

**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 Lucan 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 9.7km. It will commence at Junction 3 of the N4 Lucan Road / Lucan Bypass where the C-Spine route terminates before splitting to branch routes and is directed east towards the City Centre (C-Spine is the Dublin Bus term for the network serving Maynooth, Celbridge, Leixlip, Lucan, Adamstown, Liffey Valley and Palmerstown). From the R136 Ballyowen Road junction with the R835 Lucan Road the Proposed Scheme will run east down the R835 Lucan Road to the roundabout serving the Lucan Retail Park and the N4 Lucan Road eastbound on-slip. It does not include the provision on Ballyowen Road or Old Lucan Road (Route 80) at Palmerstown. The Proposed Scheme will continue via the N4 (passing the Liffey Valley Shopping Centre at Junction 2) as far as the M50 Junction 7 and then via the R148 along Palmerstown bypass, Chapelizod bypass, Con Colbert Road, St John's Road West, ending at Frank Sherwin Bridge, where it will join the prevailing traffic management regime on the South Quays.

The Proposed Scheme includes an upgrade of the existing bus priority, pedestrian and cycle facilities. The scheme includes a substantial increase in the level of bus priority provided along the corridor, including the provision of additional lengths of bus lane resulting in improved journey time reliability. Throughout the Proposed Scheme bus stops will be enhanced to improve the overall journey experience for bus passengers and cycle facilities will be substantially improved with segregated cycle tracks provided along the links and protected junctions, with enhanced signalling for cyclists provided at Junction 3 of the N4, cycle facilities are provided along R136 Ballyowen Road between Hermitage Road and the R835 Lucan Road, and then along the length of the Core Bus Corridor to Junction 2 of the N4. It does not include the significant cycle provision feeding into this route from side roads.

From there cycle facilities are provided along the Old Lucan Road either side of the M50 and through Palmerstown village, to the start of the R148 Chapelizod bypass, at which point they will connect with other future cycle facilities

<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).

through Chapelizod village. Cycle facilities are also provided on the R148 between Con Colbert Road and the end of the corridor at Heuston station on St John's Road West.

Moreover, pedestrian facilities will be upgraded and additional signalised crossings will be provided. In addition, urban realm works will be undertaken at key locations with higher-quality materials, planting, and street furniture provided to enhance the pedestrians' experience.

The scheme will require a number of significant structures, bridges, gantries, retaining walls and switch back ramps.

Table 4.1 summarises the changes that 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)
<b>Bus Lanes</b>		
Inbound	7.45	9.17
Outbound	6.4	8.6
<b>Bus Measures</b>		
Proportion of Route with Bus Priority Measures	72%	93%
<b>Cycle Facilities - Segregated</b>		
Inbound	0.73	6.45
Outbound	0.73	6.31
<b>Cyclist Facilities – Non-segregated</b>		
Inbound	0.8	0.28
Outbound	1.5	0.4
<b>Cyclist Facilities - Overall</b>		
Total Cyclist Facilities (both directions)	3.83	13.42
Proportion Segregated (including quiet street treatment)	26%	95%
<b>Other Features</b>		
Number of Pedestrian Signal Crossings	20	28 (40% increase)
Number of Residential Properties with Potential Land Acquisition	Not applicable	0

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 the EIAR and these should be read in conjunction with this chapter.

**Table 4.2: List of Relevant Drawings**

Drawing Series Number	Description
BCIDA-ACM-SPW_ZZ-0006_XX_00-DR-CR-9001	Site Location Plan
BCIDA-ACM-GEO_GA-0006_XX_00-DR-CR-9001	General Arrangement
BCIDA-ACM-GEO_HV-0006_ML_00-DR-CR-9001	Mainline Plan and Profile
BCIDA-ACM-GEO_CS-0006_XX_00-DR-CR-9001	Typical Cross Sections
BCIDA-ACM-STR_GA-0006_XX_00-DR-CB-9001	Bridges and Retaining Structures
BCIDA-ACM-UBR_ZZ-0006_XX_00-DR-LL-9001	Landscaping General Arrangement
BCIDA-ACM-PAV_PV-0006_XX_00-DR-CR-9001	Pavement Treatment Plans
BCIDA-ACM-SPW_BW-0006_XX_00-DR-CR-9001	Fencing and Boundary Treatment
BCIDA-ACM-TSM_GA-0006_XX_00-DR-CR-9001	Traffic Signs and Road Markings
BCIDA-ACM-LHT_RL-0006_XX_00-DR-EO-9001	Street Lighting
BCIDA-ACM-TSM_SJ-0006_XX_00-DR-TR-9001	Junction System Design

Drawing Series Number	Description
BCIDA-ACM-DNG_RD-0006_XX_DR-CD-9001	Proposed Surface Water Drainage Works
BCIDA-ACM-UTL_UD-0006_XX_DR-CU-9001	IW Foul Sewer Asset Alterations
BCIDA-ACM-UTL_UE-0006_XX_DR-CU-9001	ESB Asset Alterations
BCIDA-ACM-UTL_UG-0006_XX_DR-CU-9001	GNI Asset Alterations
BCIDA-ACM-UTL_UW-0006_XX_DR-CU-9001	IW Water Asset Alterations
BCIDA-ACM-UTL_UL-0006_XX_DR-CU-9001	Telecommunications Asset Alterations
BCIDA-ACM-UTL_UC-0006_XX_DR-CU-9001	Combined Existing Utility Records

### 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 process described in Chapter 1 (Introduction), undertaken throughout the option selection and design development process have been incorporated where appropriate.

Examples of how the design evolved are as follows:

- The Proposed Scheme includes a significant improvement in cyclist facilities from the R136 Ballyowen Road at N4 Junction 3 to the start of the R148 Chapelizod Bypass on the east side of Palmerstown village;
- At Liffey Valley Shopping Centre the existing bus stops will be relocated some 200m further west, with improved segregation from the existing carriageway and a new bridge over the N4 that links with the proposed bus interchange within Liffey Valley Shopping Centre;
- The layout of all bus stops along the route have been enhanced to the latest design guidance;
- Some bus stop locations have been optimised to allow better connectivity for bus passengers; and
- The layouts of all junctions have been updated to the latest design guidance, particularly in respect of facilities for cyclists.

### 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 Scheme).

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 include the following:

- The Design Manual for Urban Roads and Streets (DMURS) (Government of Ireland 2013);
- The National Cycle Manual (NCM) (NTA 2011);
- TII Design Manual for Roads and Bridges;
- The Traffic Signs Manual (TSM) (DoT 2019-21);
- Guidance on the use of Tactile Paving Surfaces (UK DfT 2021);

- Building for Everyone: A Universal Design Approach (NDA 2020), and
- Greater Dublin Strategic Drainage Study (GDSDS) (Irish Water 2005).

An example of the application of the design principles for the Proposed Scheme can be seen at the proposed redesign of the signalised gyratory junction of R111 South Circular Road with the R148 Con Colbert Road and R148 St. John's Road West. The existing layout with multiple slip lanes facilitates the movement of vehicles, but provides poor facilities for pedestrians, cyclist and buses. Pedestrians and cyclists have to walk a significant distance off their desire line to cross the road at a signalised crossing, which many are observed not to do, resulting in unsafe conditions for these vulnerable road users at a very busy junction.

Having considered the objectives for the Proposed Scheme and using the principles set out in the PDGB an amended traffic signal-controlled junction arrangement was developed to address the issues outlined above. This layout could be used to control the flow of traffic and provide a high level of priority for buses on all arms of the junction and improve cycle and pedestrian facilities. On the eastbound and westbound approaches to the junction the existing left turn slip lanes will be removed. In order to improve the standard of pedestrian and cyclist facilities at this junction, the number of general traffic lanes through the junction will be reduced in the eastbound, northbound and southbound directions and the R111 South Circular Road is widened along the western edge through the junction to facilitate the inclusion of segregated cycle tracks in each direction. For cyclists, taking into account the high traffic volumes and speeds, a fully segregated facility is provided where cyclists are segregated in both space and time from moving vehicles, which significantly enhances the safety of these vulnerable road users. The revised layout is typical of junctions along the corridor that have been developed to meet the objectives of the project.

As it is an area of high activity the junction redesign proposals at the R148 Con Colbert Road / R111 South Circular Road junction, include a number of public realm upgrades including widened footways, high quality hard and soft landscaping and street furniture being provided, which contribute towards a safer, more attractive environment for pedestrians.

Additionally, on the R111 South Circular Road northbound a short right turn lane is provided to facilitate future bus movements and compensate for restricted turns included in the Liffey Valley to City Centre Core Bus Corridor Scheme.

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 2021), 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 aims 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 commences at Junction 3 on the N4 where the C-Spine route terminates before splitting to branch routes, and it is routed via the N4 as far as Junction 7 (M50), and via the R148 along the Palmerstown Bypass, Chapelizod Bypass, Con Colbert Road and St John's Road West as far as Frank Sherwin Bridge, where it will join the prevailing traffic management regime on the South Quays.

The Proposed Scheme is described below, split into three sections to reflect the national, suburban and urban nature of the corridor.

- Section 1: N4 Junction 3 to M50 Junction 7 – N4 Lucan Road;
- Section 2: M50 Junction 7 to R148 Con Colbert Road – R148 Palmerstown bypass and Chapelizod bypass; and
- Section 3: R148 Con Colbert Road to City Centre – St John's Road West.

## **4.5.1 Section 1: N4 Junction 3 to M50 Junction 7 – N4 Lucan Road**

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

This section of the Proposed Scheme runs from Junction 3 on the N4 Lucan Road / Lucan bypass, as far as M50 Junction 7 and, as described below, will include upgrades to the following junctions to provide bus priority and enhanced pedestrian and cyclist facilities:

- R136 Ballyowen Road / R835 Lucan Road;
- R136 Ballyowen Road / N4 Junction 3;
- R136 Ballyowen Road / Hermitage Road;
- N4 Junction 2; and
- N4 / M50 Interchange (Junction 7).

At the start of the Proposed Scheme at Junction 3 on the N4 Lucan Road / Lucan bypass modifications are proposed to the signalised junction at the end of the N4 westbound off-slip, including the removal of the left-turn slip lane. In order to provide priority for buses and maintain adequate junction capacity for general traffic, the existing lane configuration is maintained on the bridge carrying the R136 Ballyowen Road over the N4. A two-way segregated cycle track is proposed on the east side of the R136 Ballyowen Road between R835 Lucan Road and Hermitage Road, including a new pedestrian and cycle bridge across the N4, which will replace the existing pedestrian only bridge at this location.

At the R136 Ballyowen Road junction with the R835 Lucan Road, it is proposed to remove the existing left-turn slip lanes. Additionally, the location of the existing east bound bus stop on the R835 Lucan Road will be moved closer to the junction and will also be increased in length. A continuous bus lane is proposed along the R835 Lucan Road to the roundabout serving the Lucan Retail Park and also on the N4 Lucan Road eastbound on-slip. A segregated two-way cycle track is proposed on the northern side of this section of the R835 Lucan Road which will require land acquisition from the adjacent green space.

On the N4 Lucan Road it is proposed to maintain the existing continuous eastbound and westbound bus lanes over this section of the route with no change to the number of existing general traffic lanes. In addition, the bus lane on the westbound service road Junction 3 will be extended to ensure bus priority is provided on the approach to the junction with R136 Ballyowen Road at the top of the slip road. A small area of land acquisition will be required from the site of the former Foxhunter public house to facilitate this extended bus lane.

The proposed design provides a significant improvement to the bus stop provision in the vicinity of the Liffey Valley Shopping Centre (LVSC). The bus stops themselves will be moved some 150m further west, increased in length and bus laybys are proposed, segregated from the adjacent N4 Lucan Road carriageway. A small strip of land acquisition is required on the southern side of the N4 adjacent to the car park of the Liffey Valley Office Campus to facilitate the new westbound bus stop arrangement. A retaining wall is proposed for the new boundary at this location.

To better serve the increased bus stop capacity a new pedestrian only bridge is proposed adjacent to the new bus stop locations, some 200m further west from the existing foot / cycle bridge, which will be retained. The position of this new bridge aligns with the new public transport interchange within the LVSC site which is under construction. A small piece of land acquisition is required from the green area adjacent to the shopping centre for the provision of the ramps leading to the new footbridge. Additionally, the speed limit for the bus lanes between N4 junction 2 and the M50 will be reduced from 60km/hr to 50km/hr in the vicinity of the new bus stops.

Between N4 Junction 2 and the M50 on the eastbound approach a change to the lane designation is proposed to separate earlier the general traffic heading towards the M50 northbound and the R148 Palmerstown bypass and provide a continuous bus lane. A new portal gantry is proposed to provide additional lane destination signage. The relocation of the bus stops for LVSC will allow for an increased length for the buses to accelerate and weave with eastbound traffic approaching the M50 interchange, and also an increased weaving length for all westbound traffic exiting the M50 interchange. On the M50 interchange itself it is proposed to provide two general traffic lanes and a continuous bus lane in both directions through the junction.

To provide a continuous facility for the Primary Cycle Route 6 as identified in the GDA Cycle Network Plan, from the roundabout serving the Lucan Retail Park, facilities for cyclists will initially comprise a Quiet Street along the public road providing access to the Hermitage Golf Club.

On the northern side of the N4 between the entrance to the Hermitage Golf Club and Junction 2 of the N4 a segregated two-way cycle track is included in the Proposed Scheme. Land acquisition will be required from the Hermitage Golf Club to provide this cycle track which will connect with the existing foot / cycle bridge over the N4 adjacent to the Mount Andrew estate / St Loman's Hospital access. A piled retaining wall is proposed for the new boundary and 15m high sports netting is proposed adjacent to the relocated boundary for a 130m length opposite Ballyowen Lane, as well as infill planting to the road side boundary and southern edge of the fairway. Eastwards of this location the two-way cycle track continues on the north side of the N4 and will require land acquisition from the Hermitage Medical Clinic. A retaining wall is proposed for the new boundary. The two-way cycle track will then run along the north side of the eastbound off-slip at Junction 2.

From Junction 2 of the N4 the segregated two-way cycle track will be located along the south side of the Old Lucan Road before connecting to the foot / cycle bridge that crosses the M50. The cycle track will be accommodated within the existing road space on the Old Lucan Road, with the lanes for general traffic being narrowed, and traffic calmed to reflect a proposed 30km/hr speed limit.

On the south side of the N4 a pedestrian priority zone is provided between Ballyowen Lane and the existing foot / cycle bridge over the N4 adjacent to the Mount Andrew estate. From Ballyowen Lane a Quiet Street is proposed along Hermitage Road to the R136 Ballyowen Road. The provision of the two-way segregated cycle track along the northern side of the N4 and the Quiet Street along Hermitage Road avoids the need for a segregated one-way cycle track on the southern side of the N4, as well as along the westbound service road and off-slip at Junction 3.

#### 4.5.1.2 Deviations from Standard Cross Sections

There are four deviations from the cross-sectional elements within Section 1 – N4 Junction 3 to M50 Junction 7 as outlined in Section 4.6.1. These are detailed in Table 4.3.

**Table 4.3: Reduced Standard Cross Sections on Section 1 – N4 Junction 3 to M50 Junction 7**

Location: Road Name	Chainage	Design Speed	Description of Departure	Standard Required	Departure Justification
N4 - Outbound	A420-A650	50km/h	Cycle track width = 1.5m	Cycle Track Width = 1.75m	Existing cycle lane facilities have been retained with an alternative route proposed as part of the design as an offline route. The alternative route will provide a Quiet Street along Ballyowen Lane and Hermitage Road to access Ballyowen Road from the N4 Footbridge (Ch. A900).
M50 bridge - Inbound	I625-I883	n/a	Cycle track width = 1.5- 2.5m	Cycle Track Width = 2.65m	Existing bridge/conditions are to be retained. Significant works would be required to facilitate widening of existing bridge to meet NCM requirements.
M50 Bridge - Inbound	I0 to I883	n/a	Footway width = 1.6m-2.2m	Footway width = 1.8m	Existing bridge/conditions are to be retained. Significant works required to facilitate widening of existing bridge required to facilitate NCM requirements.
R136 Ballyowen Road – South bound	B225	50km/h	Footway width = 1.5m-1.8m	Footway width = 1.8m	Reduction in width over a length of max. 5.0m. Reduction required to facilitate 2-way cycle track and retain existing vehicle movements onto Ballyowen Road. Cross-section constrained either side of carriageway.



#### 4.5.1.3 Bus Lane Provision

An overview of the bus lane provisions as part of the Proposed Scheme is provided in Section 4.6.4. Full bus priority is proposed along the entire length of Section 1, with the following exceptions:

- Inbound; approximately 250m of the N4 Junction 2 on-slip (buses merge with general traffic due physical constraints of the Deadman’s Inn; and
- Outbound; N4 between junctions 2 and 3, approximately 600m along the service road between St Loman’s Hospital and the N4 Junction off-slip.

#### 4.5.1.4 Bus Stops

The different types of bus stop (island, shared landing, inline and lay-by bus stops) are described in Section 4.6.4. Five out of the eight proposed bus stops within this Section of the Proposed Scheme are Layby bus stops, with two inline and one Island bus stops proposed. The bus stop locations and types are outlined in Table 4.4 and shown in the General Arrangement series of drawings (BCIDC-ACM-GEO\_GA-0006\_XX\_00-DR-CR-9001) in Volume 3 of this EIAR. Further details of bus stop design are included in the PDGB (NTA 2021) – Appendix A4.1 in Volume 4 of this EIAR.

**Table 4.4: Proposed Bus Stop Locations within Section 1 – N4 Junction 3 to M50 Junction 7**

Inbound / Outbound	Bus Stop Name	Bus Stop Number	Chainage	Bus Stop Type	Bus Shelter
Inbound	Lucan Retail Park	2234	C150	Island bus stop	Proposed: Yes Existing: Yes
Inbound	Hermitage Clinic	5056	E250	Inline bus stop	Proposed: Yes Existing: Fingerpost
Inbound	Hermitage Bridge	2236	A980	Layby bus stop	Proposed: Yes Existing: Fingerpost
Inbound	Liffey Valley	2239	A2150	Layby bus stop	Proposed: Yes New Location
Outbound	Hermitage Valley	4599	N300	Inline bus stop	Proposed: Yes Existing: Fingerpost
Outbound	Ballyowen Lane	2216	A650	Layby bus stop	Proposed: Yes Existing: Yes
Outbound	St Loman’s Hospital	2215	A1100	Layby bus stop	Proposed: Yes Existing: Yes
Outbound	Clarion Hotel	2214	A1790	Layby bus stop	Proposed: Yes Existing: Yes

#### 4.5.1.5 Cycling Provision

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

To provide a continuous facility for the Primary Cycle Route 6 as identified in the GDA Cycle Network Plan, from the roundabout serving the Lucan Retail Park, facilities for cyclists will initially comprise a Quiet Street along the public road providing access to the Hermitage Golf Club.

On the northern side of the N4 between the entrance to the Hermitage Golf Club and Junction 2 of the N4 a segregated two-way cycle track is included in the Proposed Scheme. Land acquisition will be required from the Hermitage Golf Club to provide this cycle track which will connect with the existing foot / cycle bridge over the N4 adjacent to the Mount Andrew estate / St Loman’s Hospital access. Eastwards of this location the two-way cycle track continues on the north side of the N4 and will require land acquisition from the Hermitage Medical Clinic. The two-way cycle track will then run along the north side of the eastbound off-slip at Junction 2.

From Junction 2 of the N4 the segregated two-way cycle track will be located along the south side of the Old Lucan Road before connecting to the foot / cycle bridge that crosses the M50. On the east side of the M50, the cycle track will be accommodated within the existing road space on the Old Lucan Road, which will be narrowed, and traffic calmed to reflect the existing 30km/hr speed limit.

On the south side of the N4 a pedestrian priority zone is provided between Ballyowen Lane and the existing foot / cycle bridge over the N4 adjacent to the Mount Andrew estate. From Ballyowen Lane a Quiet Street is proposed along Hermitage Road to the R136 Ballyowen Road. The provision of the two-way segregated cycle track along the northern side of the N4 and the Quiet Street along Hermitage Road avoids the need for a segregated one-way cycle track on the southern side of the N4, as well as along the westbound service road and off-slip at Junction 3.

#### 4.5.1.6 Junction Information

An overview of the approach to junction review and design is provided in Section 4.6.7. The major and moderate junctions (signalised) within Section 1 - N4 Junction 3 to M50 Junction 7 of the Proposed Scheme are outlined in Table 4.5.

**Table 4.5: Major and Moderate Junctions (Signalised) within Section 1 of the Proposed Scheme**

Junction Location	Summary	Signal Operation
<b>Major Junctions (Signalised)</b>		
N/A		
<b>Moderate Junctions (Signalised)</b>		
R136 Ballyowen Road / R835 Lucan Road	Existing 3-arm signalised junction Minor geometric changes proposed Left turn slip lanes removed	A four stage signal operation is proposed – buses and cyclists on the western approach will run for three stages, with general traffic from the western and eastern approaches on the mainline and pedestrian and cyclist crossings on the western side of the southern approach. This is followed by left turning traffic on the southern approach and then turning traffic to both side arms from the southern approach, with pedestrian and cyclist crossings on the eastern side of the southern approach. The pedestrian and cyclist crossings on the mainline and the eastern side of the southern approach run on a separate stage with the left turning traffic from the southern approach.
R136 Ballyowen Road / N4 Junction 3 Eastbound off-slip	Existing 3-arm signalised junction No changes proposed	A two stage signal operation is proposed - mainline traffic and the buses from the northern and southern approaches operate together in one stage followed by the side arm traffic and cyclists in a separate stage.
R136 Ballyowen Road / N4 Junction 3 Westbound off-slip	Existing 4-arm signalised junction Minor geometric changes proposed Left turn slip lane removed	A three stage signal operation is proposed - mainline cyclists from the northern and southern approaches and the pedestrian crossing on the side arm will run for two stages, with the mainline straight ahead traffic on the northern and southern approaches and left turning traffic from the southern approach, followed by the right turning traffic from the northern approach. The side arm will operate on its own stage.
R136 Ballyowen Road / Hermitage Road	Existing 3-arm signalised junction Minor geometric changes proposed	A four stage signal operation is proposed – mainline traffic and buses will run for two stages on the southern arm, with cyclists from the northern arm and pedestrian crossing on the eastern arm followed by the mainline traffic from the northern arm. Cyclists from the southern arm and eastern arm along with right turning traffic from the southern arm will run together followed by traffic and cyclists on the eastern arm.

#### 4.5.1.7 Parking and Loading Bays

With the provision of the two-way cycle track along the Old Lucan Road west of the M50, informal parking along the south side of the road will no longer be permitted apart from along the 100m of the road nearest the M50.

#### 4.5.1.8 Landscape and Urban Realm

For an overview of the landscape 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.

##### 4.5.1.8.1 Hermitage Golf Club and Hermitage Medical Clinic Boundaries

Existing boundary walls will be set back and replaced to accommodate a 2m wide footway, 3.25m two-way cycle way and a 0.65m wide buffer strip adjacent to the proposed boundary wall. The existing boundary walls are to be demolished, relocated and reconstructed incorporating additional retaining structure elements where required. Netting will also be provided at this location to mitigate the potential for stray golf balls reaching the road. Existing trees along the boundaries will be retained where possible and replacement planting will be proposed where appropriate. This is shown in Image 4.1.



**Image 4.1: Segregated Two-Way Cycle Track Proposed Adjacent to Hermitage Golf Club**

##### 4.5.1.8.2 Liffey Valley Pedestrian Bridge

There is an opportunity for public space at the bridge/pedestrian linkage to Liffey Valley Shopping Centre. The public realm adjacent to the new bus stops will be paved with concrete paving and complemented with new soft landscaping and tree planting to create a link to the new pedestrian bridge. To the north of the carriageway the public realm will connect with the cycle lane and pedestrian crossing point along Old Lucan Road. Existing trees will be retained where possible, and those that will be removed will be replaced accordingly. Bike parking will also be incorporated into the public realm. New planting is proposed between the ramps and Old Lucan Road in order to screen the structural elements and in addition the lower part of the ramp will be of solid construction, providing some noise screening.

#### 4.5.1.9 Land Acquisition and Use

Land acquisition will be required to facilitate the Proposed Scheme. Temporary land acquisition is required within this Section to facilitate:

- Construction Compounds LU1a and LU1b; and
- Replanting / additional planting within Hermitage Golf Club.

Temporary and permanent land acquisition is required within this Section to facilitate:

- Provision of new cycle facilities and footway realignment. To accommodate this, an area of land acquisition and realignment of the boundary wall will be required from three commercial properties, one possible domestic residence and one medical facility, these are:
  - Site in the Townland of Woodville;
  - Hermitage Golf Club;
  - Bungalow in Hermitage Golf Club;
  - Sureweld International Limited; and
  - Hermitage Medical Clinic.
- Carriageway widening will require an area of land take and realignment of the boundary wall will be required from one commercial property, the site of the Foxhunter Pub; and
- Provision of new pedestrian footbridge over the N4 to LVSC and access to proposed bus stops. To accommodate this, an area of land take will be required from two commercial properties, Liffey Valley Shopping Centre and Block B Liffey Valley Office Campus.

The impacts on residential amenity arising from land acquisition in Section 1 of the Proposed Scheme are addressed where appropriate 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).

#### **4.5.1.10 Rights of Way**

No existing rights of way in this Section will be affected by the Proposed Scheme.

### **4.5.2 Section 2: M50 Junction 7 to R148 Con Colbert Road – R148 Palmerstown bypass and Chapelizod bypass**

#### **4.5.2.1 General overview of the Proposed Scheme**

On this section between M50 Junction 7 and R148 Con Colbert Road – R148 Palmerstown bypass Chapelizod bypass junctions, as described below, it is proposed to upgrade the following junctions to provide bus priority and enhanced pedestrian and cyclist facilities:

- R148 Palmerstown bypass / Kennelsfort Road;
- Old Lucan Road / Kennelsfort Road Lower; and
- R148 Palmerstown bypass / The Oval.

Between the M50 junction and Kennelsfort Road junction, it is proposed to provide a continuous bus lane and two general traffic lanes in the eastbound direction. In the westbound direction, a bus lane and two general traffic lanes are proposed, with the lane designation amended to separate earlier the general traffic heading toward the M50 and the N4 Lucan Road westbound. This arrangement will allow for a continuous westbound bus lane from the Kennelsfort Road junction and through the M50 interchange.

On the R148 Palmerstown bypass modifications are proposed to both the Kennelsfort Road and the Old Lucan Road / The Oval junctions to remove the existing left turn slip lanes. In addition, the left turn movement from Kennelsfort Road Lower to the R148 Palmerstown bypass eastbound is to be prohibited to facilitate new signalised crossings on the east side of the Kennelsfort Road junction to serve the enhanced bus stops, the pedestrian demand and to cater for the proposed two-way cycle track that crosses the R148 Palmerstown bypass at this location. Traffic in Palmerstown village wishing to travel east on the R148 towards the city centre will be able to do so by travelling east along the Old Lucan Road to the junction with the Oval.

In addition, at the signalised junction of the R148 with the Old Lucan Road / The Oval a new westbound, bus only, right turn lane is proposed on the R148 Palmerstown bypass to facilitate new bus services through Palmerstown village. A small area of land acquisition will be required from the western edge of the petrol filling station at this

location to accommodate this new bus movement. The existing R148 westbound u-turn facility located some 40m east of the junction with the Oval will be closed.

The existing bus stops on the R148 Palmerstown bypass at Kennelsfort Road and The Oval are to be lengthened and relocated to allow the provision of a bus layby in all cases. In addition, it is proposed to rationalise the bus stops within Palmerstown village with new bus stops provided on the Old Lucan Road immediately west of the junction with Mill Lane.

Between the junction with The Oval and the R833 Con Colbert Road junction, it is proposed to maintain a continuous bus lane and two general traffic lanes in each direction, as per the existing arrangement. The existing bus lane and public transport signals on the westbound on-slip from the R112 Kylemore Road will be retained. New bus stops with laybys are proposed where the R148 Chapelizod bypass crosses Chapelizod Hill Road. These will be connected to Chapelizod Hill Road via a combination of steps and ramps. The existing bridge carrying the R148 Chapelizod Bypass over Chapelizod Hill Road will be widened to accommodate the eastbound bus layby and retaining walls are proposed to support the road widening, steps and ramps. Additionally, the speed limit for the bus lanes along the full length of the R148 Chapelizod bypass will be reduced from 80km/hr to 60km/hr.

A segregated two-way cycle track is proposed to run along the north side of the Old Lucan Road from the foot / cycle bridge crossing the M50, all the way through Palmerstown village connecting to the existing pedestrian priority zone at the start of the R148 Chapelizod bypass. A new Toucan crossing is also proposed on the R112 Lucan Road on the approach to Chapelizod village. The cycle track will be accommodated within the existing road space on the Old Lucan Road, with the lanes for general traffic being narrowed and traffic calmed to reflect the existing 30km/hr speed limit. Several lengths of informal parking will be lost along the northern side of the Old Lucan Road between the M50 and Kennelsfort Road Lower where the two-way cycle track is provided.

Along the Old Lucan Road between Kennelsfort Road Lower and the Oval, the existing pay and display parking on the northern side of the road will be lost to accommodate the two-way cycle track. To offset this loss of parking spaces, the existing parallel pay and display parking spaces on the southern side of Old Lucan Road will be replaced with a higher number of perpendicular parking spaces.

In addition, a new segregated two-way cycle track is proposed along the east side of Kennelsfort Road Lower resulting in the loss of a small number of pay and display parking spaces and resulting in the need for a small area of land acquisition from the frontage of the numbers 20 and 22 (the Palmerstown Lodge hotel). The proposed two-way cycle track crosses the R148 Palmerstown bypass via the new signalised cycle crossing on the east side of the junction described above and ends at a new Toucan Crossing on Kennelsfort Road Upper to provide a connection to the existing cycle lanes.

#### 4.5.2.2 Deviations from Standard Cross Sections

There is one deviation from the cross-sectional elements as outlined in Section 4.6.1. This is described in Table 4.6.

**Table 4.6: Reduced Standard Cross Section on Section 2 – M50 Junction 7 to R148 Con Colbert Road – R148 Palmerstown bypass and Chapelizod bypass**

Location: Road Name	Chainage	Design Speed	Description of Departure	Standard Required	Departure Justification
Kennelsfort Road Lower - Southbound	A3675	30km/h	Footway width = 1.7m - 1.8m	Footway width = 1.8m	Footway width reduced over 5m to facilitate right turn pocket as part of Palmerstown Lodge planning application.

#### 4.5.2.3 Bus Lane Provision

An overview of the bus provision being proposed as part of the Proposed Scheme is provided in Section 4.6.4. Existing bus priority signals are present at the slip road to the westbound Chapelizod Bypass carriageway off Kylemore Road where bus services could conflict with merging vehicles.

#### 4.5.2.4 Bus Stops

The different types of bus stop (island, shared landing, inline and lay-by) are described in Section 4.6.4. The bus stop locations and types are outlined in Table 4.7 and shown in the General Arrangement series of drawings (BCIDC-ACM-GEO\_GA-0006\_XX\_00-DR-CR-9001) in Volume 3 of this EIAR. Further details of bus stop design are included in the PDGB (NTA 2021) – Appendix A4.1 in Volume 4 of this EIAR.

**Table 4.7: Proposed Bus Stop Locations within Section 2 - M50 Junction 7 and R148 Con Colbert Road**

Inbound / Outbound	Bus Stop Name	Bus Stop Number	Chainage	Bus Stop Type
Inbound	Palmerstown	4401	A3750	Proposed: Yes Existing: Yes
Inbound	The Oval	7239	A3950	Proposed: Yes New Location
Inbound	Chapelizod Bypass	New bus stop	A5650	Proposed: Yes New Bus stop
Inbound	Mill Lane Palmerstown	New bus stop	K100	Proposed: Yes New Bus stop
Outbound	Old Lucan Road	New bus stop	K100	Proposed: Yes New Bus Stop
Outbound	Palmerstown	4401	A3750	Proposed: Yes Existing: Yes
Outbound	The Oval	7239	A3950	Proposed: Yes Existing: Fingerpost
Outbound	Chapelizod Bypass	New bus stop	A5600	Proposed: Yes New Bus stop

#### 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 the signal-controlled junctions are described in Section 4.6.3.

A segregated two-way cycle track is proposed to run along the north side of the Old Lucan Road from the foot/cycle bridge crossing the M50, all the way through Palmerstown village connecting to the existing pedestrian priority zone at the start of the R148 Chapelizod bypass. A new Toucan crossing is also proposed on the R112 Lucan Road on the approach to Chapelizod village.

In addition, a new segregated two-way cycle track is proposed along the east side of Kennelsfort Road Lower requiring a small area of land acquisition from the frontage of the Palmerstown Lodge hotel. The two-way cycle track crosses the R148 Palmerstown bypass via the new signalised crossing on the east side of the junction described above, then connects to a new Toucan Crossing on Kennelsfort Road Upper.

#### 4.5.2.6 Junction Information

An overview of the approach to junction review and design is provided in Section 4.6.7. The major and moderate junctions (signalised) within Section 2 - M50 Junction 7 and R148 Con Colbert Road of the Proposed Scheme are outlined in Table 4.8.

**Table 4.8: Major and Moderate Junctions (Signalised) within Section 2 of the Proposed Scheme**

Junction Location	Description	Signal Operation
<b>Major Junctions (Signalised)</b>		
R148 Palmerstown Bypass / Kennelsfort Road	Existing 4-arm signalised junction Minor geometric changes and southbound left turn prohibited Left turn slips removed	A four-stage signal operation is proposed - mainline traffic and buses from the eastern and western approaches except the right turners will run together with the pedestrian crossing on the eastern side of the northern approach in one stage. The right turners on the mainline run along with the left turning traffic from the southern approach and the pedestrian crossings

Junction Location	Description	Signal Operation
		on the eastern side of the northern approach and the northern side of the eastern approach in a separate stage. The southern approach runs with the pedestrian crossing on the southern side of the eastern approach in its own stage followed by the northern approach traffic, cyclists crossings, pedestrian crossings on the southern side of the eastern approach and the western side of the northern approach in a separate stage.
<b>Moderate Junctions (Signalised)</b>		
R148 Palmerstown Bypass / The Oval	Existing 4-arm signalised junction Minor geometric changes and introduction of new westbound bus-only right turn Left turn slips removed	A five stage signal operation is proposed – mainline traffic and buses from the western approach and the pedestrian crossing on the northern approach will run for two stages, with the mainline straight ahead buses from the eastern approach and the pedestrian crossing on the southern approach, followed by the mainline traffic from the eastern approach. The right turners from the eastern and western approaches run together with the pedestrian crossing on the southern side of the western approach in a separate stage. The southern side arm will operate along with the pedestrian crossing on the northern side of the western approach in its own stage followed by the northern side arm which runs in a separate stage along with the northern side of the western approach.
R148 Chapelizod Bypass / R833 Con Colbert Road	Existing 3-arm signalised junction Minor geometric changes	A two stage signal operation is proposed - right turning traffic from the side arm will run with the cyclists from the side arm along with an advance start for cyclists. The mainline traffic and buses run together in a separate stage.

#### 4.5.2.7 Parking and Loading Bays

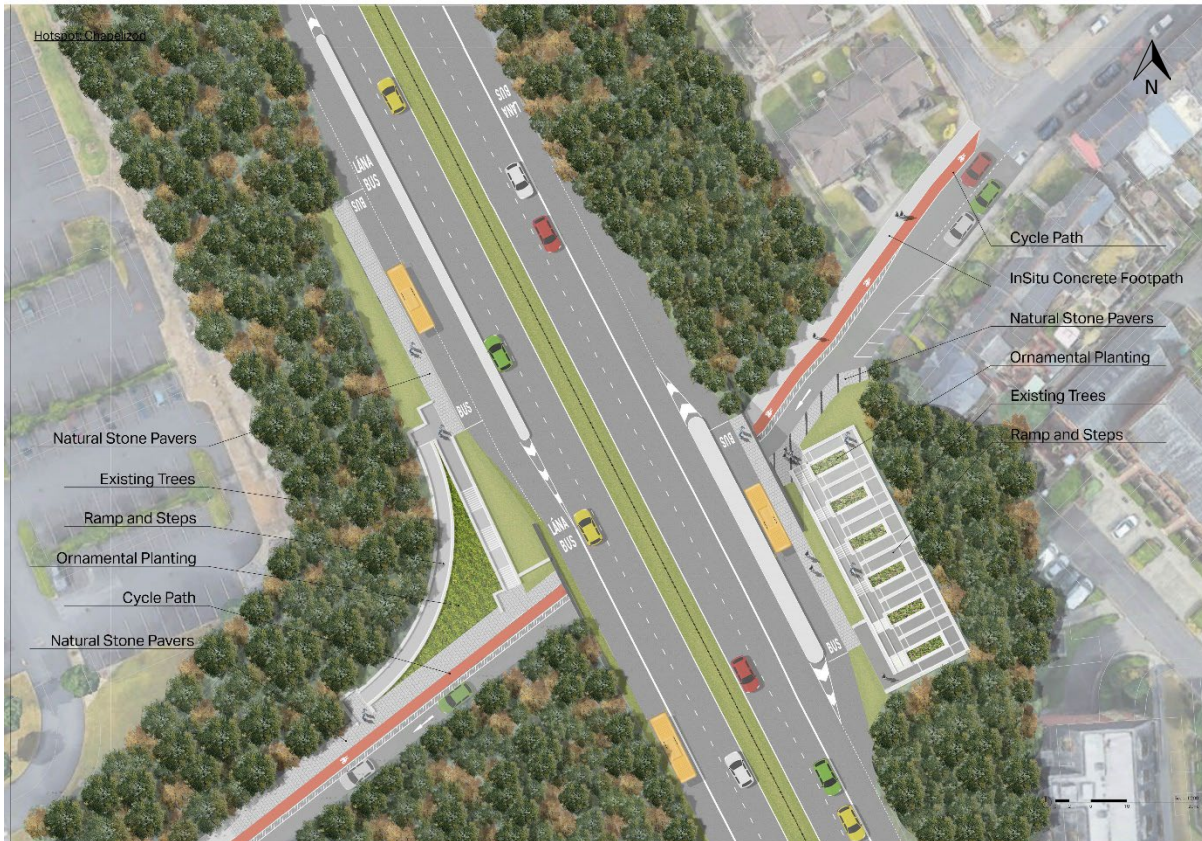
Due to the reallocation of road space at Kennelsfort Road Lower in Palmerstown, there is the loss of three paid parking spaces and a disabled space. New parking and disabled parking will be provided east of Kennelsfort Road Lower on Old Lucan Road.

Due to reallocation of road space on Old Lucan Road in the centre of Palmerstown Village, there is the loss of existing pay-and-display parking and a single disabled parking space on the northern side of the road. To reduce the number of lost parking spaces, existing parallel pay-and-display parking on the southern side of the road will be replaced by perpendicular pay and display parking, including disabled parking provision, where the road width permits. This provides an increase of 14 spaces on the southern side of the road.

#### 4.5.2.8 Landscape and Urban Realm

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

Ramps and steps will create connections from Chapelizod Hill Road to the new bus stops on the Chapelizod Bypass. This has been achieved on the northern side of the bypass by utilising a switch back ramp arrangement with integrated steps. The ramp is integrated into the buffer planting edge using green wall systems to create a soft interface with the existing context while retaining existing tree planting. High quality paving will delineate the ramp access on Chapelizod Hill Road connecting the ramp access space and creating a newly defined area in the public realm. Ornamental planting within the ramp structure will create a pleasant walking area to the new bus stops on Chapelizod Bypass. The walkway on the south side of the bypass will integrate into the existing landscape to create a gradual walking route and steps to the bus stop. Existing planting will be retained and supplemented to further enhance the walkway into the urban realm. This is shown in Image 4.2.



**Image 4.2: New Bus Stop Access at Chapelizod Bypass Landscape and Public Realm Proposals**

#### 4.5.2.9 Land Acquisition and Use

Temporary and permanent land take is required within this Section to facilitate:

- Provision of new cycle facilities and footway realignment. To accommodate this, an area of land take and realignment of the boundary wall will be required from one commercial property, Palmerstown Lodge Hotel;
- To accommodate carriageway widening, including a new left turn lane from Old Lucan Road, and footway realignment an area of land take and realignment of the boundary wall will be required from one commercial property, Applegreen service station; and
- Provision of new bus stops on the Chapelizod bypass and associated accesses from Chapelizod Hill Road. To accommodate this, areas of land take will be required from the site of the City of Dublin Education and Training Centre.

Temporary land take is required within this Section to facilitate:

- Construction Compounds LU2 and LU3.

#### 4.5.2.10 Rights of Way

Table 4.9 outlines the locations where existing rights of way will be affected by the Proposed Scheme.

**Table 4.9: Existing rights of way affected by the Proposed Scheme**

Location	Chainage	Existing Situation	Proposed Change
Junction of Kennelsfort Road Lower	A3690	Currently vehicular traffic can turn left from Kennelsfort Road Lower on to the R148	It is proposed that the left turn movement from Kennelsfort Road Lower to the R148 Palmerstown bypass eastbound is to be prohibited to facilitate new signalised crossings on the east side of the



Location	Chainage	Existing Situation	Proposed Change
with R148 Palmerstown Bypass		Palmerstown Bypass utilising a left turn slip lane.	Kennelsfort Road junction to serve pedestrian demand and cater for the proposed two-way cycle track that crosses the R148 Palmerstown bypass at this location. Access to R148 Palmerstown bypass eastbound from Palmerstown village will still be available via the R148 Palmerstown bypass junction with The Oval.
Junction of The Oval with R148 Palmerstown Bypass	A4050	Currently vehicular traffic travelling westbound on the R148 Palmerstown Bypass can undertake a U-turn utilising a right turn slip lane c. 30m before the junction with The Oval.	It is proposed that the U-turn movement from the R148 Palmerstown bypass westbound is to be prohibited to facilitate a new westbound, bus only right turn at the R148 Palmerstown bypass junction with The Oval to facilitate new bus services through Palmerstown village. Westbound vehicles wishing to U-turn at this point will need to turn right at Kennelsfort Road Lower through Palmerstown village, Old Lucan Road and turn left at the junction with The Oval. The operation of the proposed pedestrian crossing at the junction with Kennelsfort Road will not permit provision of a westbound U-turn facility.

### 4.5.3 Section 3: R148 Con Colbert Road to City Centre – St John’s Road West

#### 4.5.3.1 General overview of the Proposed Scheme

On this section between R148 Con Colbert Road – Chapelizod bypass and Frank Sherwin Bridge – St John’s Road West junctions, as described below, it is proposed to upgrade the following junctions to provide bus priority and enhanced pedestrian and cyclist facilities:

- R148 Chapelizod bypass / R148 Con Colbert Road
- R148 Con Colbert Road / R839 Memorial Road;
- R148 Con Colbert Road / R111 South Circular Road;
- R148 St John’s Road West / R111 South Circular Road;
- R148 St John’s Road West / Heuston South Quarter;
- R148 St John’s Road West / Military Road;
- R148 St John’s Road West / Heuston Station; and
- R148 St John’s Road West / Victoria Quay (Frank Sherwin Bridge).

At the R833 Con Colbert Road junction with the R148 Chapelizod bypass the existing left turn slip lane from R833 Con Colbert Road is removed and a segregated cycle track is proposed in each direction. Between the R833 Con Colbert Road junction and the R111 South Circular Road junction the existing continuous bus lanes and two general traffic lanes are maintained and narrowed slightly to facilitate the introduction of a segregated cycle track in each direction.

At the junction between the R148 Con Colbert Road and Memorial Road, the pedestrian crossing will be moved to the east side of the junction to be on the same side of the junction as the bus stops. In addition, while the junction has been designed to tie-in to the existing one-way layout of Memorial Road, consideration has been given to the tie-in with the proposals contained in the Liffey Valley to City Centre CBC, which proposes making Memorial Road two-way. To facilitate this a new eastbound right-turning lane on the R148 Con Colbert Road could be accommodated within the proposed junction layout.

At the R111 South Circular Road junction, there are a number of changes to existing traffic lanes. On the eastbound and westbound approaches to the junction the existing left turn slip lanes will be removed. On the R111 South Circular Road northbound a short right turn lane is provided to facilitate future bus movements and compensate for restricted turns included in the Liffey Valley to City Centre Core Bus Corridor Scheme. In order to improve the standard of pedestrian and cyclist facilities at this junction, the number of general traffic lanes through the junction will be reduced in the eastbound, northbound and southbound directions and the R111 South Circular Road will be widened along the western edge through the junction to facilitate the inclusion of segregated cycle tracks in each direction.

At the R148 St John's Road West / HSQ junction and the R148 St John's Road West / Military Road junction, existing left-turn slip lanes are removed and improved pedestrian and cyclist facilities will be provided, including Toucan crossings of the R148.

On the R148 St John's Road West between the R111 South Circular Road junction and Heuston Station the existing eastbound lane configuration of one bus lane and one single general traffic lane is proposed to be maintained.

In the westbound direction of R148 St John's Road West a continuous bus lane is to be provided instead of one of the two existing general traffic lanes. A segregated cycle track is proposed in each direction along this section. The existing taxi queuing lane on the eastbound direction will be maintained between the Heuston South Quarter junction and Heuston Station, along with the existing taxi rank at the station.

Along the section of the R148 St John's Road West between the Heuston South Quarter junction and Heuston Station some trees will need to be removed and replaced so that the facilities for both taxis and cycles described above can be provided. An urban realm landscaping improvement is therefore proposed along this section of the road. This includes the removal of the pedestrian guard railing and new planting, which will result in a net increase in the number of trees along the road.

In the immediate vicinity of Heuston Station continuous bus lanes and segregated cycle tracks are provided in both directions as far as Frank Sherwin Bridge, which the Proposed Scheme will tie into the existing arrangement at the Victoria Quay junction. It is proposed to upgrade the bus stop provision on R148 St John's Road West outside the southern façade of the station, with lengthened bus stops and bus laybys provided in both directions. On the southern side of the road this will require some land acquisition from the Health Service Executive's Dr Steevens' Hospital. The extents of this land acquisition have been minimised by the removal of the central kerbed median between the two signalised crossings of the R148 St John's Road West, which will be upgraded to raised Toucan crossings. A detailed urban realm and landscaping proposal has been developed at this location.

A speed limit of 30km/hr is proposed on the R148 St John's Road West between the junction with Military Road and the end of the Proposed Scheme at the junction with Frank Sherwin bridge. This is in recognition of the high amount of pedestrian activity associated with the public transport interchange at Heuston station. While no changes are proposed to the signalised crossing of the Luas Red Line or the platforms for the Luas stop, a minor reduction in height is proposed to the southern end of the rear wall of the eastern Luas platform to provided clearance to the proposed inbound cycle track.

#### 4.5.3.2 Deviations from Standard Cross Sections

The width of the cross-sectional elements as outline in Section 4.6.1 have been reduced (from published guidance, e.g., DMURS), at a number of constrained locations across the Proposed Scheme. The deviations within Section 3 are detailed in Table 4.10.

**Table 4.10: Reduced Standard Cross Section on Section 3 – Con Colbert Road to City Centre – St John's Road West**

Location: Road Name	Chainage	Design Speed	Description of Departure	Standard Required	Departure Justification
Con Colbert Road Inbound	A7800 - A7900	60km/h	Cycle track width = 1.5m	Cycle Track Width = 1.75m	Cycle track is tapered down to 1.5m to accommodate minimum width footway, existing traffic lanes and proposed right turn lane. No further road space is available as the highway boundary bordering the Irish National War Memorial Park.
R111 South Circular Road - Southbound	A8475	30km/h	Cycle track width = 1.2m - 1.4m	Cycle Track Width = 1.5m	15.0m right turn lane only, concrete protection island is to be provided at stop line for further protection and deter vehicles from entering cycle lanes.
R148 St John's Road West Outbound	A8500 - A8550	50km/h	Cycle track width = 1.5m	Cycle Track Width = 1.75m	Cycle track width is below standard to retain vehicle/bus lane widths and to provide 1.8m min footway width due to minimum road space available.
R148 St John's Road	A8625 - A8700	60km/h	Cycle track width = 1.5m	Cycle Track Width = 1.75m	Cycle track width is below standard to retain vehicle/bus lane widths and to provide 1.8m min footway width due to minimum road space available.

Location: Road Name	Chainage	Design Speed	Description of Departure	Standard Required	Departure Justification
West Outbound					
R148 St. John's Road West - Inbound	A9100 - A9250	50km/h	Footway width = 1.2m-1.6m	Footway width = 1.8m	Existing footway to be retained to retain existing trees.
R148 St Johns Road West/HSQ entrance	A9000 - A9060	50km/h	2.8m - 2.9 m	3.0 m	Straight on and right turn lanes reduced to below 3.0m to accommodate cycle track while retaining existing trees within verge. Kerb adjacent to right turn lane is unable to be relocated due to retaining earth works/slope which would result in significant works to widen.
Con Colbert Road - Inbound	A 7880 - A 7885	60 km/h	Footway width = 1.4 m	Footway width = 1.8	Footpath reduced over 6m length to accommodate right turn jug for cyclists
Con Colbert Road - Outbound	A 7850 - A 7900	60 km/h	Footway width = 1.65 m	Footway width = 1.8	Footpath reduced to facilitate proposed cycle track
St John's Road West - Inbound	A 9307 - A9320	60 km/h	Footway width = 1.7 m	Footway width = 1.8	Footpath reduced to facilitate proposed cycle track which includes the provision of waiting area for right turning cyclists without impeding on going cyclists

#### 4.5.3.3 Bus Lane Provision

An overview of the bus lane provision being proposed as part of the Proposed Scheme is provided in Section 4.6.4. Full bus priority is provided along the entire length of Section 3.

#### 4.5.3.4 Bus Stops

The different types of bus stop (island, shared landing, inline and lay-by bus stops) are described in Section 4.6.4. The majority of the proposed bus stops within this section of the Proposed Scheme are Island Bus Stops. The bus stop locations and types are outlined in Table 4.11.

**Table 4.11: Proposed Bus Stop Locations within Section 3 of the Proposed Scheme**

Inbound / Outbound	Bus Stop Name	Bus Stop Number	Chainage	Bus Stop Type
Inbound	Memorial Gardens	7435	A7900	Island Bus Stop
Inbound	Islandbridge	2722	A8325	Island Bus Stop
Inbound	Heuston Station	4413	A9550	Island Bus Stop
Inbound	Heuston Station	4413	A9550	Layby Bus Stop
Outbound	Memorial Gardens	7012	A7900	Island Bus Stop
Outbound	South Circular Road	2721	A8350	Island Bus Stop
Outbound	Heuston Station	2637	A9425	Island Bus Stop
Outbound	Heuston Station	New bus stop	A9550	Island Bus Stop
Outbound	Ballyowen	4599	N300	Inline Bus Stop
Outbound	Heuston Station	New bus stop	A9550	Layby Bus Stop

#### 4.5.3.5 Cycling Provision

The specific proposals for cycling facilities in Section 3 of the Proposed Scheme are described below. Provision for cyclists at the signal-controlled junctions are described in Section 4.6.3.

A fully segregated cycle track will be provided on Con Colbert Road from Chainage A7550 to St John's Road West, Chainage A9570 (single cycle tracks in both in and outbound directions).

#### 4.5.3.6 Junction Information

An overview of the approach to junction review and design is provided in Section 4.6.7. The major and moderate junctions (signalised) within Section 3- R148 Con Colbert Road to Frank Sherwin Bridge of the Proposed Scheme are outlined in Table 4.12.

**Table 4.12: Major and Moderate Junctions (Signalised) within Section 3 of the Proposed Scheme**

Junction Location	Description	Signal Operation
<b>Major Junctions (Signalised)</b>		
R148 Con Colbert Road / R111 South Circular Road / R148 St. John's Road West	Existing signalised gyratory junction Minor geometric changes and introduction of new northbound right turn lane Number of general traffic lanes reduced	This junction works based on a coordinated signal control system at four sections of the junction. The signal operation at each section is summarised below:  a) Section A: A four stage signal operation is proposed - mainline traffic and buses going straight ahead from the western approach will run in two stages, with the straight-ahead cyclists from the western approach and the pedestrian crossings on the northern approach, followed by left turning traffic from the western approach. The straight-ahead traffic and cyclists from the northern and southern approaches then run together with the pedestrian crossings on the eastern and western approaches and the left turning cyclists from the western approach in a separate stage. The traffic and cyclists from the southern approach run on their own stage with the left turning cyclists from the western arm.  b) Section B: A four stage signal operation is proposed - mainline traffic and buses from the eastern approach except the left turning traffic will run in two stages, with the left turning traffic from the eastern approach running for a stage, followed by the cyclists from the eastern approach along with the pedestrian crossing on the southern approach. The cyclists from the northern and southern approaches run together with the pedestrian crossings on the eastern and western approaches in a separate stage followed by a stage for the traffic and straight-ahead cyclists from the northern approach and the traffic from the southern approach.  c) Section C: A two stage signal operation is proposed - mainline traffic, buses and cyclists from the western approach run together with the pedestrian crossing on the north-west approach in one stage, followed by the traffic from the north-west approach in a separate stage.  d) Section D: A two stage signal operation is proposed - mainline traffic and buses from the eastern approach will run together in one stage, followed by the traffic from the north-east approach in a separate stage.
<b>Moderate Junctions (Signalised)</b>		
R148 Con Colbert Road / Memorial Road	Existing 3-arm signalised junction Introduction of new eastbound right turn lane	A three stage signal operation is proposed - mainline traffic, cyclists and buses run together with the pedestrian crossing on the side arm in one stage on the eastern arm followed by a separate stage for the toucan crossings on the eastern approach. The side arm runs along with the cyclists from the western arm and the toucan crossing on the southern side of the eastern approach in its own stage.
R148 St John's Road West / Heuston South Quarter Access	Existing 3-arm signalised junction Replacement of westbound traffic lane with bus lane	A three stage signal operation is proposed - mainline straight-ahead traffic, cyclists and buses from the western approach will run for two stages with mainline followed by traffic, buses and cyclists from the eastern approach along with an advance start, then right turning vehicles from the western approach, left turning vehicles from the southern approach and pedestrians on the southern side of the eastern approach. Followed by a separate stage for the pedestrian crossing on eastern and southern arms.
R148 St John's Road West / Military Road	Existing 3-arm signalised junction Minor geometrical changes	A three stage signal operation is proposed – mainline buses, traffic and cyclists on the eastern and western approaches with an advanced start for the eastern approach. The toucan crossings on the eastern approach and southern run in a separate stage followed by a stage for the side arm traffic and the cyclists on the western arm.
R148 St John's Road West / Steevens Lane	Existing 4-arm signalised junction Minor geometrical changes	A three stage signal operation is proposed – mainline traffic, buses and cyclists will run on the eastern and western approaches, followed by the LUAS running on the north and south approaches along with the toucan crossing over the mainline. Buses from the bus interchange at Heuston Station will run on its own stage.
R148 St John's Road West /	Existing 4-arm signalised junction	A three stage signal operation is proposed – mainline buses, traffic and cyclists on the southern approach, with an advanced start along with left turning buses, vehicles and cyclists from the eastern approach. Followed by

Junction Location	Description	Signal Operation
Victoria Quay / Frank Sherwin Bridge	Minor geometrical changes Left turn slip removed	all traffic, bus and cyclist movement from the eastern approach, left turning vehicles from the western approach and pedestrians on the eastern side of the southern approach. A separate stage is provided for cyclist and pedestrian movement across the mainline.

#### 4.5.3.7 Parking and Loading Bays

Eight existing public parking spaces on the south side of St John's Road West outside the Eir building will be removed to facilitate footpath widening and new cycle facilities. An existing electric vehicle charging point on the south side of St John's Road West opposite Heuston Station is proposed to be relocated to the frontage of the Eir building.

Along St John's Road West, the section of the existing taxi queuing lane to the west of the HSQ car park entrance (20 spaces) is proposed to be removed to accommodate the new segregated cycle track. The taxi queuing lane and taxi rank to the east of the HSQ car park entrance will remain.

#### 4.5.3.8 Landscape and Urban Realm

For an overview of the design principles and approach please refer to Section 4.6.12. The following sections provide a description of specific landscape and public realm design in Section 3 of the Proposed Scheme.

##### 4.5.3.8.1 Irish National War Memorial Interface

Improved pedestrian access to Irish National War Memorial Gardens will be provided, with an opportunity for an enhanced entrance feature. New concrete paving is proposed to footways that will connect R839 Memorial Road to the new bus stop locations on either side of R148 Con Colbert Road. Additional tree planting is proposed within the existing median to soften and complement the character of the area.

##### 4.5.3.8.2 Interface at Heuston Station and Dr Steevens' Hospital

The public realm around Heuston Station will be upgraded and decluttered, to include wayfinding, street furniture and new natural stone paving throughout. Pedestrian crossing points will be paved with natural stone. Existing heritage lighting columns and post boxes will be retained and relocated within Proposed Scheme.

Adjacent to Dr Steevens' Hospital the existing boundary with St John's Road West will be re-configured to create a public realm space that responds sensitively to the surrounding architecture whilst creating a public realm space that balances the needs of cyclists/pedestrians and bus stop locations. The proposed road alignment has been designed in order to maintain the majority of existing trees, in particular a large mature tree located at the north-west corner of the existing lawn. The introduction of formal tree planting and hedgerows along with raised seated edges will help re-define this interface. The existing pedestrian path from Steevens' Lane will be maintained and incorporated into the new public realm. This is shown in Image 4.3.

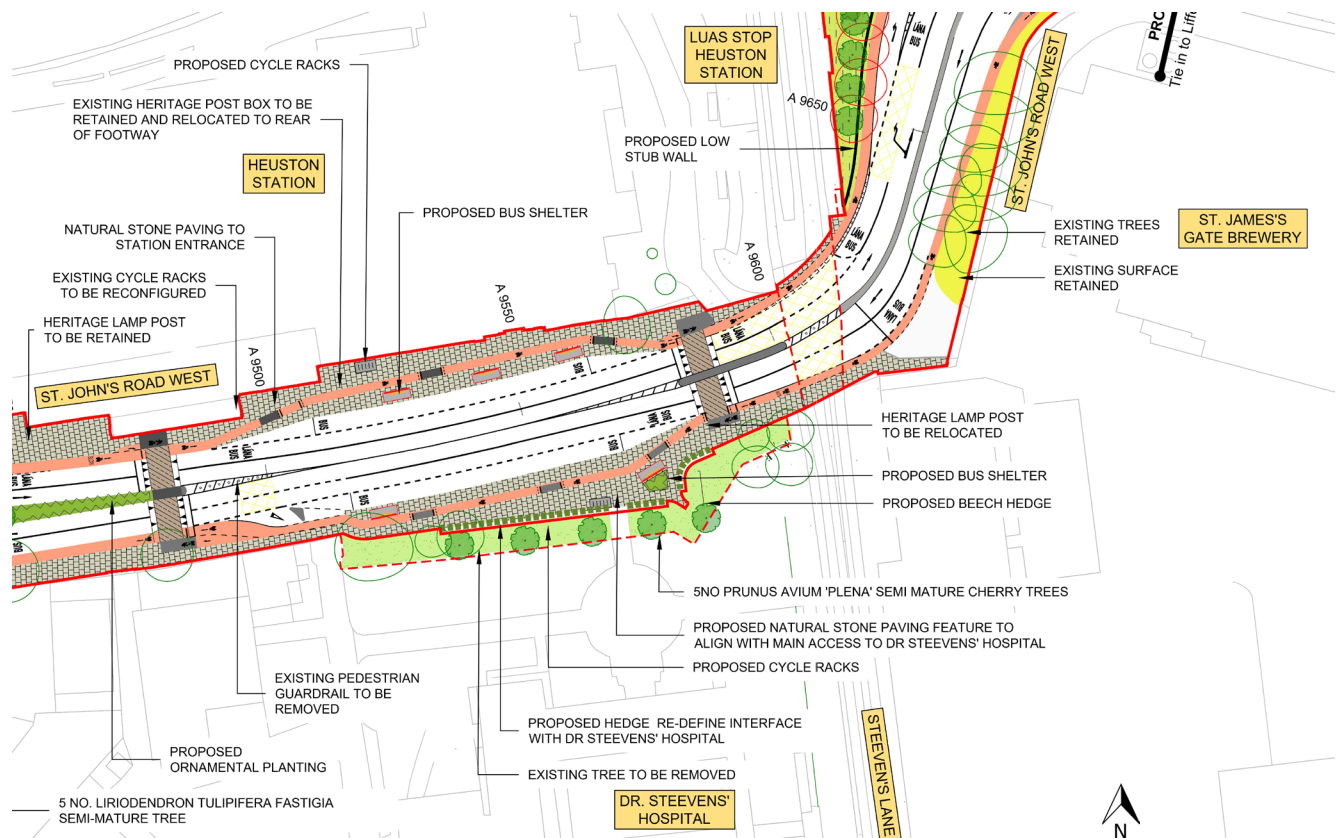


Image 4.3: Interface at Heuston Station and Dr Steevens' Hospital

#### 4.5.3.9 Land Acquisition and Use

Land acquisition will be required to facilitate the Proposed Scheme. Temporary and permanent land take is required within this Section to facilitate:

- Provision of a dedicated cycle tracks and footway facilities will be maintained through this section. To accommodate this, an area of land take will be required from a commercial property (Eir Head Office) on the south side of the westbound St John's Road West carriageway; and
- Dedicated bus facilities and footway facilities will be maintained through this section. To accommodate this, an area of land take will be required from the Health Service Executive (Dr Steevens' Hospital).

#### 4.5.3.10 Rights of Way

No existing rights of way in this Section will be affected by the Proposed Scheme.

### 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

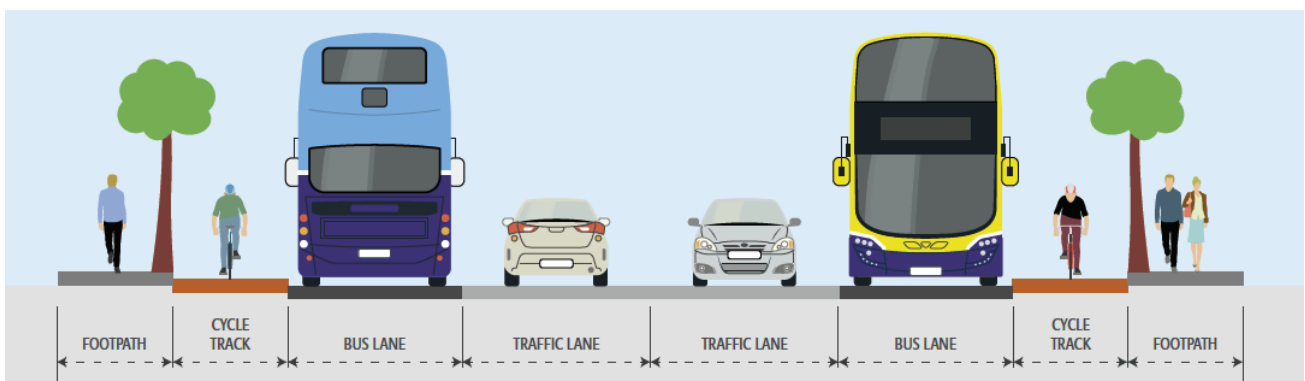
- 3.25m in areas with a posted speed limit >60km/h.

Traffic lane widths of 2.75m are permissible but not desirable and should only be permitted on straight road sections with very low Heavy Goods Vehicles (HGV) percentage and where all desirable minimum widths for footpaths, cycle tracks, parking, bus lanes are not achievable without impacting 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 the 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 4.4.



**Image 4.4: Typical BusConnects Road Layout (PDGP)**

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 outlined in Table 4.13.

**Table 4.13: Cross-Sectional Design Parameters**

Design Element	Desirable Minimum Standard	Minimum Width	Permitted Reductions at Constraints
Footpath	2.0m	1.8m	1.2m (over distances <2m as per PDGB in Appendix A4.1 in Volume 4 of this EIAR)
Cycle Track (one-way)	2.0m	1.5m	1.2m (over distances <2m as per Preliminary Design Guidance Booklet in Appendix A4.1 in Volume 4 of this EIAR)
Cycle Track (two-way)	3.25m + 0.5m (buffer)	Refer to National Cycle Manual Width Calculator. 0.3m (buffer)	Reduced at bus stops
Bus Lane	3.0m	3.0m	n/a
Traffic Lane	3.0m (<60kph)	3.0m	2.75m (low HGV flow)

For the Proposed Scheme the width of the bus lanes and traffic lanes have not been reduced below 3.0m. The width of the cross-sectional elements detailed in Table 4.13 have been reduced at a number of constrained locations across the Proposed Scheme. These deviations from the standards are outlined for each section of the Proposed Scheme in Section 4.5.

## **4.6.2 Pedestrian Provision**

### **4.6.2.1 Footpath Widths**

The desirable minimum width for a footpath is 2.0m. 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, where practicable.

Throughout the Proposed Scheme, footpath widths of two metres or wider have been proposed, however where this has not been achieved, deviations from standard have been required as outlined in Section 4.5.

### **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 applied across the Proposed Scheme is 19m. This is applicable at stand-alone pedestrian crossings as well as at junctions.

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 a staggered crossing, 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 (BCIDC-ACM-UBR\_ZZ-0006\_XX\_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 Bus Stops and key additional locations as noted in the Landscaping General Arrangement drawings (BCIDC-ACM-UBR\_ZZ-0006\_XX\_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.

The Proposed Scheme is approximately 9.7km long from end to end and includes approximately 10.2km of new cycle facilities.

Existing Provision:

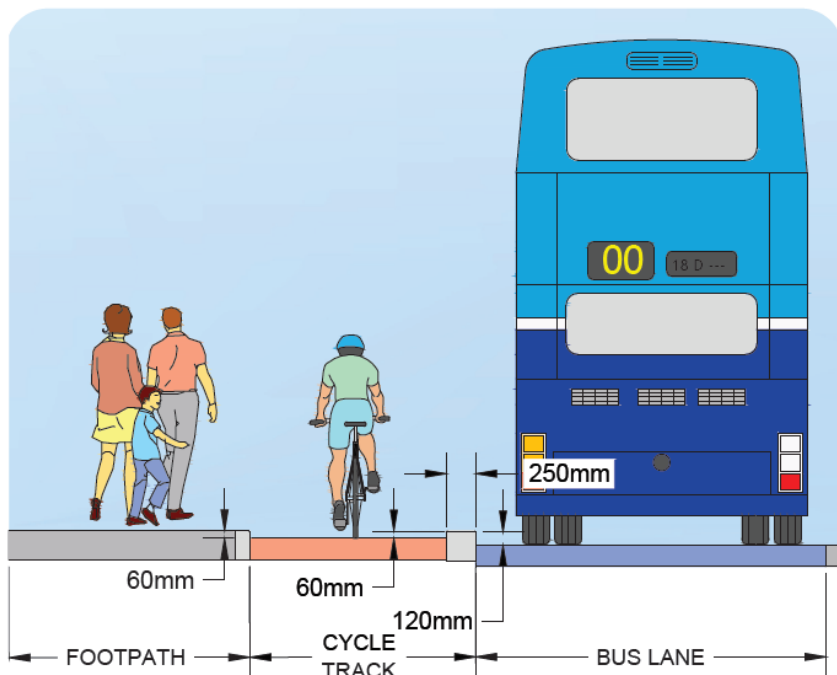
- 21% inbound (of which 10% segregated and 11% non-segregated); and
- 30.5% outbound (of which 10% segregated and 20.6% non-segregated).

Proposed Provision:

- 90.5% inbound (of which 86% segregated and 3.4% non-segregated); and
- 90.5% outbound (of which 85% segregated and 5.5% non-segregated).

#### **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 4.5, taken from the PDGB.



**Image 4.5: Fully Segregated Cycle Track**

Wherever possible, the Proposed Scheme design has endeavoured to incorporate segregated cycle tracks, and has done so in the following locations:

- R136 Ballyowen Road from Ch. B10 to Ch. B254 (two-way cycle track adjacent to southbound lane including N4 overbridge);
- Lucan Road from Ch. C0 to Ch. C288 (two-way cycle track from Ch. C100, adjacent to eastbound carriageway);
- N4 Junction 3 to Junction 2 from Ch. A 450 (two-way cycle track, adjacent to eastbound carriageway.) to Ch. E305 (N4 Junction 2 off-slip);
- Old Lucan Road east and west of M50 from Ch. G0 crossing over the M50 to Ch. L300 beyond Applegreen Petrol Station. Protective cycle tracks also provided along Kennelsfort Road (linked with Old Lucan Road (Ch. A3650); and
- Con Colbert Road from Ch. A7550 to St John's Road West Ch. A9570 (single cycle tracks in both in/ westbound directions).

Offline cycle tracks are fully offset from the road carriageway, providing a greater level of protection and comfort to cycle users. Offline sections of cycle track are provided at the following locations:

- East side of R136 Ballyowen Road, Ch. B100 to Ch. B0, two-way cycle track provided over the N4 (via proposed new pedestrian/ cycle bridge);
- Northern roundabout of N4 Junction 2, Ch. F90 to Ch. F149, two-way cycle track provided as alternative route for cyclists, avoiding the navigation of the roundabout and improving directness to Old Lucan Road;
- Ch. H175 to Ch. I150 two-way cycle track proving continuation of cycle route from ramp of existing bridge to the existing two-way cycle track adjacent to the M50 Northbound slip road;
- Old Lucan Road west of the M50, Ch. I550 to Ch. I883, existing two-way pedestrian / cycle bridge retained to navigate over M50;
- Kennelsfort Road Upper, Ch. A3700, connectivity and directness between signalised crossings; and
- Ch. L0 to Ch. L300, OLR to R112 Lucan Road, continuation and enhancement of existing shared cycle/pedestrian facilities to two-way cycle track and segregated footway.

#### 4.6.3.2 Cycle Lanes

Cycle lanes do not have vertical and/ or horizontal separation from adjacent traffic lanes. Wherever possible, the Proposed Scheme has endeavoured to incorporate segregated cycle tracks as opposed to cycle lanes, and where possible has removed cycle lanes in favour of segregated cycle tracks. However, where segregated cycle tracks cannot be provided due to constraints or location, i.e. signalised junctions and priority junctions (where a raised table is not feasible), cycle lanes have been incorporated into the design.

The Proposed Scheme will tie into existing cycle lanes on Ballyowen Road, Kennelsfort Road Upper and the South Circular Road.

A short length of shared bus and cycle lane is proposed at the western end of the N4 Junction 3 westbound off-slip, transitioning from the existing cycle lane along the service road.

#### 4.6.3.3 Quiet Street Treatment

Where Core Bus Corridor roadway widths cannot facilitate cyclists without significant impact on bus priority, alternative cycle routes are explored for short distances 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 Preliminary Design Guidance Booklet for (Appendix 4.1 in Volume 4 of the EIAR), which states:

*“Divisions 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.”*

They are called Quiet Streets due to the low amount of general traffic users travelling at low speed and are deemed suitable for cyclists sharing the roadway with the general traffic without the need to construct segregated cycle tracks or painted cycle lanes.

Quiet Street treatments have been proposed as part of the Proposed Scheme in the following locations:

- A Quiet Street is proposed to provide a link between Ballyowen Lane and the R136 Ballyowen Road via a short connection through Hermitage Park and Hermitage Road. This will link communities south of the N4 to the two-way cycle track via the existing pedestrian footbridge at Ballyowen Lane / Mount Andrew and avoids the need for a segregated one-way cycle track on the southern side of the N4, as well as along the westbound service road and off-slip at Junction 3; and
- Along the access road to Hermitage Golf Club, helping provide a safe route for cyclists between the proposed two-way cycle track on the R835 Lucan Road and the proposed two-way segregated cycleway on the north side of N4.

The Quiet Street Treatments will involve appropriate direction signs, road markings and advisory signage for the general road users.

#### 4.6.3.4 Treatment of Constrained Areas

At some locations along the Proposed Scheme, standard width of cycleways cannot be achieved, and localised narrowing is required. All locations where substandard widths are required have been recorded and presented in each of the sections of the Proposed Scheme as described in Section 4.5.

#### 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.

Cycling provision through the junctions has been provided as follows:

- Pedestrian crossings of the cycle track are controlled by traffic signals where the cycle track runs parallel to the carriageway;
- Where cycle crossings of the carriageway at signal controlled junctions can be offset to provide an additional level of protection to cycle users, this has been included. In this arrangement, left turning vehicle drivers have better visibility of cycle users crossing the road and are therefore able to move at the same time as the cycle users with a flashing amber indicating a warning to both movements;
- Where cycle crossings cannot be offset due to space constraints, cycle users will cross within the junction itself and will be given a green light in a different stage to left turning traffic; and
- Where cycle tracks cross non-signal controlled junctions, the arrangements within the BusConnects Design Guide have been provided to maximise the priority for cycle users on the mainline.

These locations are shown on the General Arrangement drawings (BCIDC-ACM-GEO\_GA-0006\_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 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 widths 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 (BCIDC-ACM-GEO\_GA-0006\_XX\_00-DR-CR-9001) included in Volume 3 of this EIAR.

##### **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). On the Proposed Scheme, bus priority is achieved without the need for SCP. There are no sections of Signal Controlled Priority proposed as part of the Proposed Scheme.

##### **4.6.4.5 Bus Gates**

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

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 positions and number of bus stops have been reviewed as part of a bus stop assessment.

The criteria for consideration 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 interchange stops;
- Where there is space for a bus shelter;
- Location in pairs, 'tail to tail' on opposite sides of the road;
- Close to (and on exit side of) pedestrian crossings;
- Away from sites likely to be obstructed; and
- Adequate footway 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 on route, reducing 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 stop, the inline bus stop and the layby bus stop.

Further detail on the design and locations of bus stops along the Proposed Scheme are described in Section 4.5.

##### 4.6.4.5.1 Island Bus Stop

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. Part-time signals will enable controlled crossing. 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 single file cycling through the bus stop, as overtaking is not required in this area.

Examples of island bus stops are shown in Image 4.6 (One-way Cycle Track) and Image 4.7 (Two-way Cycle Track).

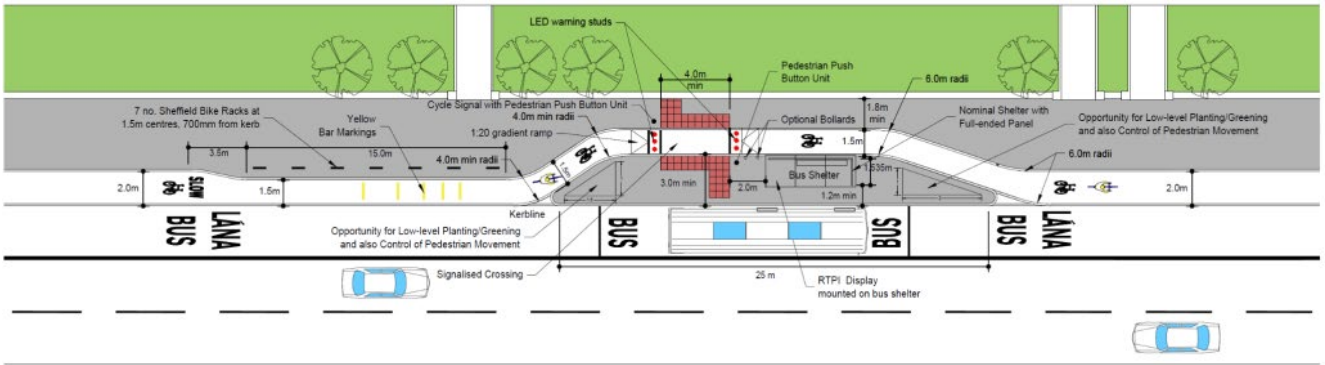


Image 4.6: Island Bus Stop Arrangement – One-way Cycle Track

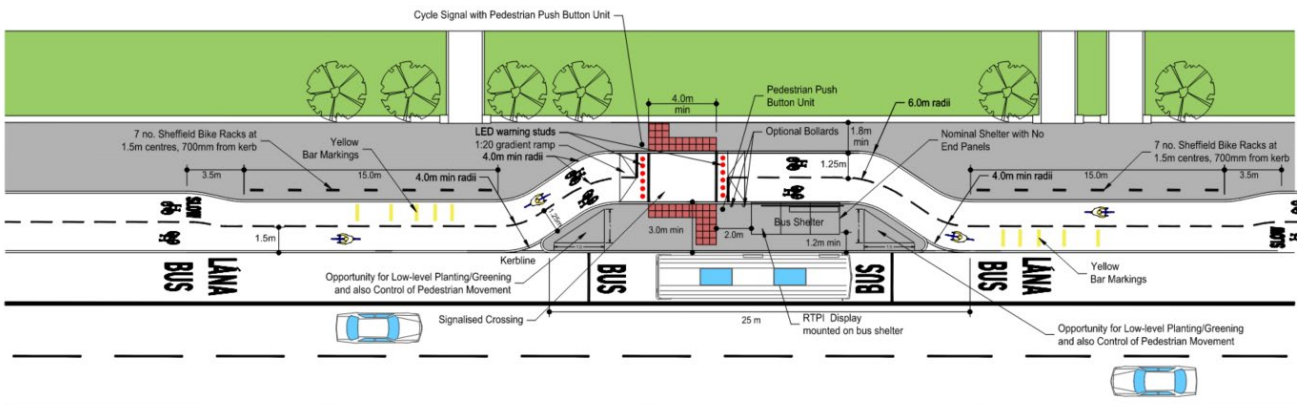


Image 4.7: Island Bus Stop Arrangement – Two-way Cycle Track

#### 4.6.4.5.2 Shared Landing Bus Stops

Where space constraints do not allow for an island bus stop, an option consisting of a shared bus stop landing zone has been considered. This will reduce conflict between cyclists and stopping buses by ramping cyclists up to footpath level where they continue through the stop. The cycle track will also be narrowed when level to the footpath and tactile paving provided to prevent pedestrian/cyclist conflict. An example of a shared landing bus stop is shown in Image 4.8.

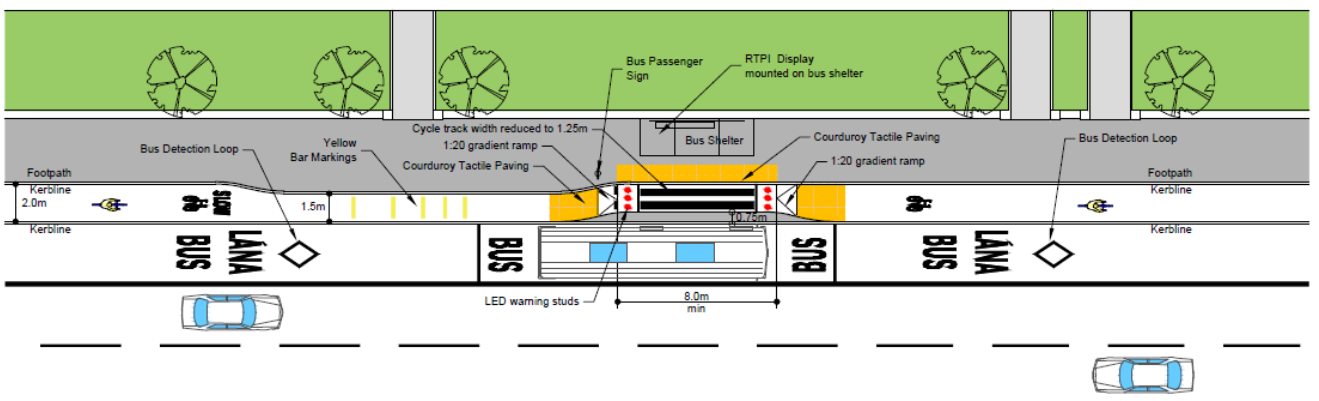


Image 4.8: Shared Landing Bus Stop

There are no shared landing bus stops proposed as part of the Proposed Scheme.

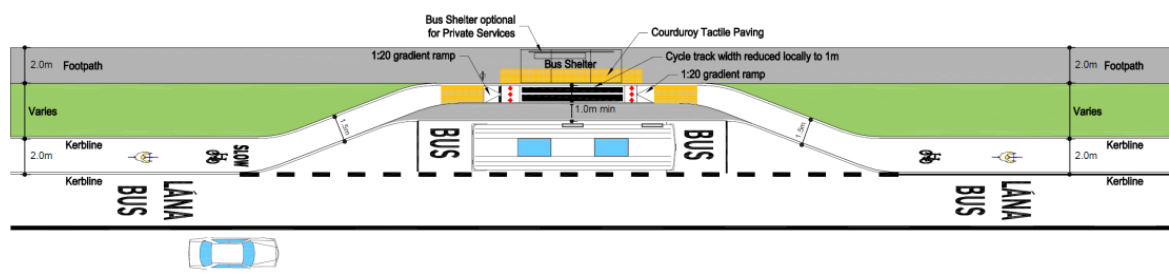
#### 4.6.4.5.3 Inline Bus Stop

Where there are no cycle tracks provided, inline bus stops are used, where the users departing the bus exit straight on the footway. Inline bus stop locations for the Proposed Scheme are outlined in Section 4.5.

#### 4.6.4.5.4 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. In these cases, and where space has permitted, a separate layby bus stop has been proposed.

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



**Image 4.9: Layby Bus Stop Landing Arrangement**

The locations of Layby Bus Stops are outlined in Section 4.5.

#### 4.6.4.5.5 Bus Stop Shelters

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.

### 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);
- Guidance on the use of tactile paving surfaces (UK DfT 2021); 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 footway 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**

One of the key 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:

- GDA Cycle Network (Primary, Secondary and feeder routes);
- The Luas Red Line at Heuston Station;
- The Kildare rail line at Heuston Station;
- Liffey Valley to City Centre Core Bus Corridor at three locations;
- Up until November 2021, the Lucan Corridor was primarily used by Dublin Bus Route 25 (Dodsborough via Lucan village to Sandymount/UCD), Route 66 (Maynooth/Leixlip to Ringsend Road), and Route 67 (Maynooth/Celbridge to Ringsend Road). The corridor is also used by several regional bus services; and
- Dublin bus network re-design introduced November 2021 - Orbital Dublin bus routes such as the Tallaght to Blanchardstown, Tallaght to Liffey Valley and City Centre orbital services.

On 28<sup>th</sup> November 2021, BusConnects Dublin introduced a redesigned, higher capacity bus network which is more coherently planned and more understandable, delivering a better overall bus system for Dublin and the surrounding areas.

Image 4.11 indicates the final output from the Bus Network Redesign and illustrates that the C-Spine (C1, C2, C3, C4) runs from the City Centre to the West, serving areas along the Lucan to City Centre Corridor and shows the different interfaces along the Proposed Scheme which is primarily along C-Spine. It shows the different interfaces along the Proposed Scheme which is primarily routed along the C-Spine. The principal interfaces with the associated bus routes are listed below.

- R136 Ballyowen Road/ R835 Lucan Road – C1, C2, C3, C4, L54, X30, X31, X32;
- R136 Ballyowen Road/ N4 Junction 3 – C1, C2, L54, W4;
- R136 Ballyowen Road/ Hermitage Road – C1, C2, L54, W4;
- N4 Junction 2 - C1, C2, C3, C4, P29, W4, X25, X26, X27, X28, X30, X31, X32, 52;
- N4/ M50 Interchange (Junction 7) – C1, C2, C3, C4, P29, W4, X25, X26, X27, X28, X30, X31, X32, 52;
- R148 Palmerstown bypass/ Kennelsfort Road - C1, C2, C3, C4, 52, 80;



- Old Lucan Road/ Kennelsfort Road Lower - 80;
- R148 Palmerstown bypass/ The Oval - C1, C2, C3, C4, 52, 80;
- R148 Chapelizod bypass/ R112 Kylemore Road - C1, C2, C3, C4, 52;
- R148 Chapelizod bypass/ R148 Con Colbert Road - C1, C2, C3, C4, 52;
- R148 Con Colbert Road/ R839 Memorial Road - C1, C2, C3, C4, 52;
- R148 Con Colbert Road/ R111 South Circular Road - C1, C2, C3, C4, 52, 58, 60;
- R148 St John's Road West/ R111 South Circular Road - C1, C2, C3, C4, 52, 58, 60;
- R148 St John's Road West/ HSQ - C1, C2, C3, C4, 52, 60;
- R148 St John's Road West/ Military Road - C1, C2, C3, C4, 52, 60;
- R148 St John's Road West/ Heuston Station - C1, C2, C3, C4, S2, N2, 52, 60; and
- R148 St John's Road West/ Victoria Quay (Frank Sherwin Bridge) - C1, C2, C3, C4, 52, 60.

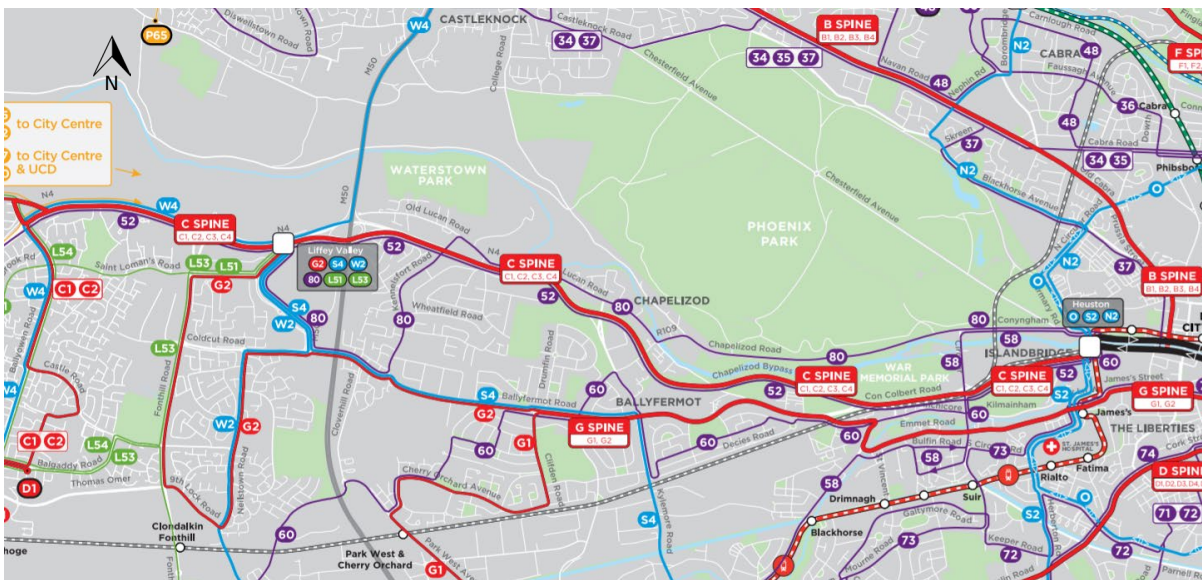


Image 4.10: BusConnects Service Network Plan – Lucan to City Centre Scheme C Spine

#### 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 Integration 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:

##### Liffey Valley Shopping Centre (LVSC) Expansion

Phase 1 of the LVSC expansion located adjacent to the Proposed Scheme immediately southeast of the N4 Junction 2, includes a new bus interchange facility with enhanced bus facilities, pedestrian and cycling infrastructure.

The proposed design includes a significant improvement to the bus stop provision in the vicinity of the LVSC, and to better serve the increased bus stop capacity a new pedestrian only bridge is proposed adjacent to the new bus stop locations, some 200m to the west of the existing foot/cycle bridge, which will be retained. The position of this new bridge aligns with the proposed public transport interchange within the LVSC site.

Phase 2 of the LVSC expansion includes significant redevelopment and expansion including upgrades and signalisation of N4 Junction 2 roundabout junctions and Fonthill Road R133. Planning permission for the LVSC expansion was granted in December 2021.

### **Strategic Housing Development**

Construction is underway on a strategic housing development (SHD) of 250 no. apartments on the north-west corner of the R148 Palmerstown bypass/Kennelsfort Road Junction, Palmerstown. This will include provision of a left-in left-out access arrangement, with bollards in the centre of Kennelsfort Road to enforce the left only egress, and segregated pedestrian and cycle access. Service vehicles entering the site will be restricted to one way only traffic movements, with service vehicles entering the subject site from Kennelsfort Road Lower and exiting onto the Old Lucan Road.

The SHD proposal provides for a Toucan Crossing of Kennelsfort Road Lower. The Proposed Scheme will provide a central refuge and staggered crossing as part of the Toucan Crossing at this location.

### **Palmerstown Lodge Hotel Development**

Permission has been granted for a 53-bedroom boutique hotel to replace the existing 29 bedroom guesthouse located at 20 and 22 Kennelsfort Road Lower in the north east corner of the R148 Palmerstown bypass/Kennelsfort Road junction. The development proposes replacing the existing two entrance/ exits with one wider pedestrian, cycle and vehicular entrance/ exit served by a wider yellow box junction, and realignment of front site boundary, including transfer of land to facilitate the provision of the segregated two-way cycle track and footway in the Proposed Scheme.

### **Kildare Route Project (KRP)/ Dart+ South West**

Irish Rail proposes to upgrade/ four-track the Kildare rail line and the reconstruct or refurbish existing footbridges along the route. Design development of the scheme is still at an early stage; however, Irish Rail have confirmed their proposed design will stay within the limits of the existing structures at R148/ South Circular Road Junction.

The Proposed Scheme has marginally increased the carriageway set back/ protection to the sub-standard bridge parapet at the South Circular Road junction bridge OBC1.

#### **4.6.6.4 Integration with Other Adjacent BusConnects Core Bus Corridor Schemes**

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

The closest such scheme to the Proposed Scheme is the Liffey Valley to City Centre Core Bus Corridor Scheme (the Liffey Valley Scheme) with which the Proposed Scheme interacts at Con Colbert Road and Memorial Road, and in the construction phase at Liffey Gaels Park. The BusConnects Infrastructure Team has coordinated the design tie-ins at all locations to ensure a holistic design has been achieved, so that each scheme can be implemented and integrated, regardless of the sequencing of their construction. The Liffey Valley Scheme is subject to a separate planning process, the timing of which is independent of that of the Proposed Scheme, and as such no exact sequencing of construction works can be determined at this stage.

#### 4.6.6.4.1 Con Colbert Road

The Proposed Scheme intends to tie-in with the Liffey Valley Scheme at Con Colbert Road in order to provide a cycling connection between the Proposed Scheme and Liffey Valley Scheme. This cycling connection will provide an alternative segregated cycling facility to the City Centre. Image 4.11 shows an extract of the preliminary design of the Proposed Scheme on the Con Colbert Road tie in with the existing layout.

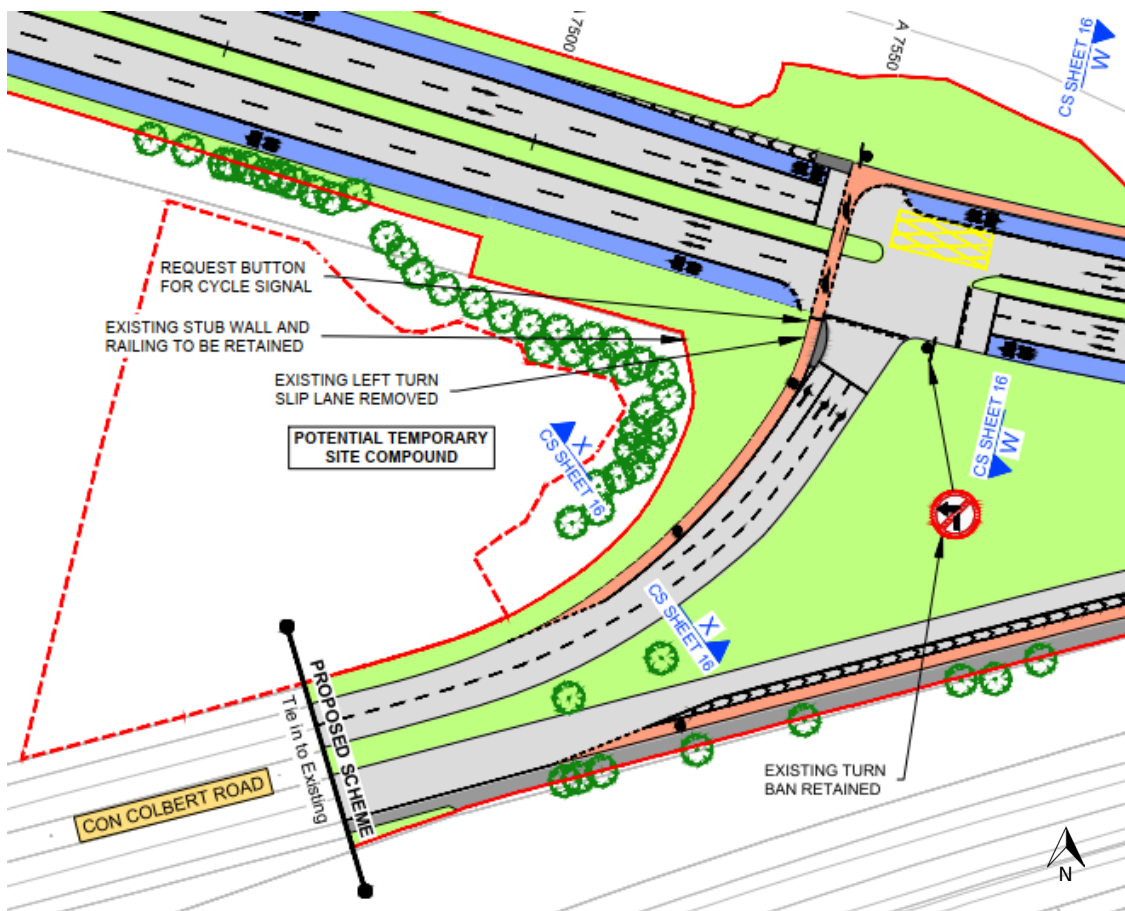


Image 4.11: Preliminary Design of the Proposed Scheme Tie-In with the Liffey Valley to City Centre Core Bus Corridor Scheme

Image 4.12 shows an indicative coordinated design of the expected overall arrangement in a scenario in which both schemes have been implemented.

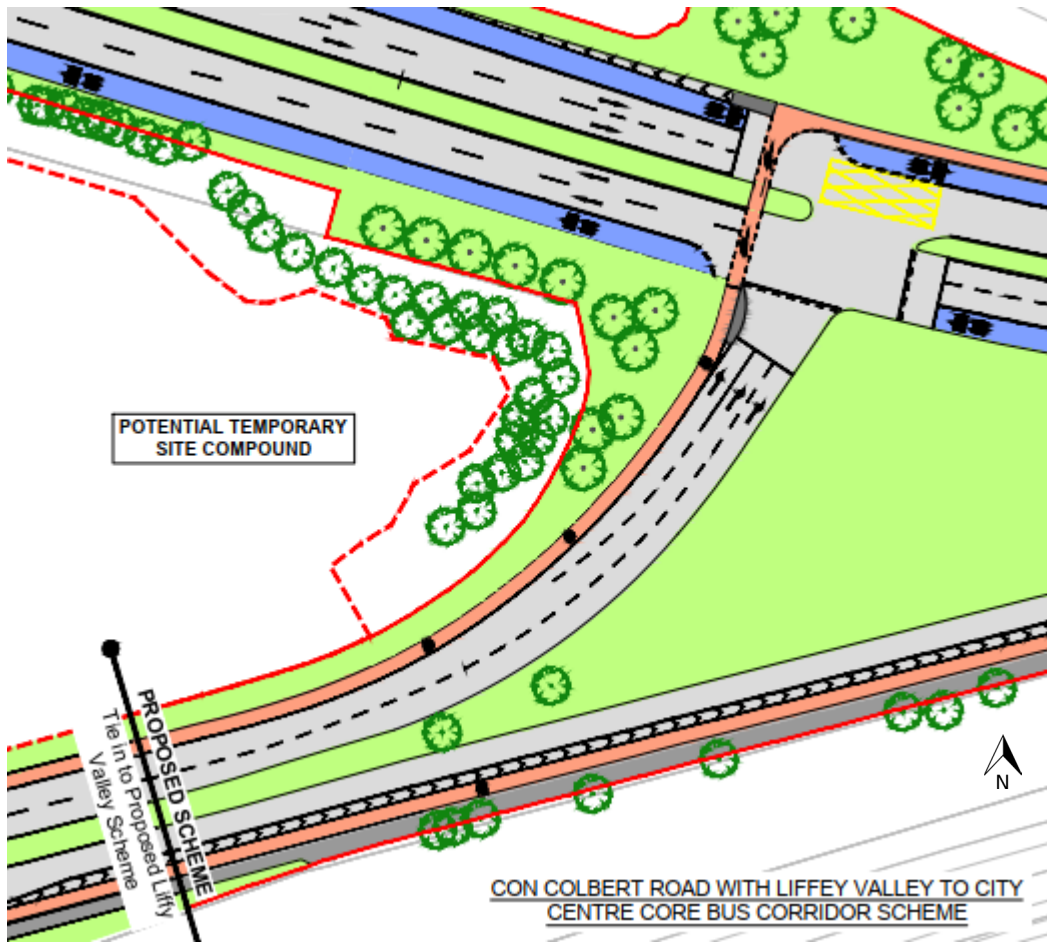


Image 4.12: Preliminary Design of the Liffey Valley to City Centre Core Bus Corridor Scheme at Con Colbert Road

Table 4.14 presents a matrix of potential interactions and impacts associated with various potential sequencing scenarios in relation to construction and operation of both schemes.

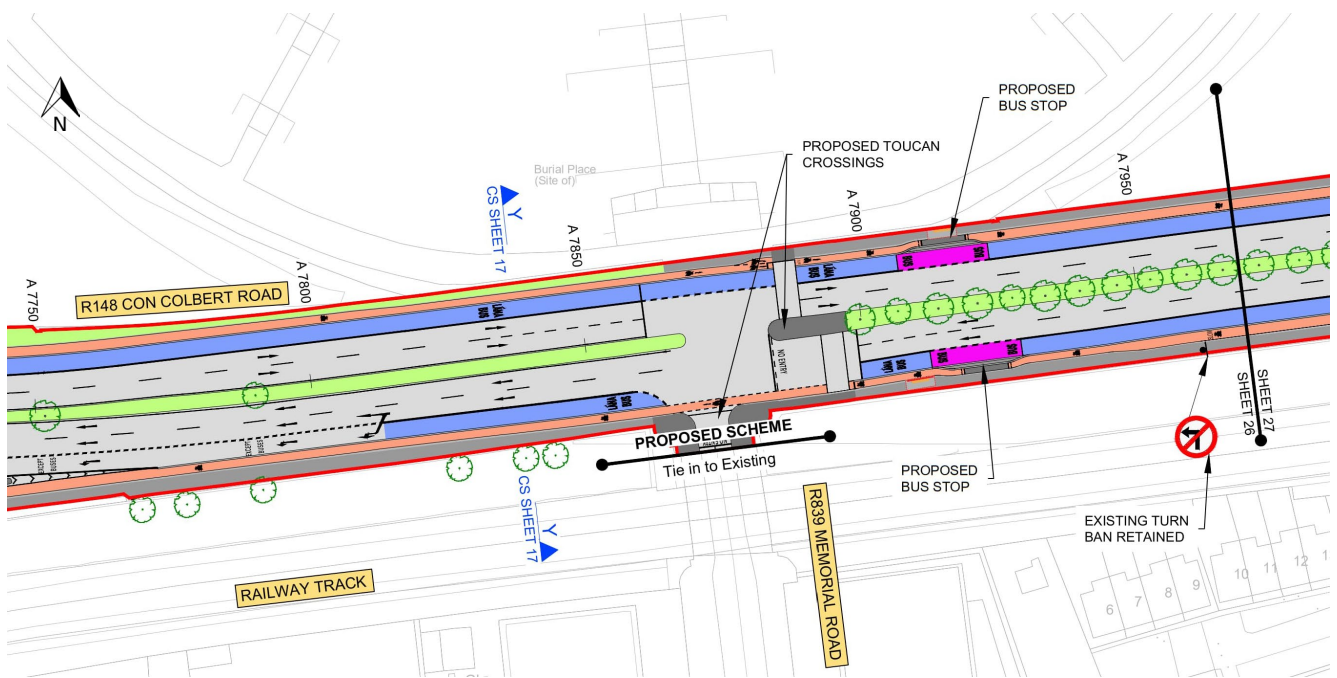
Table 4.14: Matrix of Potential Interactions and Impacts Associated with Different Sequencing Scenarios

	Liffey Valley Scheme: Not Yet Commenced	Liffey Valley Scheme: Under Construction	Liffey Valley Scheme: Completed
Proposed Scheme: Not Yet Commenced	N/A	Construction of the proposed Liffey Valley Scheme shall be carried out in accordance with the Construction Strategy within that scheme's planning application, without any potential interaction with works associated with the Proposed Scheme.	The Liffey Valley Scheme shall be in full operation, designed in accordance with its planning application which will allow for the Lucan Scheme to tie in at a future date.
Proposed Scheme: Under Construction	Construction of the Proposed Scheme will be carried out in accordance with the Construction Strategy within its planning application, without any potential interaction with works associated with the Liffey Valley Scheme.	It is not envisaged that both schemes will be under construction at the same time at this location.	The Liffey Valley Scheme will be completed and the Proposed Scheme will tie into the revised layout on the Con Colbert Road. The proposed cycling connection to the Liffey Valley Scheme will be implemented.
Proposed Scheme: Completed	The Proposed Scheme shall be in full operation, designed in accordance with its planning application as per Image 4.11 which will allow for the Liffey	The Proposed Scheme will have been completed and the Liffey Valley Scheme will tie into the revised layout on the Con Colbert Road which will	The arrangement will be as per Image 4.12.

	Liffey Valley Scheme: Not Yet Commenced	Liffey Valley Scheme: Under Construction	Liffey Valley Scheme: Completed
	Valley Scheme to tie in at a future date.	provide a cycling connection between the two schemes.	

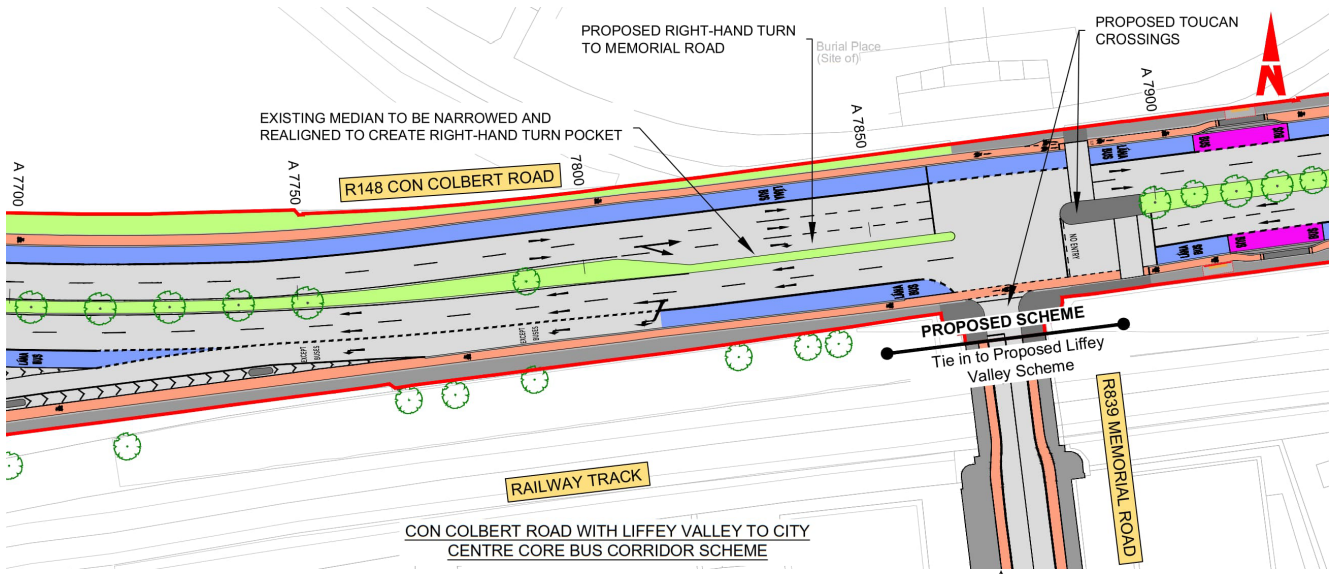
#### 4.6.6.4.2 Memorial Road

Consideration has been given to tie-in to the Liffey Valley Scheme at the Chapelizod Bypass providing a right-turn lane to accommodate the proposed revised two-way layout on R839 Memorial Road. Image 4.13 shows an extract of the preliminary design of the Proposed Scheme at the Chapelizod bypass which ties in with the existing layout.



**Image 4.13: Preliminary Design of the Proposed Scheme Tie-In with the Liffey Valley to City Centre Core Bus Corridor Scheme**

Image 4.14 shows an indicative coordinated design of the expected overall arrangement in a scenario in which both schemes have been implemented.



**Image 4.14: Indicative Coordinated Design of the Expected Overall Arrangement in a Scenario in which both Schemes have been implemented**

Table 4.15 presents a matrix of potential interactions and impacts associated with various potential sequencing scenarios in relation to construction and operation of both schemes.

**Table 4.15: Matrix of Potential Interactions and Impacts Associated with Different Sequencing Scenarios**

	Liffey Valley Scheme: Not Yet Commenced	Liffey Valley Scheme: Under Construction	Liffey Valley Scheme: Completed
Proposed Scheme: Not Yet Commenced	N/A	Construction of the proposed Liffey Valley Scheme shall be carried out in accordance with the Construction Strategy within that scheme's planning application. The right turn lane and associated works on the Chapelizod Bypass will be constructed but hatched out with road markings.	The Liffey Valley Scheme shall be in full operation, designed in accordance with its planning application which will allow for the Lucan Scheme to tie in at a future date. The right turn lane and associated works on the Chapelizod Bypass will be completed but hatched out with road markings.
Proposed Scheme: Under Construction	Construction of the Proposed Scheme will be carried out in accordance with the Construction Strategy within its planning application, as shown in Image 4.13	It is not envisaged that both schemes will be under construction at the same time at this location.	The Liffey Valley scheme will be completed, and the Proposed Scheme will make the right turn lane on the Chapelizod Bypass operational.
Proposed Scheme: Completed	The Proposed Scheme shall be in full operation, designed in accordance with its planning application as per Image 4.13	The Proposed Scheme will have been completed and the Liffey Valley Scheme will tie into the revised layout.	The arrangement will be as per Image 4.14

#### 4.6.6.4.3 South Circular Road Junction (Island Bridge)

The Proposed Scheme intends to tie-in to the Liffey Valley Scheme at South Circular Road Junction in order to facilitate a right-turn lane which will provide an alternative route to the City Centre which avoids the Mount Brown Bus Gate on the Liffey Valley Scheme. Image 4.16 shows an extract of the preliminary design of the Liffey Valley Scheme at Island Bridge which ties in with the existing layout.

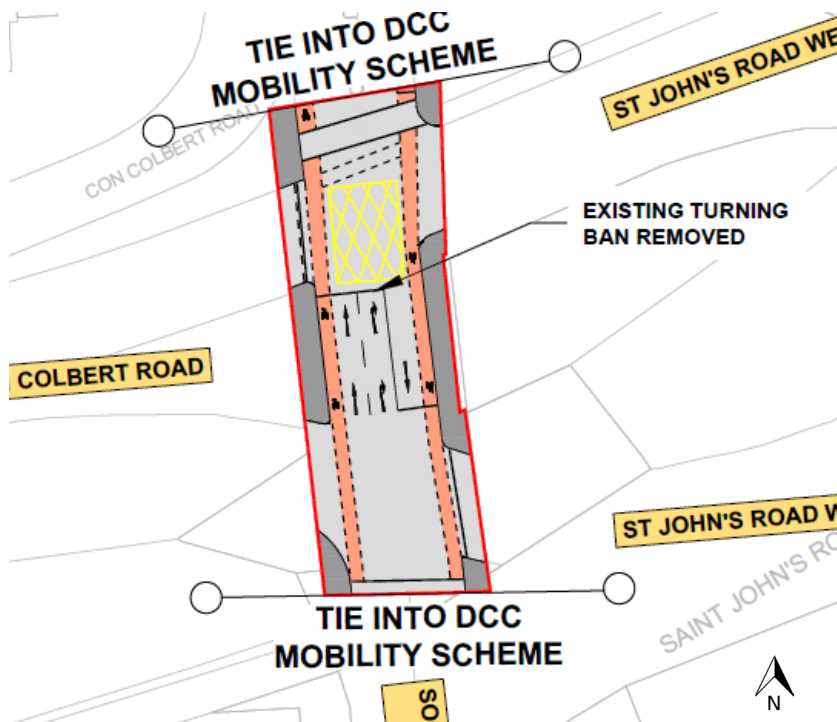
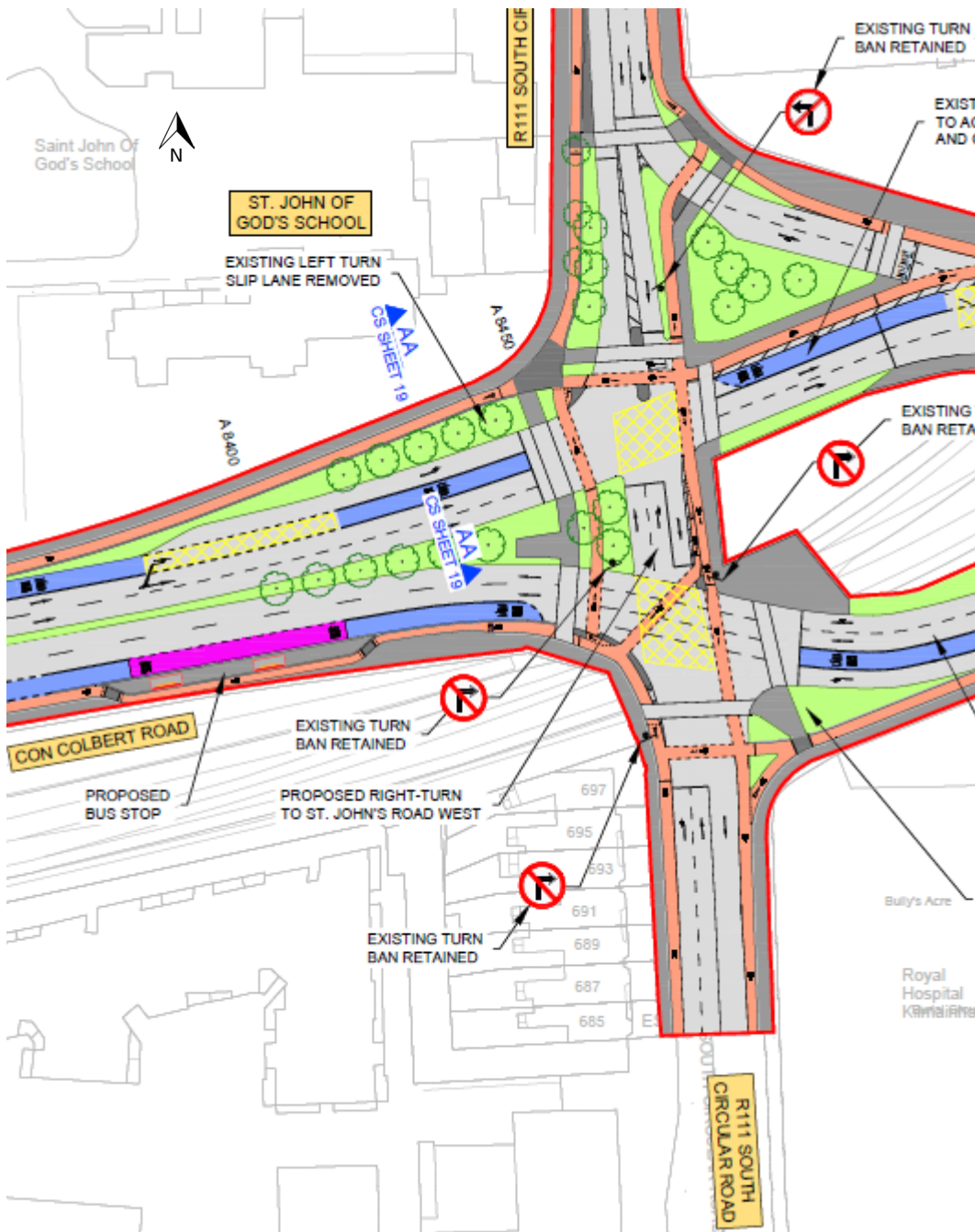


Image 4.15: Preliminary Design of the Liffey Valley Scheme at South Circular Road Junction which Ties-in with the Existing Layout

Image 4.16 shows an indicative coordinated design of the expected overall arrangement in a scenario in which both schemes have been implemented.



**Image 4.16: Indicative Coordinated Design of the Expected Overall Arrangement in a Scenario in which both Schemes have been implemented**

Table 4.16 presents a matrix of potential interactions and impacts associated with various potential sequencing scenarios in relation to construction and operation of both schemes.



**Table 4.16: Matrix of Potential Interactions and Impacts Associated with Different Sequencing Scenarios**

	Liffey Valley Scheme: Not Yet Commenced	Liffey Valley Scheme: Under Construction	Liffey Valley Scheme: Completed
Proposed Scheme: Not Yet Commenced	N/A	Construction of the proposed Liffey Valley Scheme shall be carried out in accordance with the Construction Strategy within that scheme's planning application. The right turn lane and associated works at Island Bridge will be implemented therefore no works will be required as part of the Proposed Scheme.	The Liffey Valley Scheme shall be in full operation, designed in accordance with its planning application. The right turn lane and associated works at Island Bridge will be implemented therefore no works will be required as part of the Proposed Scheme.
Proposed Scheme: Under Construction	Construction of the Proposed Scheme will be carried out in accordance with the Construction Strategy within its planning application.	N/A	The Liffey Valley Scheme will be completed and the right turn lane will be implemented, therefore no works will be required as part of the Proposed Scheme.
Proposed Scheme: Completed	The Proposed Scheme shall be in full operation, designed in accordance with its planning application.	The Liffey Valley Scheme will tie into the revised layout.	The arrangement will be as per Image 4.16.

#### 4.6.6.4.4 Liffey Gaels Park

It is intended that land at Liffey Gaels Park at Inchicore will be acquired on a temporary basis as a temporary Construction Compound for the Proposed Scheme. It is intended that this area will also be used as a Construction Compound on the Liffey Valley to City Centre Core Bus Corridor Scheme (Construction Compound LV3), pursuant to conditions imposed by An Bord Pleanála, should they grant approval. It is envisaged that the Construction Phases of the Proposed Scheme, and the Liffey Valley to City Centre Scheme will not overlap. Depending on the respective timing of the proposed schemes, the area may continue to be used uninterrupted as a Construction Compound if the second scheme commences construction within a relatively short period of time after the first scheme finishing construction. Alternatively, in the eventuality that there is likely to be a substantial time period (e.g. greater than 1 year) between the Construction Phases of the two schemes, the NTA in discussion with the Local Authority will identify the most appropriate interim use of the area. When the area has ceased to be used as a construction compound it will be returned to its original condition by the appointed contractor for the second scheme.

### 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 the following categories, namely:

- Major Junctions (Signalised);
- Moderate Junctions (Signalised);
- 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 Proposed Scheme route and the layouts that will be implemented at these locations are presented in Section 4.5.

#### **4.6.8 Structures**

Where the route interfaces with an existing structure a visual inspection has been carried out to identify the current condition and any repair/maintenance works required. In some cases, a visual inspection was not possible to due access issues, i.e., M50 bridges. 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.

A number of new structures (not including retaining walls described below) are proposed as part of the Proposed Scheme, including:

- Replacement Pedestrian & Cyclist Bridge over the N4 at Ballyowen Road;
- Supplementary portal gantry on approach to M50 Junction;
- Pedestrian Bridge over the N4 at Liffey Valley Shopping Centre;
- Widening of Chapelizod Hill Road Bridge;
- Relocation of a gantry and two lighting columns; and
- Retaining Walls along the N4 including at Hermitage Golf Club and Hermitage Medical Clinic.

The new and existing structures are detailed in Section 4.5.

##### **4.6.8.1 Retaining Walls**

Retaining walls with a retained height greater than 1.5m are classified as principal structures. There are requirements for a total of five walls greater than 1.5m at the following locations, with existing walls demolished:

- 306.4m along the eastbound verge of the N4 road, adjacent to the Hermitage Golf Club, with a maximum retained height of 3.5m;
- 130m on the westbound verge of the N4 beside Abbott Pharmaceuticals, with a maximum retained height of 2.6m;
- 38m on the eastbound verge of the Chapelizod bypass, with a maximum retained height of 4.5m and formed by a piled retaining structure;
- 68m on the westbound verge of the Chapelizod bypass, with a maximum retained height of 1.95m; and
- 83m on the eastbound verge of the N4 and Junction 2 off-slip beside Hermitage Medical Clinic with a maximum retained height of 1.5m.

Refer to Bridges and Retaining Structures (BCIDA-ACM-STR\_GA-0006\_XX\_00-DR-CB-9001) in Volume 3 of this EIAR.

##### **4.6.8.2 Retaining Walls ( $\leq 1.5m$ )**

Those retaining walls that have a retained height less than or equal to 1.5m are classified as minor retaining walls. The following is a list of the proposed minor retaining walls:

- North of Ballyowen Road Pedestrian/cyclist footbridge on approach to footbridge (25m length);
- On the embankment between the N4 westbound and N4 Junction 3 off-slip (Low block gravity retaining wall) (100m length);
- Two elements of retaining wall on the eastbound verge of the N4 and Junction 2 off-slip beside Hermitage Medical Clinic bounding the major retaining wall at either end; and

- On the eastbound verge of St. John's Road West at Heuston Station Luas Stop (Stub retaining wall).

**Table 4.17: Summary of Minor Retaining Walls ( $\leq 1.5\text{m}$ )**

Location	Chainage Start/ Chainage End	Length (m)	Max. Retained Height (m)
Ballyowen Road	B70 – B90	25	0.8
N4 Junction 3 Westbound	N200 – N300	100	0.8
N4 Junction 2 Eastbound	A1060 - A1160	106	1.5
N4 Mainline Eastbound	A1250 – A1310	65	1.5
St John's Road West	A9625 – A9680	52	0.2

#### 4.6.8.3 Other

The miscellaneous structures provided or relocated on the Proposed Scheme are as follows:

- Existing Cantilever Gantry to N4 Junction 2 eastbound diverge to be relocated 5.4m to the north;
- Supplementary Portal Gantry to be provided on the N4 eastbound carriageway on approach to M50 Junction 7, prior to the proposed Liffey Valley Footbridge;
- High mast lighting to be relocated at N4 westbound Junction 3 off-slip; and
- High mast lighting to be relocated at South Circular Road.

#### 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, 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 it where necessary.

##### 4.6.9.1 Traffic Signs and Road Markings

###### 4.6.9.1.1 Traffic Sign Strategy

A preliminary Traffic Signage design has been undertaken to identify the requirements of the Proposed Scheme, whilst allowing for further design optimisation at the detailed design phase. A combination of Information, Regulatory, and Warning signs, have been assessed taking consideration of key destinations / centres; intersections/decision points; built and natural environment; 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

To achieve the bus priority and safe negotiation length on the N4, M50 Junction 7 approaches, signs on the existing gantries are proposed to be changed to reflect the proposed revised lane destination requirements. This proposed signage strategy is the same as the existing strategy on all other National Primary radial approaches to the M50, namely the M1, N2, N3 and N7. These include full lane destination signage from the preceding junction

with no distance plates. There are different numbers of gantries on the approaches M1, N2, N3 and N7 and they are at variable spacings (250-500m).

The provision of the proposed pedestrian bridge will impact the forward visibility to the existing directional information/ lane destination sign gantry at Ch. A2350 on the eastbound approach to the M50 Junction 7. This will constitute a departure from standard for the minimum clear visibility distance as set out in the TSM. To mitigate the reduced visibility and reinforce the revised lane destination arrangement, the proposed scheme includes the provision of a new portal gantry, including additional lane destination signs, immediately west of the new pedestrian bridge.

#### 4.6.9.1.3 Road Marking

A preliminary design of road markings has been undertaken in accordance with the 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 practicable 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 bus-lanes, general traffic lanes, cycle lanes and specific trafficked areas (e.g. off-line bus stops, bus terminals, 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 routes under consideration along the scheme while the secondary network refers to the roads impacted by the re-routing of existing traffic from the Proposed Scheme to the nearby road network.

As part of the Proposed Scheme, varying pavements 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);
- New pedestrianised areas including footpaths; and
- New cycle facilities.

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 (BCIDC-ACM-PAV\_PV-0006\_XX\_00-DR-CR-9001) 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 to be 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, being 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.

The Proposed Scheme design for KFPA will include new improved pedestrian and cycle facilities including landscaped areas.

#### **4.6.10.2 Design Standards**

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

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

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

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

#### **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 most onerous value of the existing pavement condition indices, namely: Pavement Surface Condition Index (PSCI,) or Road Condition Index (RCI) for the pavement design; :
- Fully flexible carriageway;
- PSCI  $\geq$  7: no works;
- PSCI = 5 or 6: 40mm bituminous inlay;
- PSCI = 3 or 4 [RCI Amber]: 150mm bituminous inlay;
- PSCI = 1 or 2 [RCI red]: 250-350mm 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 footpaths 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 and loading.

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 Public 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 proposals 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.

##### 4.6.12.2.1 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 (BCIDC-ACM-UBR\_ZZ-0006\_XX\_00-DR-LL-9001) in Volume 3 of this EIAR illustrate these elements.

The proposed material typologies employed in the preliminary design are:

- **Poured in situ concrete footpath.** - Used extensively on existing footpaths. Concrete pavements 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 public 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 public realm. The use/reuse of granite kerbs where appropriate will further enhance the public realm. This type of material use is mostly employed in non-inner-city public 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 South Dublin County Development Plan 2016-2022 (SDCC 2016), Dublin City Tree Strategy (DCC 2105b) and the Dublin City Biodiversity Action Plan (DCC 2015a) 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 South Dublin County Development Plan 2016-2022 and 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 (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 (BCIDC-ACM-UBR\_ZZ-0006\_XX\_00-DR-LL-9001) in Volume 3 of this EIAR, a range of urban street tree species – for example Image 4.17, have been incorporated into the design. The type of tree depends on the location and whether trees are to be planted in grass verges or in tree pits within paved urban environments as appropriate, and also to ensure diversity of species and provide habitats for urban wildlife. Typically, trees will be semi-mature and where appropriate, selected for having a clear stem height to facilitate visual permeability.





**Image 4.17: Street tree species Tilia Cordata (Small-leaved Lime)**

#### 4.6.12.5.2 New Woodland / Parkland Areas and Tree Groups

The Proposed Scheme corridor includes existing mature woodland / parkland, street trees and scrub areas, some of which will be impacted where the existing carriageway is to be widened or cycling infrastructure is to be provided. It is proposed to reinstate construction working areas and also to replant the edges of impacted areas to reinstate the streetscape or roadway character.

Woodland / parkland tree planting will typically comprise bare-root native tree species including *Alnus glutinosa* (Black Alder), *Salix aurita*, *Salix cinerea oleifolia*, *Salix caprea*, *Salix petrandra* (Willow sp.), *Betula pendula* (Silver Birch), *Pinus sylvestris* (Scots Pine), *Crataegus monogyna* (Hawthorn), *Quercus petraea* (Sessile Oak) and *Prunus spinosa* (Blackthorn).

Elsewhere along the Proposed Scheme there are a range of existing mature and immature street trees. While it is proposed to retain and protect existing trees wherever possible, some will be impacted. The Proposed Scheme includes replacement and additional planting of semi-mature street trees to mitigate the loss of existing trees and to maintain the long-term tree-lined character of streets.

The Proposed Scheme incorporates additional landscaping arising from junction reconfiguration, reinforcement of existing vegetation areas, and the establishment of new urban realm and landscape opportunity areas. Tree species will be determined by location and will comprise of either native woodland / parkland trees as set out above. Landscaping proposals respond to the different localities and may include grass planting, hedgerows, trees, grasses, ornamental planting and swathes of bulbs.

#### 4.6.12.5.3 Boundary Planting

The Proposed Scheme corridor is bounded by a wide range of established private, institutional, commercial and public land boundaries. While the design development has sought to avoid impacts on such boundaries, the Proposed Scheme will nonetheless require both temporary and permanent acquisition of lands.

Impacted property boundaries will be reinstated following construction. In some instances, boundaries will be rebuilt along their original alignments. In other cases, boundaries will be re-built on a new setback alignment. In general, property boundaries will be reinstated on a 'like for like' basis, including any walls, piers, fences, railings, gates, driveway finishes and private landscaping. Private grounds that are utilised in part for construction access will be reinstated following completion of the works to match the existing landscaping of the property. Where private grounds are reduced by permanent land take required for the scheme, the remaining grounds will be reinstated to match the landscape and character of the existing grounds in consultation with the property owner.

#### **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. A number of existing columns are proposed to be relocated or replaced to accommodate the Proposed Scheme, as shown on the Street Lighting drawings (BCIDC-ACM-LHT\_RL-0006\_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 shall 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 shall be replaced and relocated to the rear of the footpath, where possible, and the existing removed once the new facility is operational. 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 that the electrical installation is compliant with the latest version of the 'National Rules for Electrical Installations, I.S. 10101'.

##### **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 will 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 Radars 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).

### 4.6.15 Drainage

#### 4.6.15.1 Relevant Standards and Guidance

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). Agencies consulted include Dublin City Council (DCC), South Dublin County Council (SDCC) and Irish Water where applicable.

#### 4.6.15.2 Existing Watercourses and Culverts

The location of existing watercourses and culverts has been identified from survey. Table 4.18 shows where the Proposed Scheme crosses one existing watercourse or culvert.

**Table 4.18: Existing Watercourses and Culverts**

Watercourse	Chainage	Crossing Detail
River Camac	A9520	Culvert

#### 4.6.15.3 Existing Drainage Description

Based on the information received from Irish Water, TII, DCC and SDCC the Proposed Scheme is served by surface water and combined drainage networks. The surface water drainage system is managed by the Local Authority, whilst the combined sewers system is managed by Irish Water. Flows are typically collected in standard gully grates, or via near surface collection systems such as slot drains and combined kerb and drainage units along the N4 and routed via a gravity network to outfall points. The design assumes that there are generally no SuDS/attenuation measures on the existing drainage networks to treat or attenuate runoff from the existing carriageway.

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, refer to the Proposed Surface Water Drainage Works drawings (BCIDC-ACM-DNG\_RD-0006\_XX\_DR-CD-9001) in Volume 3 of this EIAR. The catchments are summarised below in Table 4.19.

**Table 4.19: Summary of Existing Catchments**

Existing Catchment Reference	Chainage	Approx. Drainage Catchment Area (km <sup>2</sup> )	Existing Network Type	Existing Outfalls
6.1	A0 – A970	1.05	Surface Water (Storm)	Network outfalls to the Canal in Griffen Valley Park (discharges to River Liffey)

Existing Catchment Reference	Chainage	Approx. Drainage Catchment Area (km <sup>2</sup> )	Existing Network Type	Existing Outfalls
6.2	A970 – A2840	3.86	Surface Water (Storm)	Network outfalls to the River Liffey
6.3	A2840 – A4300	0.88	Surface Water (Storm)	Network outfalls to the River Liffey
6.4	A4300 – A5400	1.27	Surface Water (Storm)	Network outfalls to the River Liffey
6.5	A5400 – A5670	0.13	Surface Water (Storm)	Network outfalls to the River Liffey
6.6	A5670 – A5950	0.09	Surface Water (Storm)	Network outfalls to the River Liffey
6.7	A5950 – A6350	0.34	Surface Water (Storm)	Network outfalls to the River Liffey
6.8	A6350 – A7790	0.85	Surface Water (Storm)	Network outfalls to the River Liffey
6.9	A7790 – A8450	0.37	Surface Water (Storm)	Network outfalls to the River Liffey
6.10	A8450 – A9600	1.21	Surface Water (Storm) and Combined	Network outfalls to the River Liffey
6.11	A9600 – End	0.01	Surface Water (Storm) and Combined	Network outfalls to the River Liffey

#### 4.6.15.4 Proposed Drainage / Runoff

Whilst in some areas the Proposed Scheme increases the impermeable areas, additional permeable areas are also provided by the softening of urban realm along the 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 in order to define the change in impermeable surface area as a result of the Proposed Scheme. Where there is a net increase in impermeable surface area, a form of attenuation will be required prior to discharge. Where there is no net change or net decrease, then no form of attenuation will be required prior to discharge.

A summary list of the sub-catchments, the associated chainage, and impermeable surface area differential is given in Table 4.20. 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 4.20: Summary of Increased Permeable and Impermeable Areas**

Existing Catchment Reference	Chainage	Approx. Drainage Catchment Area (km <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 (%)
6.1	A0 – A970	56047	3792	36	2629	4.7
6.2	A970 – A2840	112576	7091	3703	2372	2.1
6.3	A2840 – A4300	77684	2365	570	1257	1.6
6.4	A4300 – A5400	25635	124	0	87	0.3
6.5	A5400 – A5670	10840	1411	0	988	9.1
6.6	A5670 – A5950	6427	0	0	0	0
6.7	A5950 – A6350	10189	0	0	0	0
6.8	A6350 – A7790	32172	131	68	44	0.1
6.9	A7790 – A8450	22916	477	846	-258	-1.1
6.10	A8450 – A9600	35232	849	1737	-622	-1.8
6.11	A9600 – End	3172	229	15	150	4.7

#### 4.6.15.5 Proposed Drainage System

The principle objectives of drainage design are as follows:

- All drainage structures for newly-paved areas are designed with a minimum return period of no flooding in 1:30 years with a 20% climate change allowance;
- A SuDS drainage strategy has been developed for all newly-paved areas in accordance with the SuDS hierarchy. SuDS are provided to ensure no increase on existing runoff rates from new paved areas and will also provide a level of treatment before discharging into the existing network system; and
- Infiltration rates were assumed to be zero for calculating the required attenuation volumes for SuDS measures. This is a conservative approach and ensures SuDS measures are not knowingly undersized at this stage of design. Where necessary, permeability tests will be completed so that infiltration rates can be considered in further design.

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 (BCIDA\_ACM-DNG\_RD-0006\_XX\_00-DR-CD-9001) in Volume 3 of this EIAR:

- Sealed Drainage (SD) comprises side entry gullies and sealed pipes. The narrow profile gullies will be located within the kerb line mostly between the cycle track and bus lane and / or the footpath and the cycle track depending on the carriageway profile;
- Grass Surface Water Channels, Swales and Bio Retention Areas/ Rain Gardens (SW/RG) are provided as road edge/ footpath edge drainage collection systems. They will provide treatment and can provide attenuation if required;
- Filter Drains (FD) are provided as road edge channels and comprise perforated pipes with granular surround and are designed to convey, attenuate and treat runoff prior to discharge;
- Tree pits (TP) are provided in close proximity to the road. These receive flows from the sealed pipe network and are designed to convey, attenuate, and treat runoff prior to discharge; and
- Attenuation Tanks/Oversized Pipes (AT/ OSP) are provided where there is insufficient attenuation volume provided by the proposed SuDS drainage measures.

#### 4.6.15.6 Runoff Attenuation & Sustainable Drainage Systems

SuDS measures and/or attenuation systems 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 and attenuation systems was based on the incoming flows and existing discharge rates 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.

#### 4.6.15.7 Pollution Control

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 provision of SuDS. The proposed road drainage system is shown in the Proposed Surface Water Drainage Works drawings (BCIDA\_ACM-DNG\_RD-0006\_XX\_00-DR-CD-9001) in Volume 3 of this EIAR. The system incorporates a variety of pollution control measures which will provide interception and treatment as indicated below:

- Filter drains; Filter drains are shallow trenches filled with stone/gravel that create temporary subsurface storage for the attenuation, conveyance and filtration of surface water runoff. A perforated pipe is provided above the base of the filter drain to collect and convey water to downstream drainage component. Filter drains can help reduce pollutant levels in runoff by filtering out sediments and biodegradation processes;
- Swales; Swales are shallow, flat bottomed, vegetated open channels designed to convey, treat and attenuate surface water runoff. They facilitate sedimentation and retention of pollutants, filtration through the root zone and soil matrix, evapotranspiration and infiltration into the underlying soil;

- Tree pits; Trees contribute to effective surface water management strategies. They also reduce annual building energy consumption by moderating the local climate, filter harmful pollutants from the air, and absorb and store atmospheric carbon dioxide (carbon sequestration). In the process of drawing water from the soil, trees also take up trace amounts of harmful chemicals, including metals, organic compounds, fuels and solvents that are present in the soil. Inside the tree, these chemicals can be transformed into less harmful substances, used as nutrients and /or stored in roots, stems and leaves; and
- Rain gardens and bio-retention areas: Bioretention systems, including rain gardens, are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution through the use of engineered soil and vegetation. They are particularly effective in delivering interception. Runoff collected by the systems ponds temporarily on the surface and then filters through the vegetation and underlying soils.

#### **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 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 BCIDA-ACM-TSM\_SJ-0006\_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 in order to minimise the amount of land acquisition required. However, in order to construct the Proposed Scheme, it is necessary to compulsorily acquire public and private plots of land along sections of the route.

The extent of the required landtake and land required temporarily for the construction of the Proposed Scheme is shown on the General Arrangement Drawings BCIDA-ACM-GEO\_GA-0006\_XX\_01-DR-CR-9001 included in Volume 3 of this EIAR.

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

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

- 11 non-residential properties or land, including commercial, healthcare and leisure
- 12 areas of local authority land.

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.

In addition, there is one area where land required for the Proposed Scheme is already in public ownership, at Health Service Executive (Dr Steevens' Hospital).

The Proposed Scheme will require the demolition of the following existing infrastructure:

- On Ballyowen Road, the existing pedestrian bridge over the N4 will be replaced with a new cyclist and pedestrian bridge; and
- With the provision of revised bus stop locations at Liffey Valley Shopping Centre, the ramps and steps connecting the pedestrian bridge to the existing bus stop on the south side of the N4 will be removed. The residual terrace will remain and be replanted accordingly.

#### **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).

Where cellar and private landings are affected by the Proposed Scheme pre-construction and post construction surveys will be performed by the appointed contractor. It will be determined during the detailed design stage if strengthening works are required to these existing structures.

Existing gates will be reused where practicable, 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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