision of a bus lane.

Signalised bus priority operation is not proposed along the Proposed Scheme. However, bus priority signals are incorporated to allow right turning movements from the bus lanes at the junctions with Guild Street (eastbound), and Commons Street and Park Lane (westbound).

#### **4.6.4.3 Bus Gates**

There are no Bus Gates proposed as part of the Proposed Scheme.

#### **4.6.4.4 Treatment at Pinch Points**

In line with the Road User Hierarchy designated within DMURS, at pinch points, the width of the general traffic lane should be reduced first, then the width of the cycle track should be reduced before the width of the pedestrian footpath is reduced. The Proposed Scheme design reflects this approach, where practicable.

#### **4.6.4.5 Bus Stops**

To improve the efficiency of the bus service along the Proposed Scheme, the position and number of bus stops has been evaluated as part of a bus stop assessment.

The criteria that are considered when locating a bus stop are as follows:

- Driver and waiting Passengers are clearly visible to each other;
- Location close to key facilities;
- Location close to main junctions without affecting road safety or junction operation;
- Location to minimise walking distance between bus interchange stops;
- Where ideally there is space for a bus shelter;
- Location in pairs, 'Tail to Tail' opposite sides of the road;
- Close to (and on exit side of) pedestrian crossings;
- Away from sites likely to be obstructed; and
- Adequate footpath width.

For the Core Bus Corridor Infrastructure Works it is proposed that bus stops should be preferably spaced approximately 400m apart on typical suburban sections of route, dropping to approximately 250m in urban centres.

It is important that bus stops are not located too far from pedestrian crossings as pedestrians will tend to take the quickest route, which may be hazardous. Locations with no or indirect pedestrian crossings should be avoided.

The following bus stop designs were considered for use on the Proposed Scheme - the Island Bus Stop, the Shared Landing Bus Zone, the Inline Bus Stop, and the Layby Bus Stop. There are no shared landing bus stops in the Proposed Scheme.

##### **4.6.4.5.1 Island Bus Stops**

Where sufficient space allows Island Bus Stops are the preferred bus stop option for the Proposed Scheme.

This option will reduce conflict between cyclists and stopping buses by deflecting cyclists behind the bus stop. To address the pedestrian / cyclist conflict, a pedestrian priority crossing point is provided for pedestrians accessing the bus stop area. Visually impaired pedestrians may call for a fixed green signal when necessary and the cycle signal will change to red. The cycle track will narrow from 2.0m to 1.5m for signal file cycling through the bus stop as overtaking is not required in this area. An example of an Island Bus Stop is shown on Image 4.7 (one-way cycle track) and Image 4.8 (two-way cycle track). The island bus stop design is one of the most commonly used bus stops along the Proposed Scheme. These locations are outlined in Section 4.5.

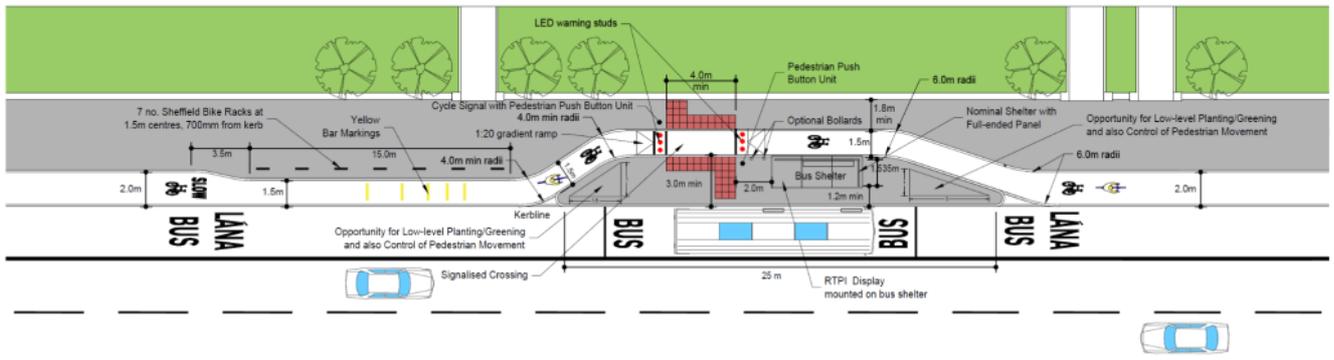


Image 4.7: Island Bus Stop Arrangement – One Way Cycle Track

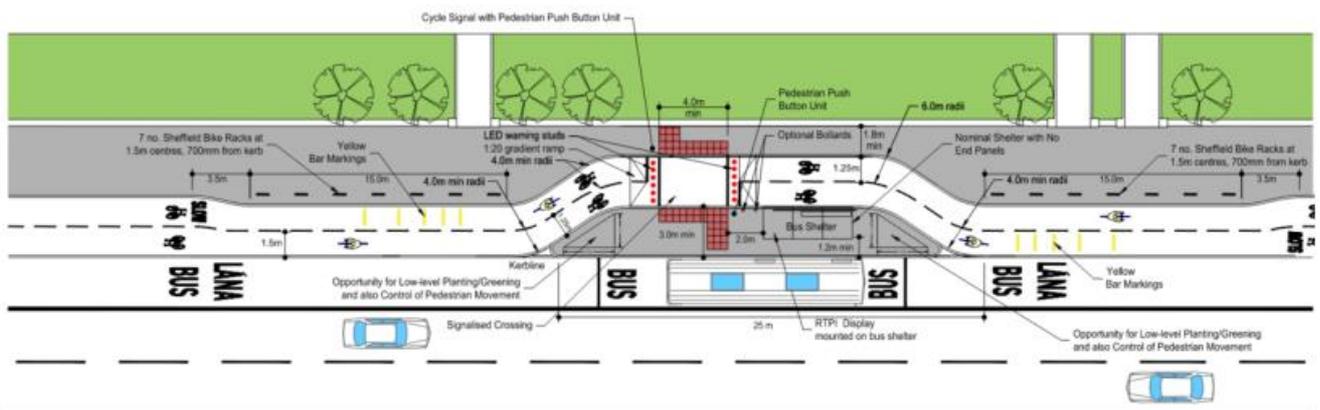


Image 4.8: Island Bus Stop Arrangement - Two Way Cycle Track

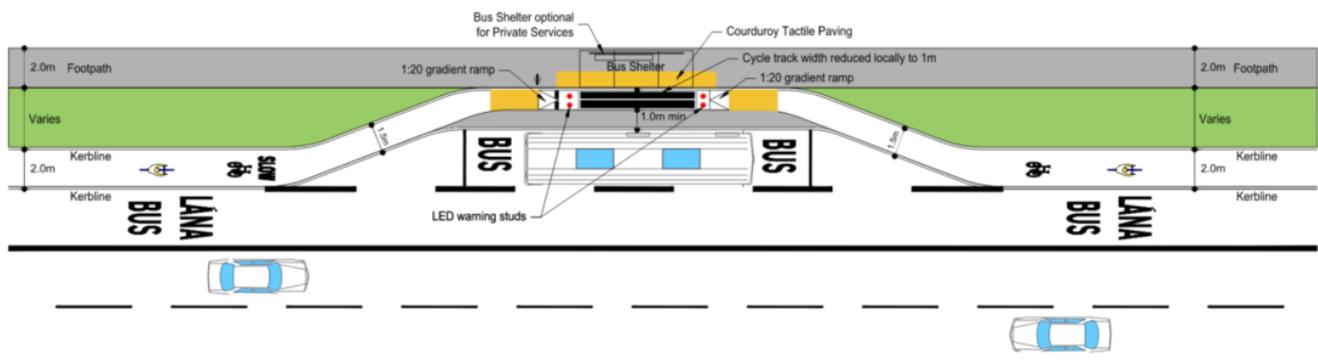
#### 4.6.4.5.2 Inline Bus Stop

Where there are no cycle tracks provided, inline bus stops are used, where the users departing the bus exit straight on to the footpath. The Inline Bus Stop is the most used bus stop types along the Proposed Scheme, particularly on the north quays, as outlined in Section 4.5.

#### 4.6.4.5.3 Layby Bus Stop

Layby bus stops can provide an effective solution for coaches with long dwell times at bus stops, allowing other buses to pass the stopped bus. These are important on routes where the frequency of buses is high and where bunching can occur if inline bus stops are provided along the entire length of the Proposed Scheme (i.e. the north quays).

An example of a layby bus stop arrangement is shown in Image 4.9.



**Image 4.9: Layby Bus Stop Arrangement**

As a general policy, shelters will be provided at all bus stops on the Proposed Scheme. This will improve the comfort of passengers waiting for a bus during poor weather, as well as providing shade on sunny days. In some locations, such as those designated as Architectural Conservation Areas, it may however not be appropriate to provide a bus shelter in front of a building of heritage value to minimise visual impact. Such deviations from the standard arrangement are noted in Section 4.5.

#### **4.6.5 Accessibility for Mobility Impaired Users**

The aim of the Proposed Scheme is to provide enhanced walking, cycling and bus infrastructure along the corridor. In achieving this aim, the Proposed Scheme has been developed using the PDGB and in accordance with the principles of DMURS and Building for Everyone: A Universal Design Approach (NDA 2020).

The following non-exhaustive list of relevant standards and guidelines have informed the approach to Universal Design in developing the Proposed Scheme:

- Preliminary Design Guidance Booklet for BusConnects Core Bus Corridors (NTA 2020);
- Building for Everyone: A Universal Design Approach (NDA 2020);
- How Walkable is Your Town? (NDA 2015);
- Shared Space, Shared Surfaces and Home Zones from a Universal Design Approach for the Urban Environment in Ireland (NDA 2012);
- Best Practice Guidelines, Designing Accessible Environments. Irish Wheelchair Association (IWA) (IWA 2020);
- UK DfT Inclusive Mobility (UK DfT 2005);
- UK DfT Guidance on the use of tactile paving surfaces (UK DfT 2007); and
- BS8300:2018 Volume 1 Design of an accessible and inclusive built environment. External Environment- code of practice (BSI 2012).

The Disability Act 2005 (as amended) places a statutory obligation on public service providers to consider the needs of disabled people. A Disability Audit of the existing environment and proposed draft preliminary design for the corridor was undertaken. The Audit provided a description of the key accessibility features and potential barriers to disabled people based on the Universal Design standards of good practice. The Audit was undertaken in the early design stages with the view to implementing any key measures identified as part of the design development process.

In achieving the enhanced pedestrian facilities there has been a concerted effort made to provide clear segregation of modes at key interaction points along the Proposed Scheme which was highlighted as a potential mobility constraint in the Audit. In addressing one of the key aspects to segregation, the use of the 60mm set down kerb between the footpath and the cycle track is of particular importance for guide dogs, whereby the use of white line segregation is not as effective for establishing a clear understanding of the change of pavement use and potential for cyclist/pedestrian interactions.

One of the other key areas that was focused on was the interaction between pedestrians, cyclists, and buses at bus stops. The Proposed Scheme has prioritised, where possible, the use of island bus stops, including signal call button for crossing of cycle tracks, to manage the interaction between the various modes with the view to providing a balanced safe solution for all modes.

## **4.6.6 Integration**

### **4.6.6.1 Integration with Existing and Proposed Public Transport Network**

One of the objectives of the Proposed Scheme is to enhance interchange between the various modes of public transport operating in the city and wider metropolitan area. The Proposed Scheme facilitates improved existing and new interchange opportunities with other transport services including:

- Existing bus services at numerous locations along the route of the Proposed Scheme, including 33x, 33d, 41x, 126, 126a, and many others (please see Chapter 6 (Traffic & Transport) for further details);
- Future bus service proposals including Spine D along R105 Amiens Street and Beresford Place as associated with the Proposed Dublin Bus Network Re-Design;
- Greater Dublin Area Cycle Network Plan 2022 (GDACNP) (NTA 2022); and
- Future rail public transport services including LUAS Poolbeg and DART+.

### **4.6.6.2 Integration with Other Road Users**

General traffic flow and local access will be maintained along the Proposed Scheme corridor although there will be impacts on vehicle capacity along the route due to the reallocation of road space to bus priority and cycle tracks and the introduction of turning movement restrictions. The provision of bus priority and segregated cycling facilities will result in more efficient movement of increased numbers of people along the route, without removing the option for general traffic to use the route. It is recognised that there is dependence by some on cars or business vehicles. Through the provision of bus priority and improved cycling and pedestrian facilities all road users get better equitable choices and associated more efficient use of the road space for people movement. The improvement provided to more reliable sustainable travel options is being balanced against the general traffic flow impacts.

### **4.6.6.3 Interactions with Other Infrastructure Projects**

Several infrastructure projects are planned within the vicinity of the Proposed Scheme which will interface with the proposals. These are outlined below:

#### **4.6.6.3.1 North and South Campshires Public Realm Scheme (east of Samuel Beckett Bridge)**

Dublin City Council proposes to construct a public realm improvement project along the north and south campshires between Samuel Beckett Bridge and the Tom Clarke East Link Bridge. Coordination has taken place between the design teams of both projects, and it has been agreed that the Proposed Scheme will develop the necessary bus and cycle infrastructure provisions, while including basic quayside provision for pedestrians and landscaping, and that Dublin City Council will develop its own complementary proposals to enhance the urban and pedestrian realm alongside.

#### **4.6.6.3.2 Blood Stoney Road to New Wapping Street Pedestrian Bridge Scheme**

Dublin City Council proposes to develop an additional river crossing between North Wall Quay and Sir John Rogerson's Quay for pedestrians and cyclists. This had originally been proposed at Forbes Street but was since subsequently moved to Blood Stoney Road. Dublin City Council is currently reviewing its preferred location for the bridge. The Proposed Scheme is compatible with any such future development but might require local modifications depending on the layout and configuration of the bridge approaches, which may also require level changes in the campshire area to overcome flood levels. The scope to integrate such modifications was considered at the possible bridge location at Blood Stoney Road and found to be feasible.

#### 4.6.6.3.3 Liffey Cycle Route

Dublin City Council and the National Transport Authority intent to develop a Liffey Cycle Route between the Phoenix Park and Talbot Memorial Bridge. The Proposed Scheme would extend the Liffey Cycle Route to the Tom Clarke East Link Bridge. The Proposed Scheme is compatible with any future Liffey Cycle Route project, which is subject to its own planning and approval processes, which are yet to commence. In the interim, the Proposed Scheme has been designed to tie-into the existing facilities.

#### 4.6.6.3.4 Tom Clarke East Link Bridge Widening and adjoining Point Footbridge Scheme

Dublin City Council proposes to improve pedestrian and cycle provision at the Tom Clarke East Link Bridge. This will most likely be achieved through the construction of a new opening pedestrian / cycle bridge upstream of the existing bridge. The project may also include the removal of footpaths on the existing bridge and the addition of turning lanes. This project is at the Option Assessment stage.

#### 4.6.6.3.5 East Wall Road & 3Arena Junction Upgrade Scheme

Dublin City Council and Dublin Port Company proposed improvements to cycling facilities along East Wall Road and at the 3Arena roundabout. These schemes are still at options development stage and will be subject to separate planning applications. An earlier proposal to replace the 3Arena roundabout with a signalised junction was abandoned.

#### 4.6.6.3.6 Poolbeg Strategic Development Zone (SDZ)

It is intended to develop the brownfield lands between Sean Moore Road and South Lotts Road for the construction of a primarily residential development. The Proposed Scheme will complement this redevelopment, by improving pedestrian, cycle and public transport connectivity to this development lands.

### 4.6.7 Junctions

The design and modelling of junctions has been an iterative process to optimise the number of people (rather than vehicles) 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 underlying objectives of the Proposed Scheme.

Junctions have been designed to ensure a high level of comfort and priority for sustainable modes of travel e.g., walking, cycling and public transport, by prioritising the space and time allocated to these modes within the operation of a junction, and subsequently to accommodate the forecasted future year traffic volumes as safely and efficiently as possible within the remaining space and time. This has allowed the design to maximise the number of people moving through each junction and to prioritise these sustainable modes of travel.

Junction design on the Proposed Scheme falls into four categories, namely:

- Major Junctions;
- Moderate Junctions;
- Minor and Priority Junctions; and
- Roundabouts.

The categorisations are based on:

- Size;
- The extent of physical work required to establish them; or
- The degree of change compared to the existing layout.

The junction locations along the route of the Proposed Scheme and the layouts that will be implemented at these locations are presented in Section 4.5.1.6 and Section 4.5.2.6.

## 4.6.8 Structures

Where the route interfaces with an existing structure, a visual inspection has been carried out to identify the current condition of the structure and any repair/maintenance works required. Where alterations to the existing carriageway lines, kerbs lines and verge widths are proposed to the superstructure of an existing structure a structural assessment has been carried out to ensure the structural capacity is fit-for-purpose for the revised arrangement. The existing structures are detailed in Section 4.5.

### 4.6.8.1 Summary of Proposed Structure

A summary of the number of structures that are proposed along the length of the Proposed Scheme are listed in Table 4.10.

**Table 4.10: Structures in the Proposed Scheme**

Name	Description	Proposal
George's Dock Scherzer Bridges (and Replacement Carriageway Bridges)	Lifting Scherzer bridge replacement	Relocation and renovation of the twin historic structures to each side with a wider replacement concrete road bridge for 2 bus lanes and 2 traffic lanes.
Custom House Quay Boardwalk	Cantilever structure over the River Liffey	New boardwalk for a wide pedestrian route past an existing building east of the Seán O'Casey footbridge.
North Wall Quay Boardwalk	Cantilever structure over the River Liffey	New boardwalk for a wide pedestrian route past two existing buildings adjacent to Excise Walk.
Royal Canal Scherzer Bridges (and Replacement Carriageway Bridges)	Lifting Scherzer bridge replacement	Relocation and renovation of the twin historic structures to each side with a wider replacement concrete road bridge for 2 bus lanes and 2 traffic lanes.
River Dodder Public Transport Bridge (DPTOB)	3 span bridge with opening span	New 200m long crossing at the mouth of the River Dodder to connect Sir John Rogerson's Quay to Ringsend.
St. Patrick's Rowing Club (SPRC) and DPTOB Control Room	Two-storey building structure	New two-storey building structure to the west of the DPTOB, adjacent to the River Liffey, to accommodate the relocation of the SPRC and the control room for the DPTOB.

### 4.6.8.2 Retaining Walls

There are no significant retaining walls proposed within Section 1 of the Proposed Scheme however there is one minor (<1m) retaining structure required to tie-in existing and proposed ground levels on Sir John Rogerson's Quay adjacent to the Samuel Beckett Bridge in this section of the Proposed Scheme. In Section 2, the DPTOB, a number of principal retaining wall structures are proposed to support the construction of the DPTOB as described in Section 4.5.2.8.2.

## 4.6.9 Other Street Infrastructure

There are a number of other elements of street infrastructure included as part of the design of the Proposed Scheme. These elements include signage, road markings and communications infrastructure. Signage and road markings will be provided along the extents of the Proposed Scheme to clearly communicate information, both regulatory and safety messages to the road user. In addition, the existing communication equipment along the Proposed Scheme has been reviewed and proposals developed to upgrade where necessary.

### 4.6.9.1 Traffic Signs and Road Markings

#### 4.6.9.1.1 Traffic Sign Strategy

A preliminary Traffic Sign 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; other modes of traffic; visibility of signs and viewing angles; space available for signs; existing street furniture infrastructure; and existing signs. In line with DMURS,

the signage proposals have been '*kept to the minimum requirements of the [Traffic Signs Manual] TSM (DoT 2019), particularly where place values are very high*'.

A review of the existing regulatory and warning signs in the vicinity of the route 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.

As stated in TSM Chapter 1, in urban areas the obstruction caused by posts located in narrow pedestrian footpaths should be minimised. 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 possible to eliminate the need for vehicle restraint systems.

#### 4.6.9.1.2 Gantry Signage

No gantry signage exists along the route, and the Proposed Scheme has no requirement for any new gantry signage.

#### 4.6.9.1.3 Road Marking

A preliminary design of road markings has been undertaken in accordance with TSM Chapter 7. 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 possible to provide a safer passage for cyclists at signal-controlled junction for straight ahead or right turn movements; and
- Pedestrian crossings have been incorporated throughout the design to connect the network of proposed and existing footpaths. Wider pedestrian crossings have been provided in locations expected to accommodate a high number of pedestrians. DMURS classifies pedestrian crossing widths in areas of low to moderate pedestrian activity as 2.5m and areas of moderate to high pedestrian activity as 3m.

### 4.6.10 Pavement

Pavement assets along the Proposed Scheme comprise of bus-lanes, general traffic lanes, cycle lanes and specific trafficked areas (e.g. off-line bus stops, off-line parking and loading bays).

Kerbs, Footways and Paved Areas (KFPA) assets along the Proposed Scheme comprise kerbs, footways and cycle tracks.

For the purpose of design, the pavement assets are categorised into two 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 bus route to the nearby road network.

As part of the Proposed Scheme, varying pavement works will be undertaken. These works will comprise the following:

- Widening of the existing carriageways;
- Carriageway realignment;
- Rehabilitation and strengthening of the existing carriageways;
- Other specific trafficked areas (e.g., bus lay-bys, off-line parking and loading bays); and
- New cycle ways.

Pavements are designed and constructed in accordance with TII's publications, international standards and relevant Local Authority standards.

#### 4.6.10.1 Design Requirements

The Proposed Scheme pavement design will include new pavement, pavement strengthening, or rehabilitation works where the existing pavement will be disturbed by construction works, as indicated in the Pavement Treatment Plans (BCIDD-ROT-PAV\_SU-0016\_XX\_00-M2-CR-0001) included in Volume 3 of this EIAR. Special attention to addressing problems associated with wheel-track rutting and ensuring that ponding will not arise at bus-stops and pedestrian/cycle crossings will be a key focus.

The prevailing principle being followed by the Proposed Scheme pavement design is the provision of a high-quality pavement construction. Therefore, the Proposed Scheme pavement must provide sufficient durability, longevity, and strength, to be able to withstand repetitive wheel track loading on a frequent basis. The pavement design strategy includes for minimising ongoing maintenance requirements along the route to minimise impact on continuity of bus service operations.

#### 4.6.10.2 Design Standards

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

- DN PAV-03021 (Dec. 2010) - Pavement & Foundation Design. Volume 7 Section 2 Part 2A. (TII 2010a);
- DN-PAV-03023 (Jun. 2020 – Surfacing Materials for New and Maintenance Construction for use in Ireland (TII 2020a);
- AM-PAV-06050 (Mar. 2020) – Pavement Assessment, Repair and Renewal Principles (TII 2020b);
- PE-SMG-02002 (Dec. 2010) – Traffic Assessment (TII 2010b);
- CC-SPW-00600 (Mar. 2013) – Specification for Road Works Series 600 – Earthworks (TII 2013a);
- CC-SPW-00700 (Jan. 2016) – Specification for Road Works Series 700 – Road Pavements – General (TII 2015a);
- CC-SPW-00800 (Mar. 2013) – Specification for Road Works Series 800 – Road Pavements – Unbound and Cement Bound Mixtures (TII 2013b); and
- CC-SPW-00900 (Sept. 2017) – Specification for Road Works Series 900 – Road Pavements – Bituminous Materials (TII 2017).

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

- DN-PAV-03021 (Dec. 2010) – Pavement and Foundation Design (TII 2010a);
- DN-PAV-03026 (Jan. 2005) – Footway Design (TII 2005);
- Construction Standards for Roads and Street Works in Dublin City Council (May 2016) – Revision 1 (DCC 2016);
- PE-SMG-02002 (Dec. 2010) – Traffic Assessment (TII 2010b);
- CC-SPW-00600 (Mar. 2013) – Specification for Road Works Series 600 – Earthworks (TII 2013a);
- CC-SPW-00700 (Jan. 2016) – Specification for Road Works Series 700 – Road Pavements – General (TII 2015a);
- CC-SPW-00800 (Mar. 2013) – Specification for Road Works Series 800 – Road Pavements – Unbound and Cement Bound Mixtures (TII 2013b);
- CC-SPW-00900 (Sept. 2017) – Specification for Road Works Series 900 – Road Pavements – Bituminous Materials (TII 2017);
- CC-SPW-01000 (Mar. 2013) – Specification for Road Works Series 1000 – Road Pavements – Concrete Materials (TII 2013b);
- CC-SPW-1100 (Feb. 2012) – Specification for Road Works Series 1100 – Kerbs, Footways and Paved Areas (TII 2012); and
- BS 7533 series of standards (1999-2021) – Pavement Constructed with Clay, Natural Stone or Concrete Pavers.

#### 4.6.10.3 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 made:

- 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  $\geq$  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  $\geq$  5: no works; and
  - PSCI  $\leq$  4: 200mm concrete inlay.

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

#### **4.6.11 Parking and Loading**

As part of the design of the Proposed Scheme, an assessment has been carried out into the impact on existing parking.

The number and type of parking spaces and loading bays were counted along the Proposed Scheme, and the proposed losses of these parking spaces and loading bays has been quantified. Mitigation measures have been identified to reduce the impact of the Proposed Scheme in so far as is reasonably practicable, by incorporating some parking provision and compensatory loading provision, and providing enhanced cycle parking facilities.

Changes to the parking and loading provisions along each section of the Proposed Scheme are described further in Section 4.5. Reference should be made to Chapter 6 (Traffic & Transport) for further information on the impacts on parking as a result of the Proposed Scheme.

#### **4.6.12 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 commute to/from work. The urban realm encompasses all streets, squares, junctions, and other rights-of-way, whether in residential, commercial, or civic use. When well designed and laid out with care in a community setting, it enhances the everyday lives of residents and those passing through. It typically relates to all open-air parts of the built environment where the public has free access. It would include seating, trees, planting, and other aspects to enhance the experience for all.

Successful urban realms or public open space tend to have certain characteristics. These include:

- They have a distinct identity;
- They are safe and pleasant;

- They are easy to move through; and
- They are welcoming.

#### 4.6.12.1 Landscape and Character Analysis

The landscape and urban realm proposals are derived from analysis of the existing urban realm, including existing character, any heritage features, existing boundaries, existing vegetation and tree planting, and existing materials. For each section of the route, the design took a broad overview of typical dwelling age and style, extents of vegetation and tree cover. The predominant mixes of paving types, appearance of lighting features, fencing, walls, and street furniture was considered. The purpose of this analysis was to assess the existing character of the area and how the Proposed Scheme may alter this. The outcome of the analysis allowed the designers to consider appropriate enhancement opportunities along the route. The enhancement opportunities include key nodal locations which focus on locally upgrading the quality of the paving materials, extending planting, decluttering of streetscape and general placemaking along the route. Where possible, a SuDS approach has been taken to assist with drainage along the route.

#### 4.6.12.2 Hardscape

##### 4.6.12.2.1 Typical Material Typologies

Through the process of developing the Proposed Scheme, a typology and palette of proposed materials was developed to create a consistent design response for various sections of the route. The proposed materials were based on the existing landscape character, existing materials, historical materials while also identifying areas for betterment through the use of higher quality surface materials. The Landscaping General Arrangement drawings (BCIDD-ROT-ENV\_LA-0016\_ML\_00-DR-LL-9001) in Volume 3 of this EIAR illustrate these elements.

The material typologies employed in the preliminary design are:

- **Poured in situ concrete footpath** - Used extensively on existing footpaths. Concrete footpaths can be laid without a kerb, can have neatly trowelled edges and textured surface for a clean, durable, slip resistant surface;
- **Asphalt footpath** - Widely used on existing footpaths and will tie in with other sections of urban realm. Laid with a road kerb, can have a smooth finish or textured aggregate surface, provides a strong flexible slip resistant surface. Opportunities to retain good quality kerbs have been explored and tie-in points considered;
- **Precast concrete unit paving** - Either concrete paving slabs or concrete block, there is a very wide variety of sizes and colours available to provide an enhanced urban realm. The use/reuse of granite kerbs where appropriate will further enhance the urban realm. This type of material use is mostly employed in non-inner-city urban realm enhancements;
- **Natural stone paving** - Employed for high quality urban realm areas, mostly in city centre locations. This typology represents natural stone surface treatments such as granite and are used to create enhanced public spaces for major urban realm interventions;
- **Stone or Concrete setts** - Proposed for distinguishing pedestrian crossing points either on raised table or at road level;
- **Self-binding gravel** - Proposed for pedestrian paths set away from the road expected to see less traffic. Used for natural areas, for example, paths through wildflower meadows. They provide a defined informal route as an alternative to asphalt or concrete; and
- **No change** - In addition to areas with proposed material changes, there were also areas identified where no change in materials would be required. For example, where pavement has recently been laid and is in good condition. The design also explores opportunities where good quality kerbs such as granite kerbs could be reused, which would have both cost and sustainability advantages.

Other design responses include:

- The re-use of existing high-quality and natural stone kerbs to maintain streetscape character, reduce construction costs and maximise sustainability;
- Pedestrian crossings at side streets will be raised where possible and will be distinguished using stone or concrete setts as appropriate to the locality;

- In some locations, existing street trees have disturbed or broken footpath surfaces. The footpath around such trees will be replaced where appropriate with self-binding gravel to improve the vitality of the trees and ensure accessible pedestrian facilities;
- 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; and
- 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.

#### **4.6.12.3 Softscape**

##### **4.6.12.3.1 Planting Strategy**

The planting strategy has been developed to meet the needs of the Dublin City Tree Strategy and the Dublin Biodiversity Action Plan as follows:

- Where possible the initial conservation of existing biodiversity has been considered;
- Opportunities have been identified to enhance biodiversity through green infrastructure;
- Promote the role of street trees planting consistent with the recommendations of the Dublin City Tree Strategy; and
- Develop the role of SuDS opportunities within the Proposed Scheme to ideally reduce impervious areas for drainage management benefit.

#### **4.6.12.4 Arboricultural Survey**

##### **4.6.12.4.1 Scope of Assessment**

An Arboricultural Impact Assessment (AIA) Report (see Appendix A17.1 in Volume 4 of this EIAR), identifies the likely direct and indirect impacts to trees of the Proposed Scheme along with suitable mitigation measures, as appropriate to allow for the successful retention of significant trees, or to compensate for trees to be removed.

#### **4.6.12.5 Typical Planting Typologies**

Several typologies were developed. These are discussed further below.

##### **4.6.12.5.1 New Street Trees**

As noted on the Landscaping General Arrangement (BCIDD-ROT-ENV\_LA-0016\_ML\_00-DR-LL-9001) in Volume 3 of this EIAR, medium to large canopy trees will be provided in large urban tree pit systems to allow for protection of the soil structure and good root development (Image 4.10). In addition, ornamental planting will also be provided, providing small landscape interventions at local community spaces that comprise of a combination of street trees, seating and more formal planting arrangements. These exist at certain intervals (Image 4.11) and are often picked up as 'focal points'. An example of this can be seen on Sheet 1 of the Landscaping General Arrangement (BCIDD-ROT-ENV\_LA-0016\_ML\_00-DR-LL-9001), along Custom House Quay.



**Image 4.10: Example of Semi-mature Street Trees**



**Image 4.11: Example of Ornamental Planting 'focal point'.**

#### **4.6.12.6 Urban Realm Design**

The urban realm design is presented on the Landscaping General Arrangement drawings (BCIDD-ROT-ENV\_LA-0016\_ML\_00-DR-LL-9001) in Volume 3 of this EIAR. Separate (illustrative) drawings are provided in Section 4.5.1.9 and Section 4.5.2.9 to further illustrate proposals within the Proposed Scheme.

Much of the route of the Proposed Scheme already has considerable street tree and ornamental planting in place however this is to be complemented by the Proposed Scheme as existing tree alignments and small residual

green spaces are to be unified by being extended to gap areas, thus allowing for a more coherent design and better natural connectivity.

#### **4.6.13 Lighting**

A 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. Several existing columns are proposed to be relocated or replaced to accommodate the Proposed Scheme, as shown on the Street Lighting drawings (BCIDD-ROT-LHT\_RL-0016\_XX\_00-DR-EO-9001) in Volume 3 of this EIAR.

Light Emitting Diode (LED) lanterns will be the light source for any new or relocated public lighting provided. The lighting design will involve 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 will be replaced and relocated to the rear of the footpath to eliminate conflict with pedestrians through obstruction. For existing columns that have specific aesthetic requirements, the intent for the replacement (where applicable) 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 the electrical installations is compliant with the latest version of the 'National Rules for Electrical Installations, I.S. 10101'.

It should be noted that navigational lighting will be provided as part of the DPTOB to control vessels in the navigational channel below the bridge.

##### **4.6.13.1 New Lighting**

All new public lighting will be designed and installed in accordance with the requirements of the relevant 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';
- Volume 1 - NRA Specification for Road Works, Series 1300 & 1400;
- Volume 4 - NRA Road Construction Details, Series 1300 & 1400;
- IS EN 40 – Lighting Columns; and
- Institution of Lighting Professionals 'GN01 Guidance Notes for Reduction of Obtrusive Light'.

Lighting schemes will comply with the 'Guidance notes for the Reduction of Light Pollution' issued by the Institution of Lighting Professionals (ILP).

##### **4.6.13.2 Lighting at Bus Stops**

The design shall include for the standards and requirements for lighting at bus stops.

#### **4.6.14 Utilities**

There are a number of measures proposed to protect existing utilities during the Construction Phase of the Proposed Scheme. These are specifically outlined in Chapter 5 (Construction) and Chapter 19 (Material Assets).

Where there are clashes between the existing utility infrastructure, measures are proposed to either protect the infrastructure in place or divert the utility infrastructure as required.

The utility design strategy included the analysis of records provided by all utility providers associated with the Proposed Scheme corridor. The analysis included desktop reviews including review of topographic surveys together with site reconnaissance. In locations where critical assets were identified and the risk of interference was considered high, Ground Penetrating Radar surveys were undertaken to inform the design.

#### 4.6.14.1 Utility Diversions

Due to the extensive nature of the Proposed Scheme, there are certain areas along the route which will require utility diversions, due to localised conflicts. Identified service conflicts and recommended diversions are described and assessed in Chapter 19 (Material Assets).

#### 4.6.14.2 Proposed Utility Infrastructure

A new ESB sub-station is proposed to facilitate the operation of the proposed DPTOB. This ESB sub-station will be located on the eastern side of the DPTOB adjacent to the junction of York Road and Thorncastle Street (see General Arrangement Drawings in Volume 3 of this EIAR for details).

### 4.6.15 Drainage

The design basis statement was developed whilst taking 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) (CIRIA 2015) into account. Agencies consulted include Dublin City Council and Irish Water where applicable.

#### 4.6.15.1 Existing Watercourses and Culverts

The location of existing watercourses has been identified by way of undertaking walkover surveys. Table 4.11 shows the watercourses in the immediate vicinity of the Proposed Scheme. No culverts were identified along the Proposed Scheme however it is noted that there are a number of storm water outfalls on the north and south quays of the River Liffey.

**Table 4.11: Existing Watercourses and Culverts**

Watercourse	Chainage	Crossing Detail
River Liffey	Immediately Adjacent to Section 1 of the Proposed Scheme, crossing it at Chainage A-925 via the Samuel Beckett Bridge	Bridge
River Dodder	B-11500	Bridge

#### 4.6.15.2 Existing Drainage Description

Based on the information received from Irish Water, the existing highway along the Proposed Scheme is served by both surface water and combined drainage networks. The surface water drainage system is managed by the local authority, whilst the combined sewer 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 11 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 existing catchment drawings, please refer to the Proposed Surface Water Drainage Works drawings (BCIDD-ROT-DNG\_ZZ-0016\_XX\_00-DR-CD-0001) in Volume 3 of this EIAR. The existing catchments are summarised below in Table 4.12.

**Table 4.12: Summary of Existing Catchments**

Existing Catchment Reference	Approx. Drainage Catchment Area (m <sup>2</sup> )	Existing Network Type	Existing Outfalls
R_01	57,130.00	Surface Water (Storm)	Network outfalls to River Liffey
R_02	55,860.00	Surface Water (Storm)	Network outfalls to River Liffey
R_03	65,330.00	Surface Water (Storm)	Network outfalls to River Liffey
R_04	142,190.00	Surface Water (Storm)	Network outfalls to River Liffey
R-05	37,160.00	Surface Water (Storm)	Network outfalls to River Liffey
R_06	17,480.00	Combined Water	Foul / combined network drains to Ringsend WwTP with sewer overflows to the River Liffey
R_07	93,310.00	Surface Water (Storm)	Network outfalls to River Liffey
R_08	187,730.00	Combined Water	Foul / combined network drains to Ringsend WwTP with sewer overflows to the River Liffey
R_09	18,315.00	-	-
R_10	241,520.00	Surface Water (Storm)	Network outfalls to River Liffey
R_11	221,530.00	Combined Water	Foul / combined network drains to Ringsend WwTP with sewer overflows to the River Liffey

#### 4.6.15.3 Proposed Scheme Drainage / Runoff

Whilst in some areas the Proposed Scheme will increase the impermeable areas, additional permeable areas are also provided by the softening of urban realm along the routes. The drainage design aims to sustain flow levels within the existing pipe network after a rainfall event by controlling the discharge rate within each catchment. Flows will be controlled by the implementation of SuDS techniques, where practicable. 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 position of: filter drains, swales, bio-retention areas, tree pits, oversized pipes, silt traps and attenuation features if necessary.

Each catchment area has been broken down into sub-catchments 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 below.

A summary list of the sub-catchments, the associated chainage, and impermeable surface area differential is given in Table 4.13. In addition, the table contains a column entitled 'Net Change' which takes account of the change of use from impermeable to permeable areas and vice versa.

**Table 4.13: Summary of Increased Permeable and Impermeable Areas**

Existing Catchment Reference	Chainage	Road Corridor Area (m <sup>2</sup> )	Change of use to impermeable areas (m <sup>2</sup> )	Change of use to permeable areas (m <sup>2</sup> )	Net Change (m <sup>2</sup> )	Percentage Change (%)
R_01	A-1420 - A-1540	4,254	0	0	0	0
R_02	A-1225 – A-1420	7,134	0	0	0	0
R_03	A-550 – A-1225	20,462	0	0	0	0
R_04	A-175 – A-550	9,457	0	0	0	0
R-05	A-0 – A-175	4,636	0	0	0	0
R_06	B-10000 – B-10370	9,201	0	0	0	0
R_07	B-10370 – B-10640	3,856	0	0	0	0

Existing Catchment Reference	Chainage	Road Corridor Area (m <sup>2</sup> )	Change of use to impermeable areas (m <sup>2</sup> )	Change of use to permeable areas (m <sup>2</sup> )	Net Change (m <sup>2</sup> )	Percentage Change (%)
R_08	B-10640 – B-11410	10,469	0	0	0	0
R_09	B-11410 – F-50000	14,400	7257	1207	6050	42.01
R_10	F-50000 – E-40610 & F-50725	19,256	1901	0	1901	9.87
R_11	F-50725 & H-70000 – F-50992 & H-70233	8,824	1086	0	1086	12.31

#### 4.6.15.4 Proposed Drainage System

The principal objectives of the drainage design are as follows:

- To drain surface water from existing and proposed pavement areas through the Proposed Scheme and maintain the existing standard of service;
- To maintain existing run-off rates from existing and newly paved surfaces using Sustainable Urban Drainage Systems (SuDS);
- To minimise the impact of the runoff from the carriageway on the surrounding environment using SuDS and / or silt traps;
- To minimise the impact of the runoff from the carriageway 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 include SuDS measures to treat and attenuate any additional run-off. These measures ensure that there is:
  - No increase in existing run-off rates from newly paved areas; and
  - The provision of appropriate treatment to ensure run-off 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).

The following drainage types are proposed for the Proposed Scheme catchments comprising newly paved and combined existing / newly paved areas, as indicated on the Proposed Surface Water Drainage Works (BCIDD-ROT-DNG\_ZZ-0016\_XX\_00-DR-CD-0001) in Volume 3 of this EIAR:

- Sealed Drainage (SD) comprised of side entry gullies and sealed pipes 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 highway profile;
- Infiltration Systems where infiltration takes place in the existing situation. These systems comprise of soakaways, infiltration trenches, infiltration blankets and infiltration basins; and
- Attenuation Tanks / Oversized Pipes (AT / OSP) are provided where there is insufficient attenuation volume provided by the proposed SuDS drainage measures.

#### 4.6.15.5 Runoff Attenuation & Sustainable Drainage Systems

SuDS measures will be provided to ensure no increase in existing run off rates from newly paved and combined existing / newly paved catchment areas. The capacity of the proposed SuDS measures was based on the incoming flows and permitted discharge for each catchment. A range of storm durations was tested for each catchment from 30-minutes to 24 hours to ensure that the proposed measures have sufficient capacity to cater for high intensity, short duration storms and longer duration, low intensity storms where the total run off volumes are greater. This hierarchy promotes the concept of a SuDS Management Train, where measures are proposed

as a sequence of components to collectively manage catchment runoff. A schematic of the SuDS Management Train is provided in Table 4.14.

**Table 4.14: The SuDS Management Train (CIRIA SuDS Manual 2015)**

Scale	SuDS Management Train
Source	<b>Rainwater Harvesting</b> – capture and reuse within the local environment
	<b>Pervious Surfacing Systems</b> – structural surfaces that allow water to penetrate the ground reducing discharge to a drainage system e.g., pervious pavement
Site	<b>Infiltration Systems</b> – structures which encourage infiltration into the ground e.g., Bioretention Basins
	<b>Conveyance Systems</b> – components that convey and control the discharge of flows to downstream storage components e.g., Swales
Regional	<b>Storage Systems</b> – components that control the flows before discharge e.g., attenuation ponds, tanks, or basins

Source scale solutions have been specified where reasonably practicable. Where Source type solutions cannot fully address an increase in runoff from a development, residual flows are discharged to be managed at the Site and then Regional scales.

#### 4.6.15.6 Pollution Control

One of the principal objectives of the road drainage system is to minimise the impact of the runoff rates from roadways on the surrounding environment via the provision of SuDS. The proposed road drainage system is shown in the Proposed Surface Water Drainage Works drawings (BCIDD-ROT-DNG\_ZZ-0016\_XX\_00-DR-CD-0001) in Volume 3 of this EIAR. The system ties in with the existing drainage system and so no new pollution control measures are proposed.

#### 4.6.16 Maintenance

All traffic signal, CCTV, and communications equipment are designed based on long-term maintenance requirements. All equipment will be accessible without significantly disrupting pedestrian, bicycle, or vehicle traffic.

Apparatus have been designed and located to allow for easy access and the safe maintenance of the Proposed Scheme into the future. This included provision, where practicable, 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. Products that allow for maintenance activities to be undertaken from ground level, where practicable, such as tilt down poles or poles with wind-down mechanisms;
- Placement of poles and retention sockets within 7m of chambers to provide ease of installation and replacement of cables;
- Location of chambers away from pedestrian desire lines, and areas of tactile paving;
- Chambers to be placed at 180m centres, where practicable, on longitudinal duct runs to allow for the ease of installation and replacement of cables;
- Safe areas for the access and parking of maintenance vehicles, where practicable; and
- Controller, and other, cabinets located in positions that allow for safe access and clear visibility of the operation of an adjacent road junction.

#### 4.6.17 Safety and Security

In addition to public lighting, it is proposed to install traffic monitoring cameras at key locations including junctions to enable the monitoring of traffic flows along the Proposed Scheme 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.

Junctions System Design information is included in the drawings BCIDD-ROT-TSM\_SJ-0016\_XX\_00-DR-TR-9001 in Volume 3 of this EIAR.

These will be high definition digital cameras with a digital communications network providing transmission of video and camera monitoring/control functionality.

#### **4.6.18 Land Use and Accommodation Works**

The Proposed Scheme has retained as far as practicable the existing horizontal and vertical layout along the route to minimise the amount of land acquisition required. However, in order to construct the Proposed Scheme, it is necessary to compulsorily acquire individual plots of land along sections of the route.

The extent of permanent land acquisition and land required temporarily for the construction of the Proposed Scheme is shown on the General Arrangement Drawings (BCIDD-ROT-GEO\_GA-0016\_XX\_00-DR-CR-9001) included in Volume 3 of this EIAR.

Construction of the Proposed Scheme requires land acquisition from several different parties, as outlined below:

- 0 residential properties;
- 8 commercial properties and non-residential land; and
- Local authority property.

There is one building proposed to be demolished as part of the Proposed Scheme. The St Patricks Rowing Club Clubhouse is proposed to be demolished and replaced adjacent to the proposed DPTOB. Boundary walls and railings will also be removed and replaced as part of the works.

Mitigation accommodation works are proposed in the affected locations, including reconstruction of boundary walls and fences, as required, as outlined in Section 4.6.18.1 below.

##### **4.6.18.1 Summary of Accommodation Works and Boundary Treatment**

There are a number of areas along the extents of the route where the Proposed Scheme will result in the requirement for accommodation works and boundary treatments. Specific accommodation works are considered on a case-by-case basis.

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 a section of street can benefit from urban improvement appropriate to the area.

Modifications to driveways and entrances will be guided by DCC's Parking Cars in Front Gardens Advisory Booklet (DCC 2011).

Existing gates will be reused where possible however considerations will be required for the use of bifold gates, or other appropriate alternatives to mitigate impacts on parking in driveways. All gates will be hung such that they will open inwards onto the property, where practicable.

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### Guidance and Legislation

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