DART+ South West

Option Selection Report

Volume 2: Technical Report

November 2021

NTA
Údarás Náisiúnta Iompair
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Glossary of Terms

Reference	Description
ABP	An Bord Pleanála
ACA	Architectural Conservation Area
AOD	Above Ordnance Datum
APIS	Authorisation for Placing in Service
ASA	Application for Safety Approval
AsBo	Assessment Body
ASPSC	Application Specific Project Safety Case
ATP	Automatic Train Protection
CAF	Common Appraisal Framework
Cantilever	OHLE structure comprising horizontal or near horizontal members supporting the catenary projecting from a single mast on one side of the track.
Catenary	The longitudinal wire that supports the contact wire.
CAWS	Continuous Automatic Warning System
CBI	Computer-Based Interlocking
CCE	Chief Civils Engineers Department of IE
CCRP	City Centre Re-signalling Project
CCTV	Closed Circuit Television
CDP	County Development Plan
CIÉ	Córas Iompair Éireann
CSS	Construction Support Sites also interchangeable with Construction Compounds
Contact wire	Carriers the electricity which is supplied to the train by its pantograph.
CPO	Compulsory Purchase Order
Cross overs	A set of railway parts at the crossing of several tracks which helps trains change tracks to other directions.
CRR	Commission for Rail Regulation (formerly RSC – Railway Safety Commission)
CSM RA	Common Safety Method for Risk Evaluation and Assessment

Reference	Description
CTC	Central Traffic Control
Cutting	A railway in cutting means the rail level is below the surrounding ground level.
D&B	Design & Build (contractor)
DART	Dublin Area Rapid Transit (IÉ's Electrified Network)
DART+	DART Expansion Programme
DeBo	Designated Body
DC	Direct Current. Electrical current that flows in one direction, like that from a battery.
DCC	Dublin City Council
DRR	Design Review Report
DSR	Design Statement Report
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement
Electrification	Electrification is the term used in supplying electric power to the train fleet without the use of an on-board prime mover or local fuel supply.
EMC	Electromagnetic Compatibility
EMU	Electric Multiple Unit (DART train)
EN	European Engineering Standard
EPA	Environmental Protection Agency
EPO	Emerging Preferred Option
ERTMS	European Rail Traffic Management System
ESB	Electricity Supply Board
Four-tracking	Four-tracking is a railway line consisting of four parallel tracks with two tracks used in each direction. Four track railways can handle large amounts of traffic and are often used on busy routes.
FRS	Functional Requirements Specification
FSP	Final Supply Points
GDA	Greater Dublin Area

Reference	Description
GI	Ground Investigation
HAZID	Hazard Identification
Horizontal Clearance	The horizontal distance between a bridge support and the nearest railway track is referred to as horizontal clearance. Bridge supports include abutments (at the ends of the bridge) and piers (at intermediate locations).
HV	High Voltage
IA	Independent Assessor
IÉ	Iarnród Éireann
IM	Infrastructure Manager (IÉ)
IMSAP	Infrastructure Manager Safety Approval Panel
Insulators	Components that separate electricity live parts of the OHLE from other structural elements and the earth. Traditionally ceramic, today they are often synthetic materials.
KCC	Kildare County Council
Lateral Clearance	Clearances between trains and structures.
LCA	Landscape Character Area
Mast	Trackside column, normally steel that supports the OHLE.
MCA	Multi-criteria Analysis
MDC	Multi-disciplinary Consultant
MEP	Mechanical electrical and plumbing
MFD	Major Feeding Diagram
MMDC	Maynooth Multi-disciplinary Consultant
MV	Medium Voltage
NDC	National Biodiversity Data Centre
NIAH	National Inventory of Architectural Heritage
NoBo	Notified Body
NTA	National Transport Authority
OHLE	Overhead Line Equipment
Overbridge (OB)	A bridge that allows traffic to pass over a road, river, railway etc.

Reference	Description
P&C	Points and Crossings, Arrangements provided in a railway track to divert a train between lines.
Pantograph	The device on top of the train that collects electric current from the contact wire to power the train.
PC	Public Consultation
Permanent Way	A term used to describe the track or railway corridor and includes all ancillary installations such as rails, sleepers, ballast as well as lineside retaining walls, fencing and signage.
POAP	Plan-On-A-Page, high-level emerging programme
PPT	Phoenix Park Tunnel
PRS	Project Requirement Specification
PSCS	Project Supervisor Construction Stage
PSDP	Project Supervisor Design Process
PSP	Primary Supply Points
QA/QC	Quality Assurance/Quality Control
RAM	Reliability, Availability, Maintainability
RC	Reinforced Concrete
Re-signalling	Re-signalling of train lines will regulate the sage movement of trains and increase the capacity of train services along the route.
RMP	Record of Monuments and Places
RO	Railway Order
RPS	Record of Protected Structures
RSC-G	Railway Safety Commission Guideline
RU	Railway Undertaking (IÉ)
SAM	Safety Assurance Manager
SAP	Safety Approval Panel
SDCC	South Dublin County Council
SDZ	Strategic Development Zone
SET	Signalling, Electrical and Telecommunications
Sidings	A siding is a short stretch of railway track used to store rolling stock or enable trains on the same line to pass

Reference	Description
SMR	Sites and Monuments Records
SMS	IÉ Safety Management System
STC	Single Track Cantilever
TII	Transport Infrastructure Ireland
TMS	Train Management System
TPH	Trains per Hour
TPHPD	Trains per Hour per Direction
TPS	Train Protection System
Track Alignment	Refers to the direction and position given to the centre line of the railway track on the ground in the horizontal and vertical planes. Horizontal alignment means the direction of the railway track in the plan including the straight path and the curves it follows.
TSI	Technical Specifications for Interoperability
TSS	Train Service Specification
TTAJV	TYPSA, TUC RAIL and ATKINS Design Joint Venture (also referred to as TTA)
TTC	Two Track Cantilever
Underbridge (UB)	A bridge that allows traffic to pass under a road, river, railway etc. The underneath of a bridge.
VDC	Direct Current Voltage
Vertical Clearance	For overbridges, an adequate vertical distance between railway tracks and the underside of the bridge deck (soffit) must be provided in order to safely accommodate the rail vehicles and the OHLE. This distance is known as vertical clearance and it is measured from the highest rail level.
WFD	Water Framework Directive

1. Introduction

The preliminary options selection and early design development for the DART+ South West Project (the 'Project') was presented during the first round of public consultations held between 12th May 2021 and 23rd June 2021. All feedback and submissions received were reviewed and assessed as part of the next stage of the design development.

This Option Selection Report (OSR) presents the 'Preferred Option' following further studies, assessments, consultations and design development. As part of the current Public Consultation No. 2 (PC2) the public are invited to submit observations and comments on the Preferred Option.

Following PC2 all information gathered by the Project Team will be used to inform further design development of the Project which will then be the subject of the Environmental Impact Assessment (EIA) and Appropriate Assessment (AA), if required, and ultimately the Railway Order (RO) application to be submitted to An Bord Pleanála in Summer / Autumn 2022.

1.1. Purpose of the Report

This OSR presents the Preferred Option and supersedes the Preliminary Option Selection Report (POSR) and 'Emerging Preferred Option' presented at Public Consultation No. 1 (PC1). It reflects consideration of the feedback received at PC1, information received from surveys and investigations, further design development and re-evaluation of the design options, where appropriate.

The Project can be characterised as one which provides for enhancement of existing railway infrastructure over the 20km length of the scheme with the installation of electrical and signalling technology. Presenting the end-to-end Preferred Option, the OSR has been drafted to focus on the methodology and findings of the optioneering process for those elements for which alternative options manifest, options which are markedly different from one another, and which have varied impact on the local environment. Examples of such include four-tracking, bridge replacements, and options for the location of substations and temporary construction compounds.

Alternatives in respect of many of the linear works vary little from an environmental perspective, and consequently the options assessment for the likes of signalling systems, for example, is largely a technical matter rather than an issue of environmental impact. Alternatives in respect of many of these elements are presented for information.

The OSR also presents additional information relating to the linear elements, design aspects and construction technologies required and / or under consideration for the Project.

1.2. Structure of Report

This OSR and related material is presented in a manner consistent with how it is presented on the DART+ Programme website:

- **Option Selection Report - Volume 1: Preferred Option Report** presents a summary of the Preferred Option 'end-to-end' following the optioneering process and the public consultation process. The Preferred Option is also presented in a series of General Arrangement Drawings.
- **Option Selection Report - Volume 2: Technical Report** (this Report) contains the technical detail, supporting information, assessments and recommendations identifying the Preferred Option for the Project.

- **Option Selection Report – Volume 3: Option Selection Reports by Area and Drawings** contains additional technical information focusing of sections of the railway infrastructure moving consecutively from west to east.
- **Option Selection Report - Volume 4** contains several key background reports that provide the policy context, objectives, and requirements for the DART+ Programme and for the DART+ South West Project. Many are publicly available documents. Other documents include background material which have helped to underpin the specific technical and infrastructural requirements of the project. Links to these documents are provided.

1.3. Structure of this Volume

This volume (Volume 2: Technical Report), is structured as follows:

- Chapter 1 provides an introduction to the DART+ Programme, DART+ South West Project and the public consultation process.
- Chapter 2 sets out the need for the project and its strategic fit with European, national, regional and local policy.
- Chapter 3 sets out the transportation analysis undertaken for the DART+ Programme and DART+ South West Project.
- Chapter 4 details the Option Selection Process, including further assessment based on PC1 findings.
- Chapter 5 provides details of the Preferred Option for General Linear Works (End-to-End)
- Chapters 6 – 8 provides details of the Preferred Option for the following discrete locations:
    - Hazelhatch to Park West
    - Park West to Heuston Station
    - East of St. John's Bridge (Islandbridge) to Glasnevin Junction
- Chapter 9 provides a summary of the next steps in the DART+ South West Project.

1.4. Step-by-Step Guide to Reading the Public Consultation Information Provided

Information is presented to varying levels of detail to enable the public to gain a broad or detailed understanding of the project and the Preferred Option sufficient to meet their information needs at this stage of the non-statutory consultation process. In this regard, the material presented in this OSR is technical in nature and should not be the starting point for a reader to gain an understanding of the Project. Instead, it is recommended that the following approach is taken to understand the Project:

- **Level 1:** An information leaflet has been prepared and circulated by mail drop to an extensive number of properties along the Project corridor. This leaflet notifies the public of the consultation event to announce the Preferred Option and directs the reader to the Project website www.DARTplus.ie.
- **Level 2:** The project website contains a Virtual Room to simulate the standard public consultation roadshow to simulate the standard public consultation roadshow event, which cannot be held during the current COVID-19 restrictions. The Virtual Room contains a number of display panels presenting high level information about

the project. Also presented in the Virtual Room will be links to various documents such as a feedback form and a brochure.

- **Level 3:** A Project brochure has been provided on the project website which contains more detailed information than is displayed on the panels in the Virtual Room. This brochure follows a similar layout to the brochure produced at PC1 in order to assist the readers with familiarity of the project. An 'end-to-end' description of the Preferred Option is provided accompanied by a set of general arrangement plans to highlight the main interventions and elements of the Preferred Option.
- **Level 4:** The Option Selection Report - Volume 1 provides a description of the end-to-end Preferred Option for the Project, presented in greater detail than is included in the brochure. On a review of Volume 1, or the brochure, the reader should be able to identify all of the different Project elements that are in their area of interest and they can then undertake a more detailed review in Option Selection Report Volume 2 to gain an understanding as to why this option was selected, should they wish.
- **Level 5:** Option Selection Report - Volumes 2 - 4 with associated drawings and supporting annexes are, together, the last stop on the journey, with more technical information provided to characterise the option selection process and the Preferred Option selected. Due to the length of the Project and the multiple Project elements involved there is a significant volume of information provided. In order to try to provide the Technical Report (OSR Volume 2) in as manageable a format as possible, significant sections and additional detailed reports are provided in the Annexes contained within Volumes 3 and 4.

1.5. Status of Design Presented in this Report

This report presents the Preferred Option for the purposes of ongoing technical and environmental analysis, as well as consultation and engagement with the public and potentially affected property owners.

This report summarises the outcomes of stakeholder engagement and public consultations that have occurred following the identification of the Emerging Preferred Option presented in the Preliminary Option Selection Report in May 2021. **Chapter 4** of this report documents the design development that has occurred as a result of feedback from the public and stakeholders which has informed the selection of the Preferred Option.

As part of the current public consultation process, the public are invited to make observations on the Preferred Option (as presented in this report) which will be considered by the Project Team for further refinement and development and ongoing environmental assessments and studies. Thereafter, the design will be further developed in preparation for the statutory Railway Order process.

1.6. DART+ Programme

DART+ Programme is a key transportation improvement to form a high quality and integrated public transport system. It will have benefits for the residents of the Greater Dublin Area and also those living in the other regions. It will assist in providing a sustainable transport system and a societal benefit for current and future generations.

The current electrified DART network is circa 50km long, extending from Malahide / Howth to Bray / Greystones, and the DART+ Programme seeks to increase the high capacity and electrified network to network to 150km. The DART+ Programme is required to facilitate increased train capacity to meet current and future demands, which will be achieved through a modernisation of the existing railway corridors. This modernisation includes the electrification, re-signalling and certain interventions to remove constraints across the four main rail corridors within the Greater Dublin Area, as per below:

- DART+ South West (this Project) – circa 16km between Hazelhatch & Celbridge Station to Heuston Station and also circa 4km between Heuston Station to Glasnevin, via the Phoenix Park Tunnel Branch Line.
- DART+ West – circa 40km from Maynooth & M3 Parkway Stations to the City Centre.
- DART+ Coastal North – circa 50km from Drogheda to the City Centre.
- DART+ Coastal South – circa 30km from Greystones to the City Centre.
- DART+ Fleet – purchase of new electrified fleet to serve new and existing routes.

The DART+ Programme is a key element to the national public transportation network, as it will provide a high-capacity transit system for the Greater Dublin Area and better connectivity to outer regional cities and towns. This will benefit all public transport users.

Delivery of the DART+ Programme will promote transport migration away from the private car and to public transport. This transition will be achieved through a more frequent and accessible electrified service, which will result in reduced road congestion, especially during peak commuter periods.

The DART+ Programme will provide enhanced, greener public transport to communities along the DART+ Programme routes delivering economic and societal benefits for current and future generations.

1.7. DART+ South West

The DART+ South West Project will deliver an electrified network, with increased passenger capacity and enhanced train service between Hazelhatch & Celbridge Station to Heuston Station (circa 16km) on the Cork Mainline, and to Glasnevin Junction on the Phoenix Park Tunnel Branch Line (circa 4km).

DART+ South West Project will complete four-tracking between Park West & Cherry Orchard Station and Heuston Station and will also re-signal and electrify the route. The completion of the four-tracking will remove a significant existing constraint on the line, which is currently limiting the number of train services that can operate on this route. DART+ South West will also deliver track improvements along the Phoenix Park Tunnel Branch Line, which will allow a greater number of trains to access the city centre.

Upon completion of the electrification of the DART+ South West route, new DART trains will be used on this railway corridor, similar to those currently operating on the Malahide / Howth to Bray / Greystones Line.

Figure 1-1 DART+ South West

1.7.1. Capacity Increases Associated with DART+ South West

The operating capacity of services in the Heuston area is currently constrained by railway infrastructure limitations and the ability of Heuston Station to accommodate terminating trains. Iarnród Éireann currently operates at a maximum capacity of 12 inbound trains in the AM peak hour and 12 outbound trains in the PM peak hour along the Cork Mainline. This provides a peak capacity of approximately 5,000 passengers per hour per direction during the AM and PM peak hours; operating inbound and outbound, respectively. DART+ South West aims to improve train service and increase train and passenger capacity on the route between Hazelhatch & Celbridge Station to Heuston Station and through the Phoenix Park Tunnel Branch Line to the City Centre, covering a distance of circa 20km.

DART+ South West will significantly increase train capacity from the current 12 trains per hour per direction to 23 trains per hour per direction (i.e., maintain the existing 12 services, with an additional 11 train services provided by DART+ South West). This will increase passenger capacity from the current peak capacity of approximately 5,000 passengers per hour per direction to approximately 20,000 passengers per hour per direction.

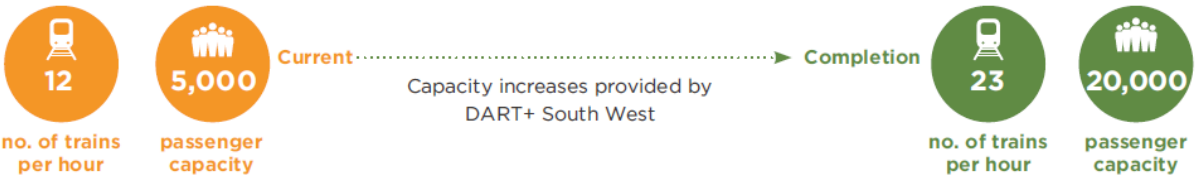


Figure 1-2 DART+ South West Capacity Increase

1.7.2. Key infrastructural elements of DART+ South West

The key elements of DART+ South West include:

- Continuation of four-tracking from Park West & Cherry Orchard Station to Heuston Station, extending the four tracking works completed on the route in 2009.
- Electrification of the line from Hazelhatch & Celbridge Station to Heuston Station and also from Heuston Station to Glasnevin Junction, via the Phoenix Park Tunnel Branch Line.
- Undertaking improvements/reconstructions of bridges to achieve vertical and horizontal clearances.
- Remove rail constraints along the Phoenix Park Tunnel Branch Line.
- Delivery of a new Heuston West Station.

The Preferred Option will be compatible with future stations at Kylemore and Cabra, although the construction of these stations is not part of the DART+ South West Project.

1.7.3. DART+ South West Timeline

A high-level timeline for statutory approval process for the DART+ South West is set out in **Figure 1-3**. Looking beyond that construction is expected to commence in 2023.

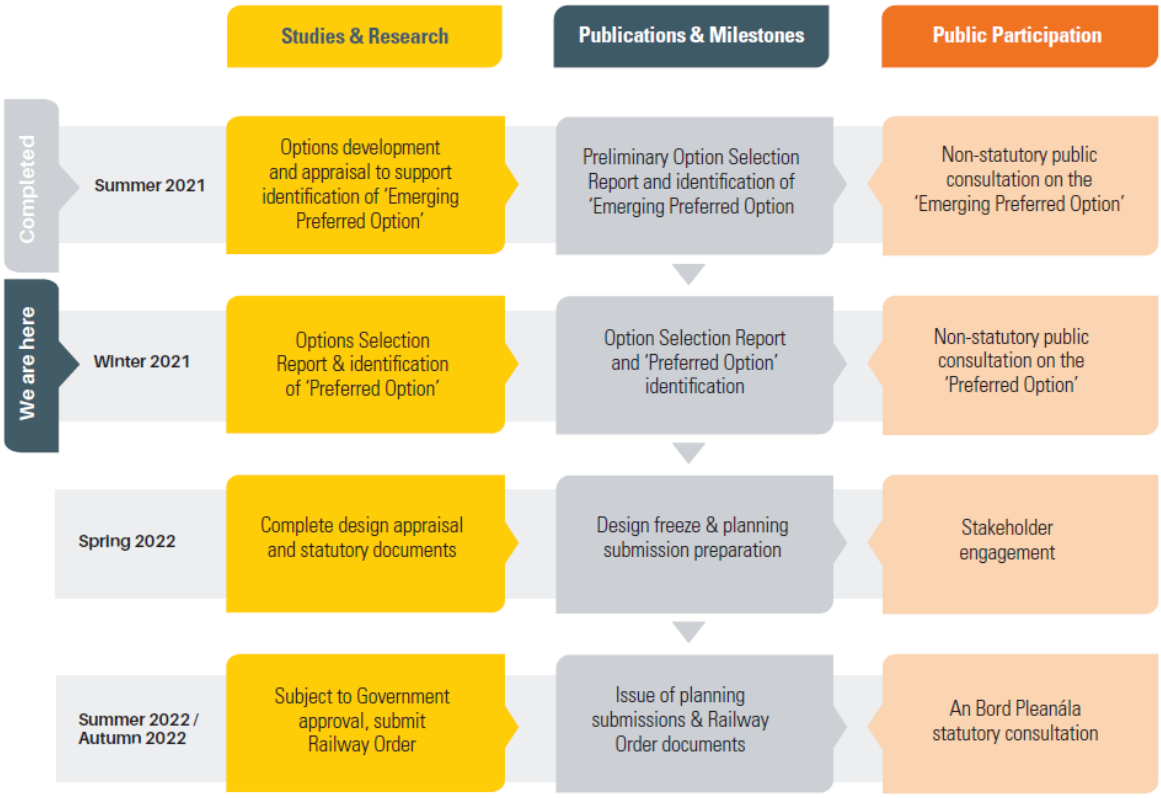


Figure 1-3 DART+ South West Timeline up to Statutory Approval Process

2. Project Need and Strategic Fit

2.1. DART+ Programme Objectives

The primary objective of the DART+ Programme is to support urban compact growth and contribute to reducing transport congestion and emissions in Dublin by enabling modernised high-quality commuter rail services between Dublin City Centre and the areas of Drogheda, Maynooth, Dunboyne, Celbridge and Greystones. This is aimed to provide a safe, sustainable, efficient, integrated, and accessible public transport service along these corridors.

Sub-objectives of the DART+ Programme include:

- Cater for existing heavy rail travel demand and improve customer services along established rail corridors in the Greater Dublin Area through the provision of a higher frequency, higher capacity, electrified heavy rail service which supports sustainable economic development and population growth.
- Improve accessibility to jobs, education, and other social and economic opportunities through the provision of improved inter-rail and inter-modal connectivity and integration with other public transport services.
- Enable further urban compact growth along existing rail corridors, unlock regeneration opportunities and more effective use of land in the Greater Dublin Area, for present and future generations.
- Deliver an efficient, sustainable, low carbon and climate resilient heavy rail network, which contributes to a reduction in congestion on the road network in the Greater Dublin Area and which supports the advancement of Ireland's transition to a low emissions transport system and delivery of Ireland's emission reduction targets.
- Provide a higher standard of customer experience including provision of clean, safe, quiet, modern vehicles and a reliable and punctual service with regulated and integrated fares.

2.2. Policy Context

The DART+ Programme and DART+ South West Project are central to the delivery of planning and transportation policy objectives at EU, national, regional and local level. This section provides an overview of the strategic fit of the DART+ Programme and DART+ South West Project in relation to European, national, regional, and local policy. A more detailed review of the policy context is provided in Volume 4 (Policy Context Report).

The policy hierarchy and relevant policy documents are listed in **Table 2-1**. Key points arising from these policy documents is provided in the following section.

Table 2-1: Planning and Policy Documents

EU Level Policy
EU White Paper on Transport: Roadmap to a single European Transport Area – Towards a competitive and resource efficient transport system.
The Trans-European Transport Network (TEN-T)
National Policy
Project Ireland 2040
The National Planning Framework
The National Development Plan 2021 - 2030
Smarter Travel – A Sustainable Transport Future
Strategic Investment Framework for Land Transport
Planning Land Use and Transport Outlook 2040
Climate Action and Low Carbon Development (Amendment) Act 2021
Regional Policy
Eastern and Midland Regional Spatial & Economic Strategy 2019-2031
Metropolitan Area Spatial Plan
Transport Strategy for the Greater Dublin Area 2016-2035
Greater Dublin Area Cycle Network Plan
Integrated Implementation Plan 2019-2024
Local Policy
Dublin City Development Plan 2016-2022 (currently under review)
Park West – Cherry Orchard Local Area Plan 2019
The City Edge Project
Draft Dublin City Development Plan 2022-2028
South Dublin County Development Plan 2016-2022
Adamstown Strategic Development Zone (SDZ) Planning Scheme 2014
Clonburris Strategic Development Zone (SDZ) Planning Scheme 2019
Draft South Dublin County Development Plan 2022-2028
Kildare County Development Plan 2017-2023
Celbridge Local Area Plan

Key objectives in European, national, regional and local planning policy which the DART+ Programme and DART+ South West are aligned with include the following:

- The DART+ Programme will support the reduction in the use of 'conventionally fuelled' cars in urban transport by 2030

  [As provided for in EU Policy.]

- The DART+ Programme will promote Sustainable Mobility as being central to enhancing competitiveness, sustaining economic progress and enabling mobility choices for citizens. This key objective aims to expand the range of public transport services available to reduce congestion and emissions. The policy also commits to invest in key transport projects such as the DART+ Programme, BusConnects and MetroLink.

  [As provided for in National Policy (e.g., National Planning Framework and Smarter Travel) Regional Policy (the RSESs) and Local Policy (e.g. Dublin City Development Plan, South Dublin County Development Plan and Kildare County Development Plan).]

- The DART+ Programme contributes to the electrification of transport fleets as a requirement to support a move away from polluting and carbon intensive propulsion systems.

  [As provided for in National Policy (e.g., National Planning Framework and 2021 Climate Act).]

- The DART+ Programme will assist with reducing work related commuting by car from a current modal share of 65% down to 45% and will assist with increasing commuting by alternative sustainable modes to 55%.

  [As provided for in National Policy (e.g., Smarter Travel).]

- The DART+ Programme is aligned with investment priorities of decarbonisation, protection and renewal of existing transport infrastructure, mobility of people and goods in urban areas, and enhanced regional and rural connectivity. [As provided for in National Policy (e.g., Strategic Investment Framework for Land Transport)].

- The DART+ Programme will facilitate the extension of the electrification of rail services and the extension of the Dublin area railway electrification for Maynooth Line (to Maynooth), Kildare Line, and Northern Line (to Drogheda).

  [As provided for in National Policy (e.g., National Planning Framework and 2021 Climate Act)]

- The DART+ Programme will have a role in the consolidation of Dublin City and the regeneration of city centre locations. DART+ South West will enhance rail services on the Dublin – Kildare line. It will also contribute to increasing capacity to support the ongoing development of strategically located lands, and lands within Strategic Development Zones including Adamstown and Clonburris within South Dublin.

  [As provided for in Regional Policy (i.e, Regional Spatial and Economic Strategy), Local Policy (e.g. Dublin City Development Plan, South Dublin County Development Plan, Kildare County Development Plan, Park West – Cherry Orchard Local Area Plan 2019, the City Edge Project, Adamstown Strategic Development Zone Planning Scheme 2014, Clonburris Strategic Development Zone Planning Scheme 2019 and Celbridge Local Area Plan 2017-2023.)]

- The DART+ Programme will support the provision of a high-quality public transport system throughout Dublin, Kildare and linking to adjoining counties, including, including the DART+ Programme, Quality Bus Corridors (QBCs) and Bus Rapid Transit (BRT) systems, together with enhanced facilities for walking and cycling.

[As provided for in Regional Policy (i.e, Regional Spatial and Economic Strategy), Local Policy (e.g. Dublin City Development Plan, South Dublin County Development Plan, Kildare County Development Plan, Park West – Cherry Orchard Local Area Plan 2019, Adamstown Strategic Development Zone Planning Scheme 2014, Clonburris Strategic Development Zone Planning Scheme 2019 and Celbridge Local Area Plan 2017-2023)].

- The National Development Plan 2021-2030 outlines the scope of the DART+ Programme to include investment in new rolling stock, new infrastructure and the electrification of the Sligo line to Maynooth and M3 parkway, the Northern line to Drogheda and the Kildare line to Celbridge / Hazelhatch to create a full metropolitan area DART network with all lines linked and connected.
- The Transport Strategy for the Greater Dublin Area, 2016-2035 documents the intention to implement the DART+ Programme, which will provide DART services as far north as Drogheda; to Hazelhatch on the Kildare Line; to Maynooth in the west and to the M3 Parkway. It proposes that the DART service will operate to a high frequency with adequate capacity to cater for the passenger demand. It is anticipated that DART services in the city centre section of the network will operate to a regular ten-minute service frequency in the peak hours from 2016 and will transition to a five-minute service frequency following the completion of the DART+ Programme.

The *Dublin City Development Plan 2016-2022* includes policy supporting the DART expansion programme and objectives in support of modal change and active travel through increasing capacity of DART suburban railway lines including: Policy MT4: "To promote and facilitate the provision of Metro, all heavy elements of the DART Expansion Programme including DART Underground (rail interconnector), the electrification of existing lines, the expansion of Luas, and improvements to the bus network in order to achieve strategic transport objectives".

It is noted that the Draft Dublin City Development Plan 2022-2028 is currently being progressed.

The South Dublin County Development Plan 2016-2022 supports the delivery of key infrastructure and transport developments and notes specific objectives with direct relevance to the DART+ South West Project infrastructure including: "Support the NTA in implementing major transport projects such as the reopening of the Phoenix Park Tunnel for rail services, DART Underground and Tallaght Swiftway (Bus Rapid Transport)".

It is noted that the Draft South Dublin County Development Plan 2022-2028 was put on public display from 7th July 2021 to 15th September 2021. Submissions received from the public are currently being considered by the planning authority. The Draft Plan supports the delivery of the DART+ South West Project.

Kildare County Development Plan 2017-2023 includes a number of policies and objectives stated in the which are of specific relevance to the DART+ Programme including: Policy PT 7: To promote and support the upgrading of the Maynooth rail line and the Kildare rail line, in accordance with the Transport Strategy for the Greater Dublin Area 2016-2035 and in co-operation with the NTA.

In addition to the relevant City/County Development Plans, the DART+ South West railway corridor runs through lands that are subject to Local Area Plans and Strategic Development Zone Planning Schemes. The DART+ South West Project is supported by, and aligns with, the policies and objectives set out in these local plans.

Further information related to the planning and policy documents in respect of the DART+ Programme and DART+ South West in particular can be found in Volume 4 (Policy Context Report).

3. Transportation Analysis

3.1. Train Service Specification

In 2018, the *DART-Expansion-Programme-Options-Assessment* (Oct 2018) by Jacobs and Systra recommended that the DART Expansion Programme (now the DART+ Programme) be delivered by enhancing the existing rail network in the short to medium term (Scheme Bundle 6). This recommendation followed modelling of the bundle options using the National Transport Authority's (NTA) Eastern Regional Model (ERM) which allowed for the performance and attractiveness of the bundles to be analysed by considering how transport demand is served by the rail system within a multi-modal network (i.e., including the public transport modes of rail, bus, Luas, Metro as well as that of car, walking and cycling). Refer to **Volume 4** (**Useful Links)** for a hyper link to *DART-Expansion-Programme-Options-Assessment (Aug 2018)*.

In 2018, the *DART-Expansion-Programme-Options-Assessment-Addendum* (August 2010) was published (also by Jacobs and Systra). It details the strategic modelling outputs of a revised Train Service Specification (TSS) Option 1 – Balanced City Centre Distribution of the Preferred Option (i.e., Scheme Bundle 6). Refer to Volume 4 (Useful Links) for a hyperlink to *DART-Expansion-Programme-Options-Assessment-Addendum (June 2019)*.

The main outcome of the assessment is the definition of the TSS, which is the 'desired' number of train services to have on each branch of the DART network (i.e., trips per hour per direction (tphpd)).

Building on the work undertaken by Jacobs and Systra, the DART+ West Multi-disciplinary Consultant (MDC) undertook feasibility and robustness analysis to demonstrate whether the desired timetable is feasible / achievable and the effects of each key element of the infrastructure on performance. The analysis provides a set of recommendations for further enhancements and considerations in order to improve the capacity of the network and obtain a more robust and predictable service pattern; this included specific recommendations for the Cork Mainline. DART+ South West has reviewed the analysis and it has been addressed in the design.

DART+ South West will significantly increase train capacity from the current 12 trains per hour per direction to 23 trains per hour per direction (i.e., maintain the existing 12 services, with an additional 11 train services). This will increase passenger capacity from the current peak capacity of approximately 5,000 passengers per hour per direction to approximately 20,000 passengers per hour per direction. Upon completion of the project, train services will be increased according to passenger demand. See **Table 3-1** below.

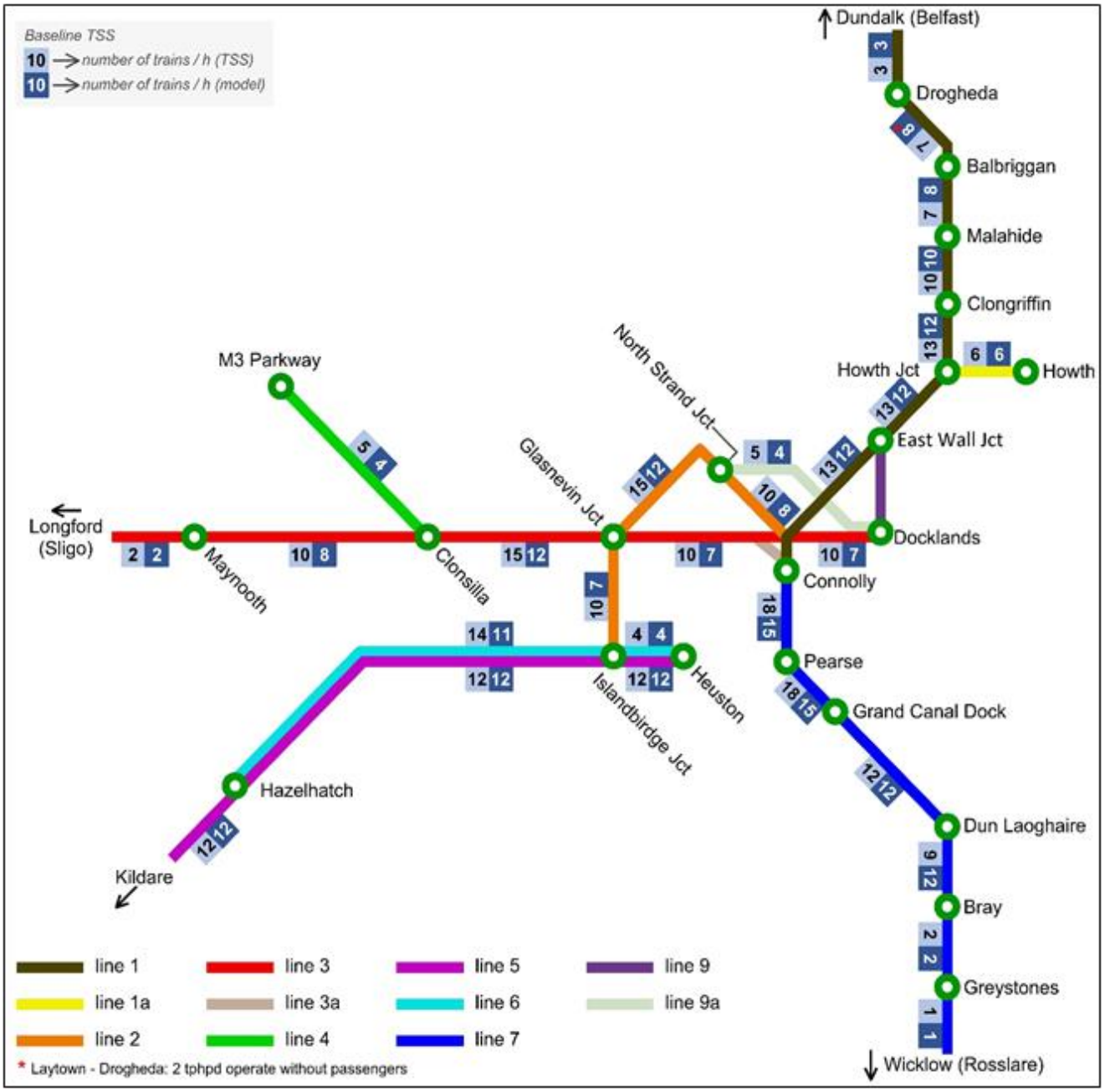


Figure 3-1 Train Service Specification

3.2. The NTA Eastern Regional Model

The Eastern Regional Model (ERM) is one of five models that comprise the National Transport Authority's (NTA) Regional Modelling System. The ERM covers the whole of Ireland with a focus on the counties within Leinster and the Greater Dublin Area (GDA). These areas are represented by 1844 detailed zones with travel between these areas and the rest of Ireland represented by 7 external zones. The base year of the model is 2016 and it represents an average weekday with five separate peak periods modelled;

- AM peak (07:00-10:00);
- Morning Inter peak (10:00-13:00);
- Afternoon Inter peak (13:00-16:00);
- PM peak (16:00-19:00); and
- Off peak (19:00-07:00).

The model covers all surface access modes for personal travel and goods vehicles including private vehicles (taxis and cars), public transport (bus, rail, Luas, BRT, Metro), active modes (walking and cycling) and goods vehicles (light goods vehicles and heavy goods vehicles).

3.3. Updates since Public Consultation No. 1

There is no current change to the TSS (or 'desired' number of train services to have on each branch of the DART network). The Project Team will continue to update the Project to optimise the model with the latest design developments and validate the targeted timetable.

The NTA's ERM model has been used to carry out the demand modelling associated with the DART+ Programme. The output from the study has been used to update the transportation modelling for the DART+ Programme and will also inform the traffic assessment as part of the Environmental Impact Assessment Report (EIAR) to accompany the DART+ South West Project Railway Order application. Since no permanent road network changes are proposed for the operational phase of the project, the transport modelling strategy will primarily be focused on several temporary bridge closures during the construction phase of the development.

4. Option Selection Process

4.1. Introduction

A clearly defined appraisal methodology has been used in the selection of the end-to-end Preferred Option for the Project. Consistent with other NTA projects, it is based on *'Guidelines on a Common Appraisal Framework for Transport Projects and Programmes'* (CAF) published by the Department of Transport, Tourism, and Sport (DTTAS), March 2016 (updated 2020), TII's *Project Management Guidelines* (MG 2019) and CIÉ's *Project Management Guidelines* and *Project Approval Guidelines*. The process comprises a two-stage approach (if / as appropriate):

- Stage 1 – Preliminary Assessment (Sifting); and
- Stage 2 – Multi-Criteria Analysis (MCA).

While applying the broad principles of the CAF, when it comes to exploring different options to achieve the identified Project objectives and requirements, the methodology has regard to the fact that DART+ South West Project involves an existing operational rail line running in a pre-defined corridor. Unlike other transport projects there are no / limited route options and spatial variables for the improvement works and interventions required to meet the Project objectives and requirements.

In this regard, the Project can be characterised as one which provides for enhancement of existing railway infrastructure over the 20km length of the scheme with the installation of electrical and signalling technology. A number of discrete elements extend beyond the boundary of the existing railway. While presenting a description of the end-to-end Preferred Option, the OSR has been drafted to focus on those elements for which alternative options manifest, options which are markedly different from one another, and which have varied impact on the local environment. Examples of such include four-tracking, bridge replacements, and options for the location of substations and compounds.

Alternatives in respect of many of the linear works (e.g., signalling) and some of the bridge works vary little from an environmental perspective. Alternatives in respect of many of these elements are largely a technical matter and optioneering, where relevant, is presented for information.

A summary of the proposed methodology is illustrated in **Figure 4-1**.

4.2. The Options to be Assessed

Many elements of the Project (or works and interventions needed) require option assessment at a local level prior to incorporation into the end-to-end Preferred Option for the Project. The options for particular interventions e.g., at a bridge location, need to be considered holistically because of the knock-on implications both within the rail corridor and outside of the rail corridor in terms of track alignment, road levels, other bridges etc.

The options presented for assessment include:

- A Do-Nothing Option. This option describes what is likely to occur in the absence of works and interventions needed to meet the Project objectives and requirements. In the case of the DART+ South West Project, this would include no four-tracking and no electrification.
- A Do-Minimum Option. This option describes the least burdensome option to maintain an intervention. For the DART+ South West Project, it is the option where the works and interventions that are needed to meet the Project objectives and requirements can generally be met within the existing rail corridor, minimising the

potential for new or additional impacts on the receiving environment. Do-Minimum in this context is not passive, as some level of works and intervention is necessary to meet the Project objectives and requirements, albeit the least burdensome.

- Do-Something Option(s): These options are available to address the objective of the intervention (i.e., the Project objectives and requirements). In the case of the DART+ South West Project, these options involve interventions and related works that are required beyond the existing railway corridor.

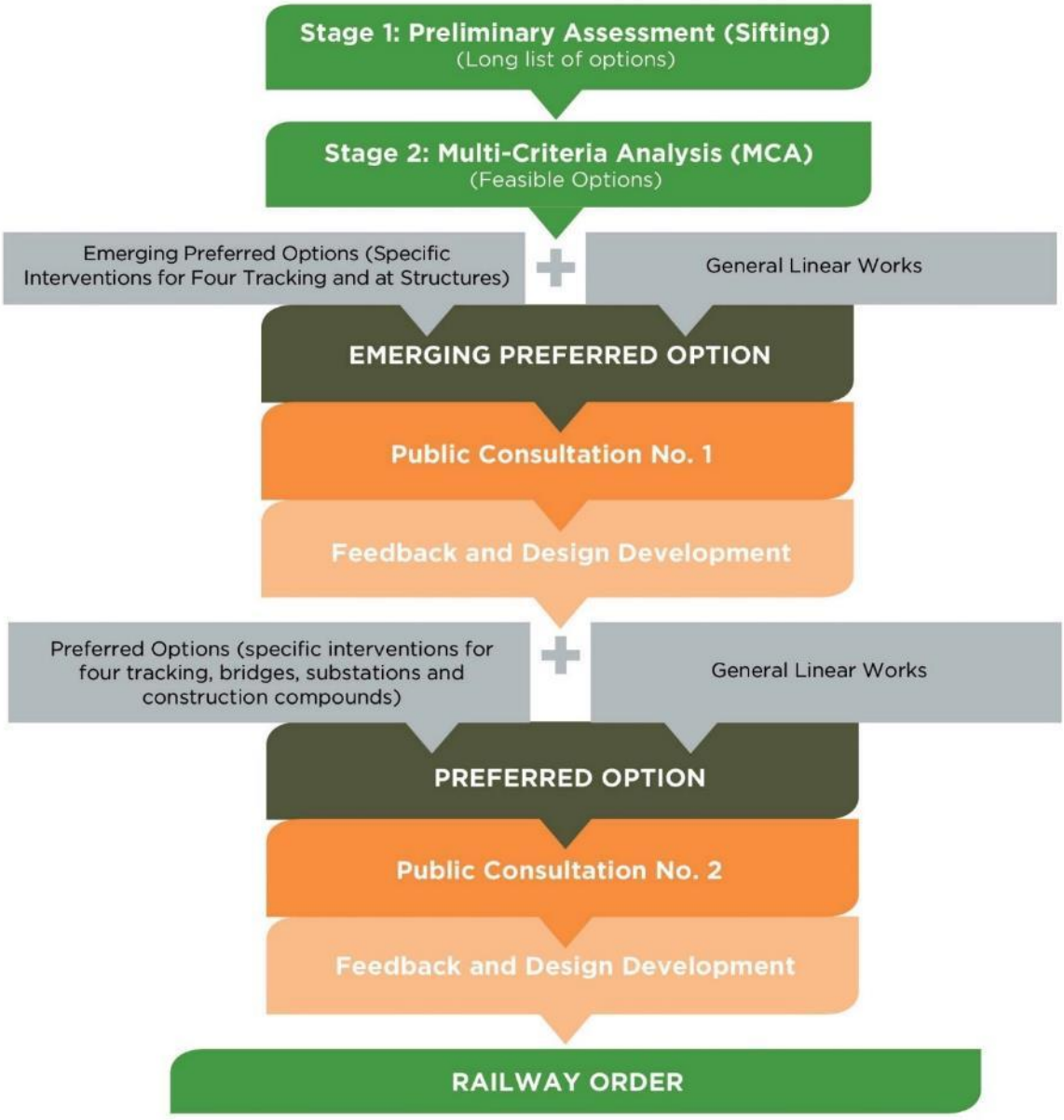


Figure 4-1 Option Selection Methodology

4.3. Starting Principle

The starting principle for the Project is to accommodate the works and interventions needed to meet the Project objectives and requirements within the existing rail corridor. In many cases this 'Do-Minimum Option' is technically feasible and will be the Preferred Option for the particular element of the Project / intervention required. However, in some cases it is not technically feasible, in this situation the options are the focus of more extensive assessment. The methodology is as follows:

- If the 'Do-Minimum' option is feasible and meets the Project objectives / requirements, it is the Preferred Option in respect of the intervention required. Stage 2 MCA is not necessary.
- If the 'Do-Minimum' option is not feasible and/or does not meet the Project objectives / requirements, other options are brought forward for detailed assessment as part of the Stage 2 MCA in order to identify the Emerging Preferred Option in respect of the intervention required.
- In some instances, while the 'Do-Minimum' option is preferred and considered likely, verification is required, and therefore other options remain open and are presented for information. However, they will not be brought forward for detailed assessment (including Stage 2 MCA, where appropriate) unless the 'Do-Minimum' option is determined not to be feasible.

4.4. Stage 1: Preliminary Assessment (Sifting) Methodology

In keeping with principles of the CAF Preliminary Appraisal approach, the purpose of Stage 1: Preliminary Assessment (Sifting) is to subject a range of options to a preliminary appraisal, before subjecting a smaller number of options to a more detailed Stage 2: Multi-Criteria Analysis (MCA). For the DART+ South West Project, the key sifting criteria was whether an option was 'Feasible' and met the Project objectives and requirements. Feasibility refers to whether the option can or cannot be done (is technically deliverable or not) and Project objectives / requirements are specific for a particular element or area along the rail corridor.

4.4.1. Long List of Options

Stage 1: Preliminary Assessment (Sifting Process) commenced with the Project Team identifying a long list of high-level options for the key elements of the scheme. This list included: a Do-Nothing" Option (as described previously); a Do-Minimum" Option (depending on the specific requirements for the particular element); and Do-Something" Option(s) where interventions and related works are required beyond the existing railway corridor in order to meet the Project objectives and requirements.

Both the 'Do-Minimum' option and 'Do-Something' options are capable of different technical variations. These variations will continue be considered in detail as the Project progresses towards the design of the proposed development to be included in the Railway Order application.

4.4.2. Sifting

Consistent with CAF, the headline criteria which the options were assessed against the criteria of Engineering; Environment; and Economy.

Of these, the key 'pass' or 'fail' criteria was Engineering and whether an option is 'Feasible' and met the Project objectives and requirements.

Where the interventions are constrained geographically, a pass/fail approach for Environment is not considered suitable at sifting stage. Rather the approach applied is to consider and raise key environmental issues during the Stage 1 process but not discount any option solely on environment criteria.

It was also considered unsuitable to apply a pass/fail approach to Economy at Stage 1. The only exception was where the option clearly runs counter to policy goals and objectives set by the political and administrative processes (this is consistent with the CAF objectives-led approach to economic appraisal). Key Economy issues were therefore identified but are not used to discount any option solely on economy criteria.

This approach only brought forward feasible options to be explored at Stage 2 in greater detail. Refer to **Table 4-1** for the Sifting Criteria for the DART+ South West Project.

Table 4-1 Stage 1: Sifting Criteria for DART+ South West

	'Pass' / 'Fail' Criteria	Four-Tracking*	Bridge Replacements*	Substation & Technical Buildings	Construction Compounds
Feasibility	Constructability	✓	✓	✓	✓
	Geometrical Fitness for Intervention	✓	✓		
	Safety	✓	✓	✓	✓
	Electrification			✓	
Project Objectives and Requirements	Four-Tracking	✓	✓		
	Electrification of tracks	✓	✓		
	Track Drainage and Alignment	✓	✓		
	Maintain Functionality of Roads	✓	✓		
	Proximity to the Railway Line			✓	✓
	Vehicular Access			✓	✓
	Direct access to the work site				✓
	Site size requirements			✓	✓

* This was the focus of optioneering presented during PC1

4.4.3. Sifting Findings

The sifting of options occurs during a multi-disciplinary workshop. Options which fail to meet the necessary Engineering Feasibility and Project Requirements are discounted. Options which meet the necessary Engineering Feasibility and Project Requirements are brought forward to Stage 2: MCA for detailed assessment. In some instances, verification is required, and therefore options remain open.

Following the Phase 1: Sifting, the Design Team developed the feasible options for presentation and consideration by a multi-disciplinary team in the next stage of the optioneering process.

4.5. Stage 2: MCA Methodology

Stage 2 of the optioneering process comprises a detailed multi-disciplinary comparative analysis of those feasible options that passed through Stage 1: Preliminary Sifting.

4.5.1. MCA Parameters, Criteria and Sub-criteria

The options are assessed against the criteria of Economy, Safety, Environment, Accessibility and Social Inclusion, Integration and Physical Activity in line with the criteria required for multi-criteria analysis in the CAF Guidelines. These parameters were split into a number of sub-criteria considered relevant to the DART+ South West Project.

The CAF parameters, criteria and considerations for comparative analysis are set out in **Table 4-2**. These include qualitative and quantitative indices.

Table 4-2 Stage 2: CAF Criteria for MCA for DART+ South West

CAF Criteria	Sub-Criteria		Four Tracking*	Bridge Replacements*	Substation & Technical Buildings	Construction Compounds
1. **Economy**	Capital Expenditure (CAPEX): construction, land acquisition, temporary works.		✓	✓	✓	✓
	OPEX: operational costs (IE or other entities), Technology advancement and future proofing / obsolescence		✓	✓	✓	✓
	Train Operations Functionality/Economic Benefit		✓	✓		
	Traffic functionality and associated economic activities and opportunities.			✓		
	Urban regeneration		✓	✓		
2. **Integration**	Transport Integration			✓		✓
	Land use integration		✓	✓	✓	
	Geographical Integration			✓	✓	✓
	Other government policy		✓	✓		✓
	Adaptability in the future (robustness in the solution)		✓	✓	✓	✓
	Equipment integration				✓	
	IE land use integration				✓	

CAF Criteria	Sub-Criteria		Four Tracking*	Bridge Replacements*	Substation & Technical Buildings	Construction Compounds
	Road access Integration				✓	
3. **Environment**	Noise and Vibration		✓	✓	✓	✓
	Air quality and Climate		✓	✓	✓	✓
	Landscape and Visual		✓	✓	✓	✓
	Biodiversity (flora and fauna)		✓	✓	✓	✓
	Cultural Heritage, archaeological and architectural heritage		✓	✓	✓	✓
	Water resources		✓	✓	✓	✓
	Agricultural and non-agricultural		✓	✓	✓	✓
	Geology and soils (including waste)		✓	✓	✓	✓
4. **Accessibility & Social inclusion**	Impact on Vulnerable Groups / Residents / Neighbours			✓	✓	
	Accessibility (station) – where relevant			✓		
	Accessibility (bridge)			✓		
	Social inclusion			✓		✓
5. **Safety**	Rail Safety		✓	✓	✓	
	Vehicular Traffic Safety			✓		
	Pedestrians, cyclists, road users, neighbour's and/or staff safety			✓	✓	
	Reliability, Availability and Maintainability				✓	
	User / Operator and Public Safety				✓	
	RAM				✓	
6. **Physical Activity**	Connectivity to adjoining cycling and walking facilities			✓		✓
	Permeability and local connectivity			✓		

* This was the focus of optioneering presented during PC1

The assessment is informed by site selection analysis and general arrangement drawings, as appropriate, focusing on detailed design aspects for the feasible options (bridges, roads, and rail corridor / permanent way, substations and compounds).

The key environmental data / constraints are available in the Environmental Constraints Reporting (refer to **Volume 4 (Constraints Report and Drawings)**. This baseline data informed the baseline characteristics of the environmental topic / CAF sub criteria under consideration. It, inter alia, identified areas or sites with specific statutory protection, which are recognised as important and / or sensitive from a planning and environmental perspective e.g., European and National designated sites, Protected Views, Record of Protected Structures etc.

Relevant considerations of the MCA analysis include:

- The assessment is a comparative analysis between options presented, not an impact assessment of each option. The impact from the Preferred Option will be assessed in the Environmental Impact Assessment Report (EIAR) in the next phase of the development.
- Not all sub-criteria may be relevant in every case. Those that are relevant to the assessment, i.e., that have differentiated options, are highlighted in the narrative.
- For each option there are potential design variations.
- For each option an indicative envelope was identified for the extent of permanent works required; a worst-case scenario was considered. The extent of temporary works was also considered. Further work including detailed design and technical and construction related solutions will seek to minimise land take in respect of the Preferred Option.
- The envelope around each option was used to spatially represent environmental constraints within / proximate to the options.
- There are direct and indirect effects associated with either or both the construction and operational activities (including maintenance) associated with the options. These are highlighted where relevant, and in particular where they have differentiated options under particular sub-criteria.
- The changes in land use are considered under the planning policy consideration under the CAF Integration criteria (specifically Land Use Integration).
- The changes in traffic and associated impacts on the 'economy' are addressed under the CAF Economic criteria (specifically Traffic functionality and associated economic activities and opportunities) and are not duplicated as part of the Environment Assessment.

4.5.2. Comparative Assessment

The next step involved assessing the performance of each option against relevant quantitative and qualitative indicators. Presented in a matrix format, each specialist includes a commentary of their analysis for each option.

All disciplines then come together at a workshop to compare the options relative to each other based on whether an option had a 'some' or a 'significant' advantage or disadvantage over other options or whether all options were 'comparable / neutral'. The basis for comparative analysis is identified in the **Figure 4-2.** This basis of comparison is consistent with the CAF Guidelines which uses a five-point ranking scale when comparing options against each other for comparative analysis.

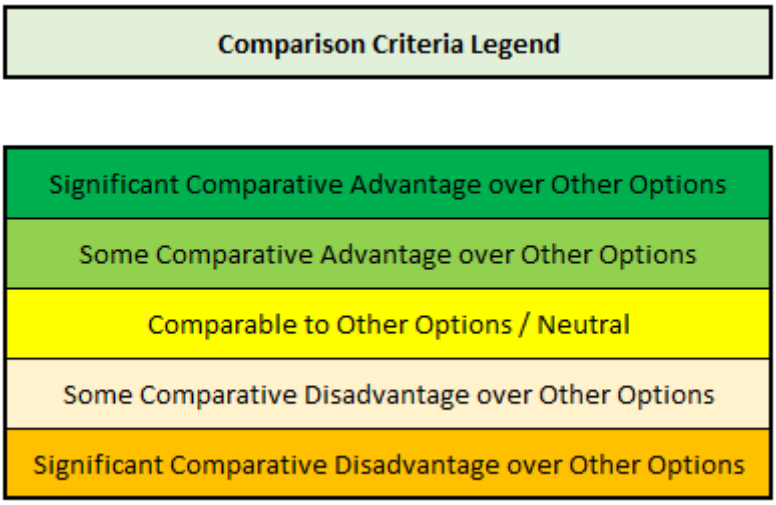


Figure 4-2 Option Comparison Criteria Legend

Criteria were then considered and aggregated to give a summary finding for each CAF criteria. The summary findings for all six CAF parameters were then considered and aggregated to determine the preferred option.

The various preferred options in respect of particular elements or interventions are then combined with general linear works needed to upgrade and modernise the railway to make up the end-to-end 'Emerging Preferred Option' (in the case of what was presented to the public at PC1), the 'Preferred Option (in the case of what is currently being presented to the public at PC2) and the design of the proposed development to be included in the Railway Order application. A key part of the iterative project development process is taking account of feedback and design development – see below.

4.6. Feedback and Design Development Overview

The purpose of non-statutory public consultation on DART+ South West is to show the status of the optioneering process at a particular point in time and provide information relating to ongoing technical and environmental analysis, as well as engaging in consultation and engagement with the public and potentially affected property owners. The optioneering and design is then analysed and re-evaluated based on public consultation feedback.

The Preliminary Option Selection Report (POSR) was published in May 2021, to show to the public and stakeholders the status of the optioneering process and identifying the Emerging Preferred Option at that point in time. The primary purpose of this report was to present an early-stage characterisation of the options selection and decision-making process for the DART+ South West Project at the time of advancing the first round of public consultation.

The Emerging Preferred Option has been analysed and re-evaluated based on public consultation feedback from PC1 and this has informed the 'Preferred Route' presented in this report.

This, Option Selection Report (OSR), presents the analysis and re-evaluation of the Emerging Preferred Option following stakeholder feedback. It also presents separate optioneering for electrical substations, construction compounds. These are then combined with further design development of the general linear works needed to upgrade the railway, and construction related methodologies, at this point in time, to make up the end-to-end 'Preferred Option'.

In due course, the analysis and re-evaluation of the Preferred Option following stakeholder feedback from PC2 and further design development will inform the design of the proposed development to be included in the Railway Order application. The Railway Order application will be subject to statutory consultation.

4.7. Public Consultation No. 1 and Stakeholder Engagement

4.7.1. Introduction

Public participation is a key element to the delivery of all major infrastructure projects, such as the DART+ South West Project. The purpose of the consultation is to engage the public in the delivery process and inform them of the likely statutory timescales required to deliver the project; to seek the public's cooperation and to record the local knowledge presented by the public to inform the Railway Order process and the Environmental Impact Assessment Report (EIAR).

The main public participation stages as part of the project development are shown below:

- Non-Statutory Public Consultation No.1 – The Emerging Preferred Option – May 2021
- Non-Statutory Public Consultation No. 2 – Preferred Option – Winter 2021
- Statutory Consultation Period as part of the Railway Order application process – Summer / Autumn 2022

The first public consultation period, 'The Emerging Preferred Option', commenced on 12th May 2021 and ran for 6 weeks until its formal closure on 23rd June 2021. However, it should be noted that the public were given an additional week up to 30th June 2021 where they could still engage and submit feedback on the Emerging Preferred Option.

The remainder of this chapter details the process, records and analyses the feedback from the first of the public consultation events.

4.7.2. Methodology

DART+ South West ensured the public consultation process was easily accessible to all stakeholders and the public. Due to COVID-19 restrictions in place at the time of PC1 and in order to comply with the public health restrictions, no physical public events could take place; instead, all consultation including meetings with potentially affected landowners / residents were conducted online (website / email / telephone). In addition, several evening webinars were held focusing on particular sections of the route.

The following engagement methods used throughout PC1 are summarised below:

- DART+ South West PC1 was launched on 12th May 2021 by Minister for Transport, Éamon Ryan T.D. It was covered widely on the day by national media including Irish Independent, Irish Times, Irish Daily Mirror, Irish Sun, RTÉ Radio 1, Newstalk, Breakingnews.ie and Journal.ie.
- A project webpage was established, which presented all the project information, including the Preliminary Options Selection Report (POSR). Information regarding the project was also shared on Iarnród Éireann's social media channels.
- A dedicated Community Liaison Representative was engaged to answer calls and emails from residents, landowners, etc. Queries seeking further information or clarity regarding the Emerging Preferred Option were responded to.

- A 54-page non-technical public consultation brochure was published in both Irish and English languages. The brochure was made available on the dedicated project webpage and hard copies were to the elected representatives following the ministerial launch.
- The affected properties were sent an information leaflet in both English and Irish highlighting the key elements of the DART+ South West project and providing information on the public consultation process.
- Letters were sent to all registered landowners who were likely to affected by the emerging option via registered post notifying them in advance of the commencement of the PC1 and welcomed them to the event to provide their feedback on the emerging preferred option.
- A project email address, project postal address and project helpline was established for stakeholders to provide support and resolve any queries. An online feedback form was also provided on the website.
- The Project Team held seven online public webinars for residents local to the affected areas, including: Heuston to Kilmainham, Inchicore to Kylemore, Ballyfermot, Clondalkin to Adamstown, Celbridge & Hazelhatch, Cabra and further meeting for all surrounding communities.
- An online virtual consultation room allowing the public and other stakeholders to view maps, project information and other relevant information in a safe and accessible environment

During PC1, the Project Team received 1,003 unique submissions from stakeholders, in addition to a further 2 petitions supported by 254 stakeholders. All submissions were received either via email, post, telephone, or through the online feedback form. All of the feedback was analysed and recorded by the Project Team on a dedicated consultation database. Before analysing the submissions, all feedback was anonymised and then categorised into identifiable themes, a summary of these themes is set out in **Section 4.7.4.**

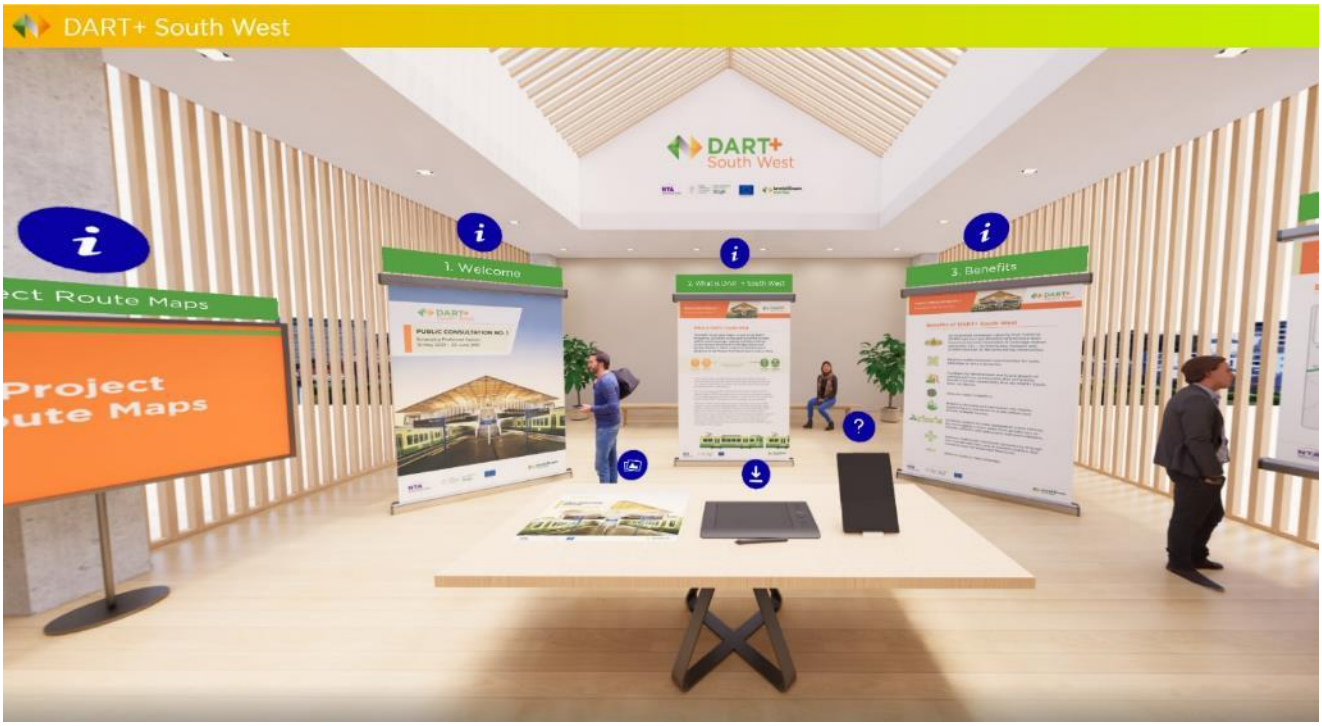


Figure 4-3 Virtual Consultation Room Developed as part of the Online Public Consultation Experience

4.7.3. Prescribed Bodies & Key Stakeholders

A list of prescribed bodies and key stakeholders has been identified for the Project. Each of them was written to as part of the non-statutory public consultation process to inform them of the project and to allow them the opportunity to contribute to the development of the scheme. The identified prescribed bodies and key stakeholders are noted below:

- An Taisce
- Bat Conservation Ireland
- Birdwatch Ireland
- Bord Gáis Eireann
- Commission for Energy Regulation
- Commission for Railway Regulation
- Construction Industry Federation
- Development Applications Unit (National Monument Service)
- Development Applications Unit (National Parks and Wildlife Service)
- Dublin City Council
- Dublin Chamber of Commerce
- Kildare County Council
- County Kildare Chamber
- South Dublin County Council
- South Dublin County Chamber
- Dublin Fire Brigade
- Kildare County Fire Brigade
- National Ambulance Service
- Dublin Port
- Dublin Bus
- Bus Éireann
- Eastern and Midland Regional Assembly
- Environmental Protection Agency (EPA)
- ESB Networks
- Gas Networks Ireland
- Irish Water
- EirGrid
- Fáilte Ireland Head Office
- Geographical Survey of Ireland
- Health & Safety Authority
- Health Service Executive (HSE)
- IBEC
- Irish Farmers Association
- Inland Fisheries Ireland
- Irish Landscape Institute
- Marine Institute
- Waterways Ireland
- Minster for Agriculture, Food and Marine (Department of Agriculture)
- Minister for the Environment, Climate and Communications
- Minister for Tourism, Culture, Arts, Gaeltacht, Sport and Media (Department of Arts, Heritage and the Gaeltacht)
- Minister of State for Sport and the Gaeltacht
- Minister for Finance, Public Expenditure and Reform
- Minster for Housing, Local Government and Heritage
- Minster for Transport
- Tánaiste and Minister for Enterprise, Trade and Employment
- Minister for Children, Equality, Disability, Integration and Youth
- Minister for Social Protection, Rural and Community Development
- Minister for Education

- Minister for Further and Higher Education, Research, Innovation and Science
- National Transport Authority
- M50 Concession Ltd.
- Transdev (Luas) – Luas Operator and Maintenance Contractor
- Transport Infrastructure Ireland
- The Irish Aviation Authority
- The Arts Council
- The Commissioner of Public Works in Ireland
- The Heritage Council
- The Office of Public Works (OPR)
- Commissioner of Public Works in Ireland
- Mobile Operations – Cables and Masts

4.7.4. Summary of Key Issues or Concerns Raised

The key issues and concerns raised by the potentially affected landowners, residents, the public, prescribed bodies and key stakeholders are set out in summary below:

Hazelhatch to Park West:

- Concerns regarding safe pedestrian and cycling infrastructure surrounding the stations to improve connectivity; and
- The need for more frequent and reliable services at Kishoge Station.

Park West to East of St. John's Bridge (Islandbridge):

- The lack of stations at Ballyfermot and Kylemore resulting in no community gain;
- Concern over construction works to bridges with regard to residential development;
- Concern regarding traffic impact around Le Fanu Bridge and Sarsfield Road Bridge;
- Concerns over drainage under Sarsfield Road Bridge;
- Queries and concerns whether cycle/pedestrian and wheelchair access will be included in bridge improvement works;
- Concerns over the cultural heritage importance of the Turret within the Inchicore Works;
- The traffic impact on Chapelizod Bypass (Con Colbert Road) and the desire for traffic calming and safe pedestrian crossings in the area;
- Concerns regarding traffic at the junction of South Circular Road and Chapelizod Bypass which is considered as 'hostile for pedestrians, cyclists and vulnerable users'; and
- Concerns around air quality in neighbourhoods.

East of St. John's Bridge (Islandbridge) to Glasnevin:

- Concerns regarding traffic at the junction of South Circular Road;
- Noise levels and impact on residents around the Memorial Road Bridge, Heuston Station and Heuston Yard;
- Missed opportunity with regard to no station at Cabra;
- Concerns regarding the impact of construction works in the Cabra area;
- Concern regarding the importance of cultural heritage around Glasnevin and the potential impacts that may occur; and
- Integration with other public transport services at Glasnevin Junction.

There were a number of reoccurring issues and concerns which were not location specific. These concerns included:

- Concerns regarding the impacts of construction works particularly at bridges;
- Concerns around safety with regard to the design of the track and stations;
- Noise and traffic impacts;
- Concerns regarding the effect on residential properties;
- Concerns regarding pedestrian/cycling and wheelchair access at the stations; and
- Public access to the bridges.

Further detail on the key issues and concerns raised throughout PC1 can be found in the Public Consultation No.1: Findings Report **(Volume 4).**

4.8. Key Issues Arising from Public Consultation No. 1 Findings

The key issues arising from public and stakeholder feedback from PC1 are dealt with under the following headings:

- Matters which require Further Assessment for the Preferred Option.
- Matters to be Addressed by Ongoing Design Development and the RO Application and EIAR.

Matters outside of the Scope of the Project.

4.8.1. Matters which Require Further Assessment for the Preferred Option

The purpose of PC1 was to present the Emerging Preferred Option for the proposed DART+ South West Project and to request the views of the public and other stakeholders. All submissions received as part of the first round of consultations have fed into the design process, an updated option selection process and the identification of the Preferred Option.

The Project Team has analysed the submissions and considered all relevant information of potential relevance for the re-evaluation of the optioneering to date. As part of this analysis the following items or options were identified as requiring further consideration and have been considered in the options re-evaluation process:

- **The inclusion of the new Heuston West Station in the scope of the Project to be brought forward for Railway Order (RO).**

  As this station is located wholly in Iarnród Eireann's Heuston Station boundary (and more specifically at the location of the existing platform 10) and having regard to the specific requirements for the station (as set out in **Section 8.3**), the options for assessment are not materially different and are therefore largely a technical matter (relating to design and access) which was subject to MCA.

- **Following feedback and more detailed design of the four-tracking requirements between Kylemore Road Bridge and Khyber Pass Footbridge, it is possible to avoid removing a turret associated with a locomotive shed to the south of the line. This structure is listed in the National Inventory of Architectural Heritage (NIAH) (Reg. No. 50080418) and is located within the Railway Works at Inchicore.**

  In the MCA which identified Option 4 as the Emerging Preferred Option, this option was assessed as having 'Some Comparative Advantage' over Option 3 in respect of the CAF criteria of Economy, Integration and Environment. However, due to the removal of both the Signal Box and Turret in Option 4, Option 3 (which only involved removal of the Signal Box) was found to have 'Some Comparative Advantage' in respect of the specific Cultural Heritage and Architectural Heritage and Biodiversity (potential for bat roosts) sub criteria;

however, this did not change the overall assessment findings for the Environment criterion favouring Option 4.

The Stage 2: MCA was re-run in respect of the options for Inchicore Works to account for the fact that following more detailed design, it is possible to avoid impacting the Turret. Both options are now found to be 'Comparable to the other option / neutral' in respect of both the Cultural Heritage and Architectural Heritage and Biodiversity criteria. This did not change the overall assessment findings of Option 4 as the Preferred Option and it was subject to more detailed design leading to the identification of the Preferred Option, which is presented in this report.

With the exception of the above elements, neither the additionally sourced baseline information nor outcomes of design development since PC1, inclusive of stakeholder input, have materially impacted the optioneering and the MCA findings presented in the POSR (and the Emerging Preferred Options for four-tracking and bridge replacements).

However, cognisant of the level of feedback relating to construction and operational environmental impacts, we have also sought to provide additional information relating to the construction technologies and methodology so that the public may understand the approach being considered. It is acknowledged that this information is based on the information and level of design available at this time, and it will continue to be developed as part of the Railway Order package and supporting documentation.

4.8.2. Matters to be Addressed as part of Ongoing Design Development, the RO Application and EIAR

All feedback relating to environmental matters has been fed back to the Project Team, including environmental specialists inputting into the Environmental Impact Assessment Report (EIAR), which will be submitted with the Railway Order. This includes *inter alia:*

- Traffic & Transportation – the potential impact of temporary bridge closures on the surrounding community, the potential impact of works for pedestrians and cyclists; and appropriate mitigation (traffic management measures).
- Air Quality – the potential benefit arising from the introduction of electric trains and potential impact at a local level in terms of dust and air pollution affecting nearby residents.
- Archaeology and Cultural Heritage – potential impact on heritage and cultural sites, including the area surrounding Glasnevin.
- Architectural Heritage – potential impact on various buildings and bridges of significant architectural heritage importance including those in Irish Rail Inchicore Works Estate (including the Signal Box and Turret and around Memorial Park); also, appropriate mitigation required in respect of any buildings of architectural heritage which must be impacted by the works. Consideration of the social heritage impact arising was also flagged.
- Biodiversity – potential impact on local biodiversity (including uncultivated areas along railway cuttings and embankment); potential for protected flora and fauna including badgers, bats and otters; also, appropriate mitigation in terms of reinstatement and replacing / enhanced planting where tree removal is necessary. Some stakeholders expressed concerns about the proposed line and its possible impact on the Phoenix Park

- Climate – the potential impact and contribution the electrification of the line will have in assisting the achievement of EU greenhouse gas emission targets and facilitating modal shift away from the private car.
- Human Health – the potential noise impact of both daytime and night-time works along the track and operational noise resulting from the increase in the frequency of passing trains and the potential impact of exposure to electromagnetic radiation.
- Land and Soils – the potential impact of the proposed works on the stability of embankments affecting roads or buildings surrounding them.
- Landscape and Visual – the potential impact of the proposed works on buildings and bridges of architectural heritage importance and the loss of green spaces and planting; also, appropriate mitigation in terms of reinstatement and replacing / enhanced planting where tree removal is necessary and careful design of replacement bridges and the siting of portal structures.
- Noise and Vibration – the potential noise and vibration impact of both daytime and night-time construction works along the track and operational noise resulting from the increase in the frequency of passing trains.
- Population – the potential impact on communities, including on community facilities (e.g, a community orchard, and communal gardens)

Key feedback came from potential impacted residents and local businesses and related to concerns in respect of the extent of temporary or permanent land take required. Some requested clarification that the Irish Rail land will be used first before any private land is taken for the tracks; others noted that agreements should be made to appropriately redress the situation faced by landowners, including compensation, and remedial/landscaping works.

The key starting principle for the Project, is to upgrade the existing railway and to undertake all works within the existing railway corridor. This can be achieved over the majority of the route. However, public and private land will be impacted by the Project, and the acquisition of land and/or property and other interests (including new rights), whether whole or in part, will be necessary. However, detailed design and technical and construction related solutions will continue to seek to minimise this up to the submission of the Railway Order.

This OSR provides an update on the potential impact of the Project outside of land owned by CIÉ.

4.8.3. Matters Outside of the Scope of The Project

4.8.3.1. New Railway Stations

A significant number of submissions during PC1 called for new railway stations along the railway line, including at Kylemore, Cabra and Heuston West.

The scope of the DART+ South West Project considers the necessary railway infrastructure to enable increased rail capacity and transition to electrical power. While the provision of new stations does not form part of this scope, consideration has been given to potential future stations during design development, including track alignments and other infrastructure which would not preclude the delivery of new stations in the future.

The National Transport Authority published the draft Transport Strategy for the Greater Dublin Area 2022-2042 in November 2021. A number of new stations have been identified in the draft Strategy, including at Kylemore, Cabra and Heuston West. Following the electrification and upgrade of the commuter lines, NTA has committed

to developing these stations in conjunction with Iarnród Éireann to provide higher levels of public transport accessibility at locations which currently accrue little gains from the presence of a rail corridor.

In the case of Heuston West, the scope of the DART+ South West Project included a Feasibility Report and Concept Design for a potential new station at this location. Having regard to public feedback, the progress made on the Feasibility Report and Concept Design and having regard to the location of the potential station within Iarnród Éireann lands at Heuston (and more specifically at the location of the existing platform 10), Iarnród Éireann has made the decision to include the new Heuston West Station in the scope of the Project to be brought forward for Railway Order (RO). The inclusion of an intermediate station between Park West & Cherry Orchard Station and Glasnevin Station at Heuston will address the concerns and opportunities identified by the public relating to servicing the local community and multi-modal interconnectivity.

4.8.3.2. Extending the DART+ South West Project

Some submissions requested the extension of the Project to Sallins / Naas.

The National Transport Authority published the draft Transport Strategy for the Greater Dublin Area 2022-2042 in November 2021. The draft Strategy identifies that forecast demand for travel, when considered in tandem with the need to reduce transport emissions, has shown that, over the lifetime of the Transport Strategy, there will be a requirement to further extend DART services to key locations in the GDA. An extension of the DART service on the Kildare Line to Naas / Sallins will provide additional capacity to this area, including to a planned regional Park & Ride site in this vicinity.

4.8.3.3. Facilities at Existing Railway Stations

A significant number of submissions raised concerns regarding existing facilities at stations. All concerns have been noted and passed to the relevant teams within the DART+ Programme, who will assess each issue in greater detail, including

Pedestrian and Cycling Facilities: Pedestrian and cycling facilities associated with many of the existing stations were provided as part of the original Kildare Route Project; the facilities are constantly under review and are the responsibility of the Iarnród Éireann Station Enhancement Programme.

The provision of strategic Park & Ride facilities and car parking at or near existing train stations is not part of the DART+ Programme. However, the NTA's Park and Ride Development Office is currently working with Iarnród Éireann to identify strategic locations to develop Park & Ride schemes that will connect with the rail system. Proposals to develop Park and Ride will be brought forward independently of the DART+ Programme.

5 General Linear Works (End-to-End)

5.1 Introduction

The Project will require modernisation and modifications to the existing railway line. There is a range of general linear works required along the full length of the Project to enable the electrification of the line and the upgrade of the existing network. This chapter sets out information in relation to elements of the Preferred Option that are relevant to the entire length of the railway corridor including:

- Overhead electrification equipment (OHLE) will be required along the full extent of the railway line from Hazelhatch & Celbridge Station to Heuston Station and through the Phoenix Park Tunnel Branch Line up to Glasnevin Junction, where it will link with the proposed DART+ West Project. This will be similar to the overhead electrification equipment currently used on the existing DART network.
- Signalling upgrades and additional signalling infrastructure.
- Telecommunications infrastructure including buildings.
- Ancillary equipment cabins.
- Works to the Permanent Way (or track or railway corridor) including all ancillary installations such as rails, sleepers, ballast interfaces with existing utilities, boundary treatments, drainage works, vegetation management and other ancillary works.

The OSR also provides a high-level consideration of options which have occurred to date in respect of particular elements of the general linear works. In this regard, alternatives in respect of many of the linear works vary little from an environmental perspective, and consequently the options assessment for the likes of signalling systems, for example, is largely a technical matter rather than an issue of environmental impact.

This Section also further elaborates, having regard to design development since PC1 / to date, the railway infrastructure requirements of the Project.

The following elements, while required along the full length of the Project, are nevertheless at discrete locations. These are dealt with in the following chapters. Nevertheless, we have included information in respect of particular elements to avoid repetition in the following chapters – including options under consideration for retaining walls.

- Six electrical substations will be required at intervals along the rail line to provide power to the network.
- Where existing bridges do not provide the necessary clearance for overhead electrification of the lines or lateral clearance for four-tracking, options are being considered on a case-by-case basis, these include:
    - Provision of specialist electrical solutions for the OHLE with reduced clearance;
    - Lowering the rail track under the bridge;
    - Modification of the existing structure;
    - Removal of the existing structure and provision of a replacement structure; or
    - A combination of the above.

- Retaining walls supporting widening of the rail corridor and replacement bridges.
- Overhead electrified line protection works at bridges.
- Construction compounds.

5.2 Signalling, Electrical and Telecommunications (SET)

5.2.1 Signalling System

The signalling system is used to safely control and monitor train movement on the Irish Rail network. The system comprises a network of sensors, controls, signs and lights; it also includes localised control cabinets and cabins.

In order to achieve the necessary capacity enhancements and performance required for the DART+ Programme, it will be necessary to upgrade the existing signalling system as well as replacing some of the legacy signalling system. This will include the provision of Signalling Equipment Rooms (SER), Low Voltage Rooms (LVRs) and Relocatable Equipment Buildings (REB) where required along the route in order to accommodate signalling equipment and associated power supplies and backup.

A Signalling scheme plan has been developed for the route. The scheme identifies the proposed number and type of signals that will be allocated on the route. The following section details the typical physical signalling infrastructure that will be installed along the route.

The signalling system is a technical, operational and safety requirement of the project; and will be located entirely within the existing and widened railway corridor.

5.2.1.1 Signals

Signals may be mounted on posts, masts or large structures, such as gantries and cantilevers. Gantries and cantilevers will generally be placed only in stations or areas with more than two tracks. **Figure 5-1** shows a typical signalling cantilever and trackside signal post.


Figure 5-1 Typical Signalling Infrastructure

5.2.1.2 Object Controller Cabinet (OBJ)

In the railway system, the movement of the train is controlled by an interlocking system. Such an interlocking system consists of different parts. From a logical perspective, there is a central device (computer) that controls and senses the condition of important equipment such as switches, signals, track circuits, etc. This equipment is collectively referred to as an object or rail side object. The equipment that handles the interface between the central device and the object is referred to as an object controller. A typical Object Controller Cabinet is shown in **Figure 5-2**.

5.2.1.3 Location Case

Location Cases (LOCs) accommodate railway signalling equipment to detect the location of trains, control the trackside signals and switch the points. They link the physical asset to the control equipment within. Additionally, they are used to accommodate the required power distribution to the signalling equipment. A typical Location Case is shown in **Figure 5-2**.

Figure 5-2 Examples of typical Object Controller Cabinet (OBJ) and Location Case

5.2.2 Electrical

It is a project requirement to provide an electrification system that is compatible with the existing DART system and other electrification projects associated with the DART+ Programme.

Equally to the existing DART network, the new DART+ Programme will operate at 1,500V DC (Direct Current), with trains being powered via the Overhead Line Equipment OHLE.

The power supply is required along the full length of the Project, from Celbridge and Hazelhatch Station to Heuston Station and through the Phoenix Park Tunnel up to the Glasnevin Junction where the line connects with the proposed DART+ West scheme.

The OHLE system will be supplied with electrical power from the ESB distribution network at regular intervals, at locations known as substations. These substations will receive power from the local power distribution network and transform this into the required 1500V DC for distribution along the OHLE system.

A Power Study was commissioned by Iarnród Éireann (IÉ) for the DART+ Programme to assess the optimal distribution of electrical substations. This Study identified the following locations for required traction power sub-stations for the DART+ South West Project:

- Islandbridge/Heuston
- Kylemore
- Park West
- Kishoge
- Adamstown
- Hazelhatch

Figure 5-3 Proposed Substation Locations (DART+ Power Study)

The substations will comprise a secured, fenced compound surrounding a building which will house all the necessary electrical switching and feeding equipment. Welfare facilities are also required for Iarnród Éireann's maintenance teams. The characteristics of the substation compound and buildings for the DART+ South West Project are as follows:

- The footprint of a typical substation compound will generally be 50m (length) x 20m (wide) (i.e. approximately 1,000sq m). The substation dimensions will generally be 35 m (length) x 10 m (width) and 6 m (height).
- Consistent with the existing Irish Rail substations:
    - The substation compound will be secured by a 2.4 m high security fence, or similar. See below for a typical OHLE substation including security fencing.
    - The architectural finish will be grey brick / blocks. However, there may be site specific areas where a high architectural finish is required. See **Figure 5-5** for a typical substation appearance.

- The substation must be located at ground level in order to facilitate the installation or replacement of heavy electrical equipment, the immediate area around the substation should be level.
- Substations must be located so that the access doors open outwards onto a clearly marked low-risk fire area.
- The exterior and the access of the electrical substation must be illuminated with sufficient lighting to assure the mobility and the security of any operation during the hours of darkness.
- The design of the substations will be subject to further design development at the next design stage and the inclusion of ESB requirements. The sizing of the proposed substations has been taken from information obtained from ESB.

Figure 5-4 Typical Substation

For further detail in relation to substations proposed along the route, please refer to Volume 3 and other sections of this report.

5.2.3 Telecommunications

The purpose of the Telecom Equipment Building (TER) is to house servers, storage devices, switches, routers, cabling patch panels and any additional passive electronics to provide IT services (access control, CCTV, intrusion detection, patch panels, public address system, voice announcement system, distributed antenna systems) in the station and its area of influence. This is where the physical connection between the field equipment (signals, train detectors, etc.) and the electronic equipment takes place.

Figure 5-5 Typical Telecom Equipment Building

TERs will typically be located within stations on CIÉ owed land, for existing stations, a new TER room will be considered when the existing TERs lack sufficient capacity for new equipment.

The following requirements apply to TER rooms / buildings:

- The Station TER shall be as per current IÉ specifications – e.g.: min 4m x 3m, false floor, air conditioned, dedicated power board, 24hr access, access monitoring, fire detection.
- Telecommunication Equipment Rooms (TERs) shall be built as close as possible to the existing TER to facilitate the migration of the existing infrastructure into the new facility.
- Secured external light switch shall activate the internal equipment room lights.

According to the current design, it is expected to implement two TER rooms that will house the new equipment needed for the existing stations.

5.2.4 Overhead Line Equipment (OHLE)

Overhead Line Equipment (OHLE) generally refers to the mechanical and electrical items used to carry and deliver electrical power to the trains.

Electrical energy is supplied to the train through contact between the equipment mounted on the top of the train (pantograph) and an electrically live overhead cable. This cable is suspended from a system of steel masts. The live overhead cable is fed electricity from individual substations which are located along the route.

The existing Project route corridor is not currently electrified and no OHLE infrastructure has been installed. OHLE will therefore be required. The preferred option for the OHLE for DART+ Programme will comprise a pre-sagged simple (2-wire) auto-tensioned system, supported on galvanised steel support structures. While functionally similar to the OHLE on the existing DART network, modern design is being considered to maximise reliability and safety on the route.

While a standardised approach to electrification will be adopted, specific arrangements will also need to be considered at particular locations.

OHLE is formed by auto-tensioned section lengths by means of a fixed-point anchor at one end and balance weights or spring solutions at the opposite end ensuring constant tension regardless of the variation of temperature.

The mechanical tension can be achieved by two main solutions, springs or counterweights/balance weights. The type of OHLE mechanical compensation equipment shall be determined at a later stage of the design process when further information is available.

OHLE masts will carry support frameworks for the OHLE system over each of the electrified tracks. Vertical hangers will support and separate the upper and lower wires; additional feeder cables, insulators and earth wire

Figure 5-6 Typical OHLE Mast Arrangement

OHLE foundations will be a critical and key element for the electrification works to be undertaken under the DART+ Programme. Three foundation options are consideration (steel pile driven, concrete bored pile and concrete PAD). The type of foundation shall be finalised at a later stage as part of the design development process.

5.2.4.1 OHLE Alternative Arrangements

The OHLE arrangement will vary at different sections along the route depending on the track configuration, clearance to structures and local site conditions. **Figure 5-8** shows a typical arrangement in a 2-track section.

Two Track Cantilevers (TTCs) are generally only be placed on one side of the line, to support OHLE on the two tracks. TTCs may also be used on two track sections where obstructions prohibit the use of single cantilevers. TTCs will be the OHLE arrangement from Hazelhatch & Celbridge Station to Park West & Cherry Orchard Station.

Single Track Cantilevers (STCs) support the OHLE over one track and are generally used on sections where there is sufficient space and no obstructions adjacent to tracks.

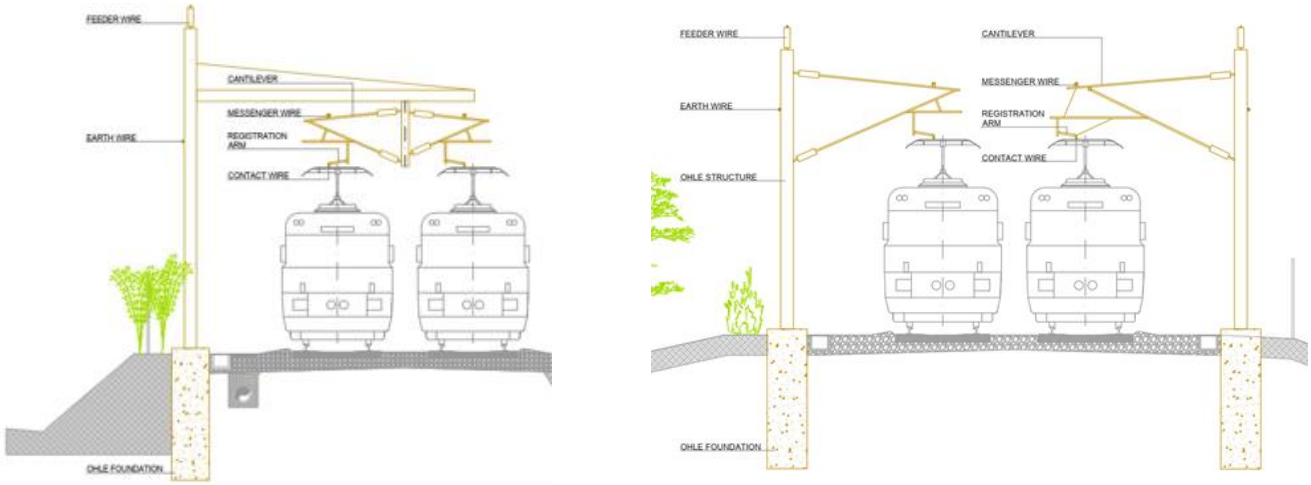


Figure 5-7 Alternative OHLE Arrangements in 2-Track Section

Figure 5-9 shows the typical configuration on the four track sections, Two Track Cantilevers (TTCs) will generally only be placed on the north side of the line, to support OHLE on the northern two tracks.

This will be the OHLE arranagement between Hazelhatch & Celbridge Station and Heuston Station.

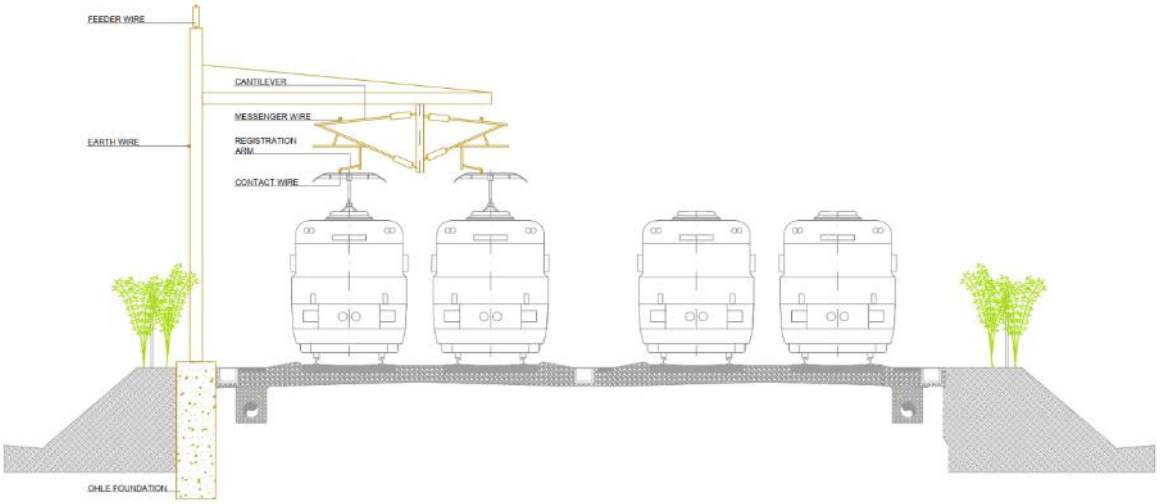


Figure 5-8 Typical OHLE Arrangement in 4-track Section (Northern Tracks Electrified)

In multi-track areas particularly around stations, more complex structures spanning multiple tracks will be needed. In such areas, it is generally not possible to use single mast structures as there is insufficient space between the tracks. In these areas TTCs or Portals (**Figure 5-10**) are proposed.

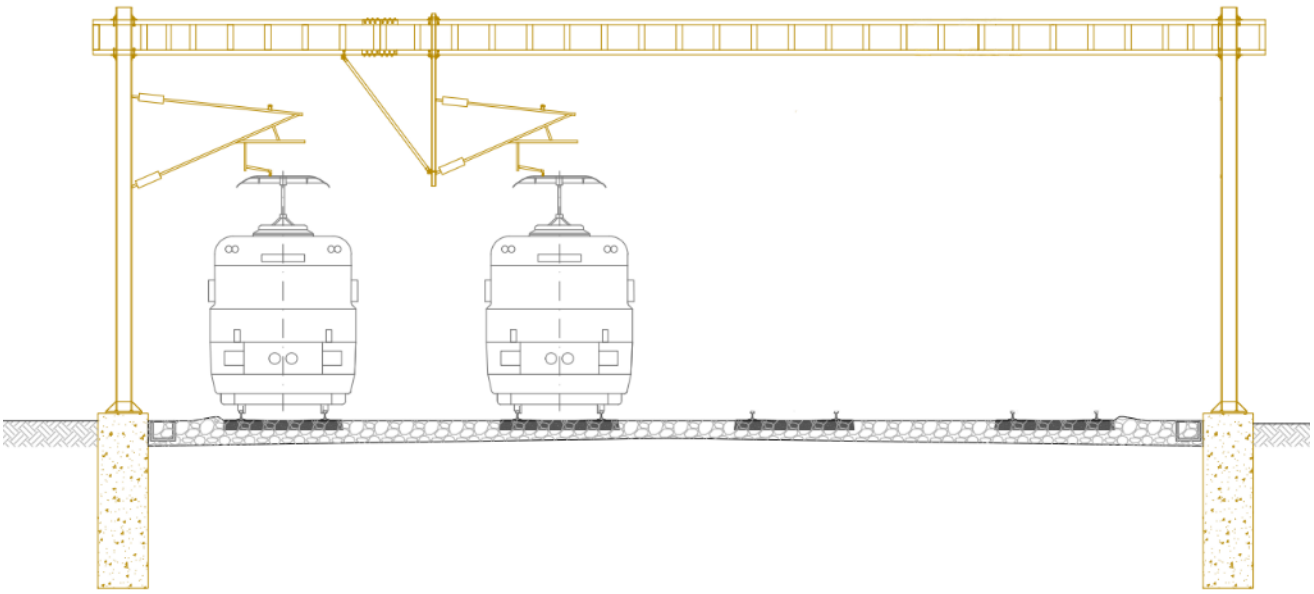


Figure 5-9 Typical OHLE portal arrangement in four track open route (Northern Tracks Electrified)

5.2.4.2 OHLE Clearances

Wherever a bridge crosses over the railway, it is necessary to ensure that the OHLE passes safely below the bridge. Where existing bridges do not, or may not, provide the necessary clearance for OHLE, a range of options have been considered on a case-by-case basis.

The options include modifications to the track layout and structural solutions to gain the necessary vertical and horizontal clearance. A detailed assessment has been carried out of each structure along the route to establish the clearance and level of intervention required to accommodate the OHLE system. The options associated with each structure are considered in further detail in **Volume 3**, and include the following (either standalone or in combination):

- Provision of specialist electrical solutions for the OHLE with reduced clearance.
- Lowering the rail track under the bridge.
- Modification of the existing structure.
- Removal of the existing structure and provision of a replacement structure.

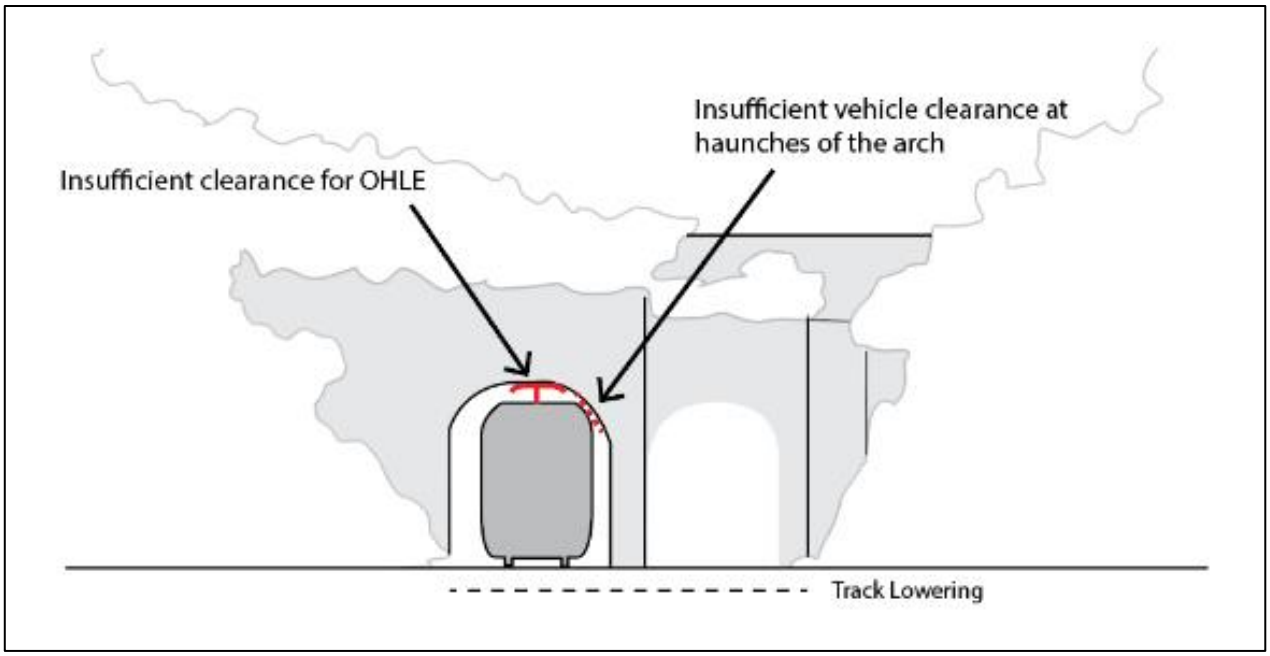


Figure 5-10 Typical Clearance Issue

Along the Project route corridor, there are several bridges that have insufficient vertical headroom for OHLE or lateral clearances for four-tracking (where required) therefore, reconstruction is unavoidable to meet the Project requirements. Six structures on the section between Cherry Orchard and Heuston Station and one structure on the Phoenix Park Tunnel branch line require reconstruction.

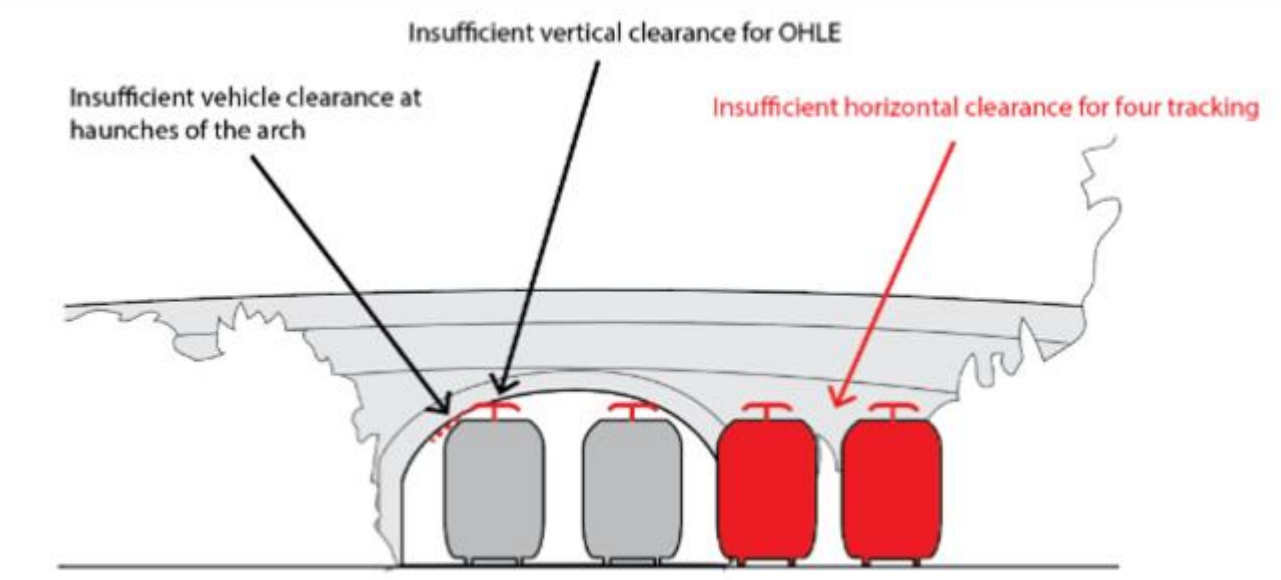
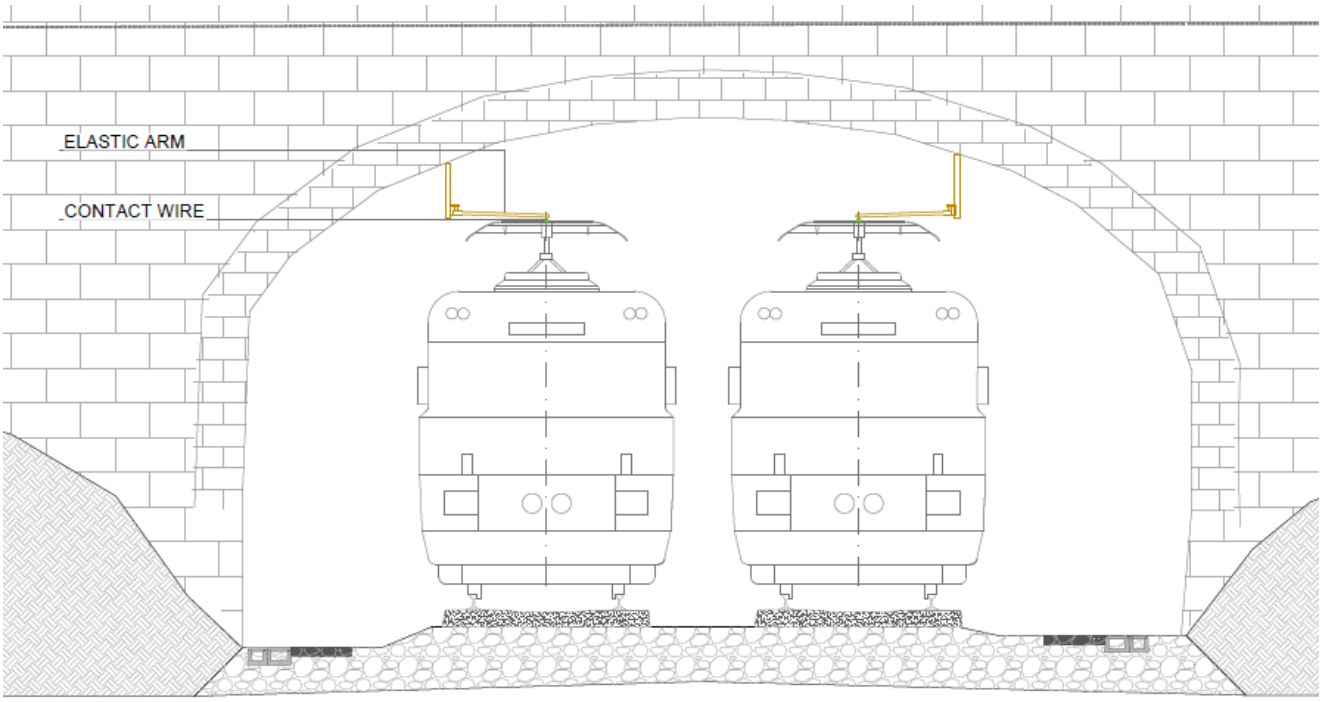
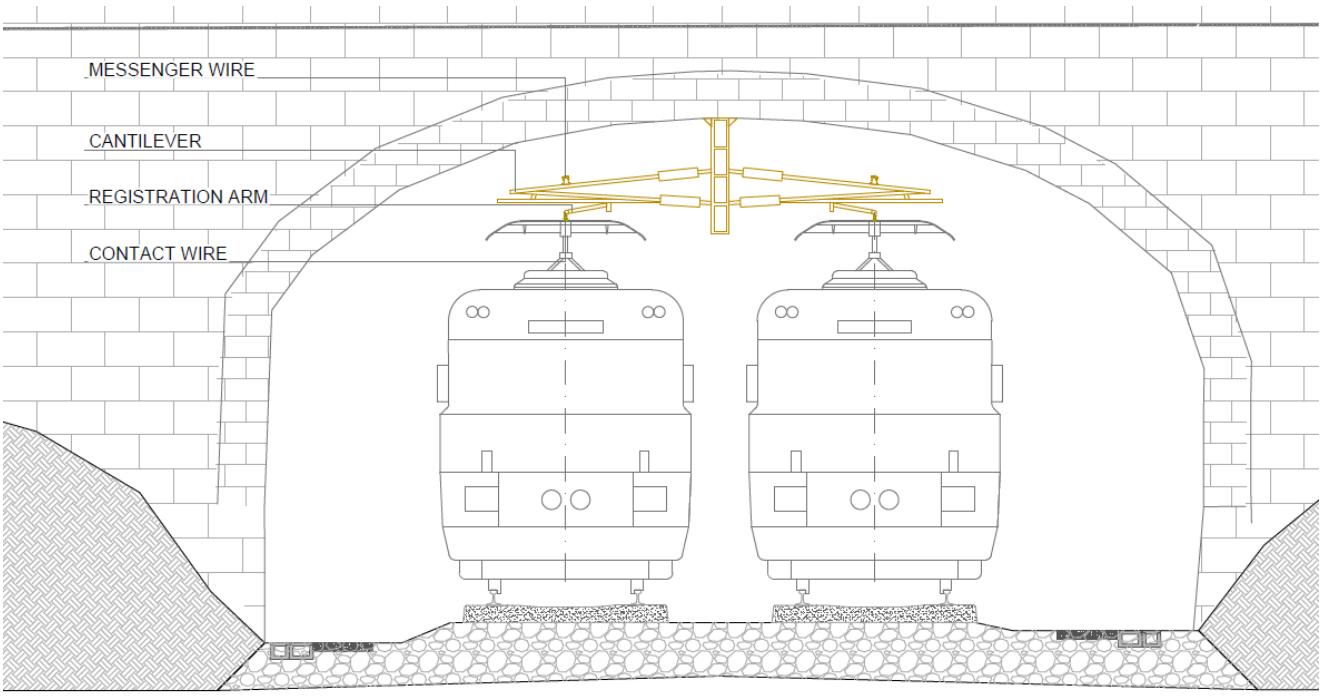


Figure 5-11 Le Fanu Road Bridge (OBC7) – Limited Vertical and Horizontal Clearances

For other bridges, including those along the Phoenix Park Tunnel Branch Line, where the required electrical clearance beneath the bridges is sub-standard, clearances will be increased by means of track lowering, fitted OHLE and / or derogation from Standard.

Detailed surveys have been undertaken of all structures along the route, and this information have been used to establish the extent of the interventions required to each of the bridges. Details of the options are outlined in **Sections 6 - 8** and **Volume 3**.





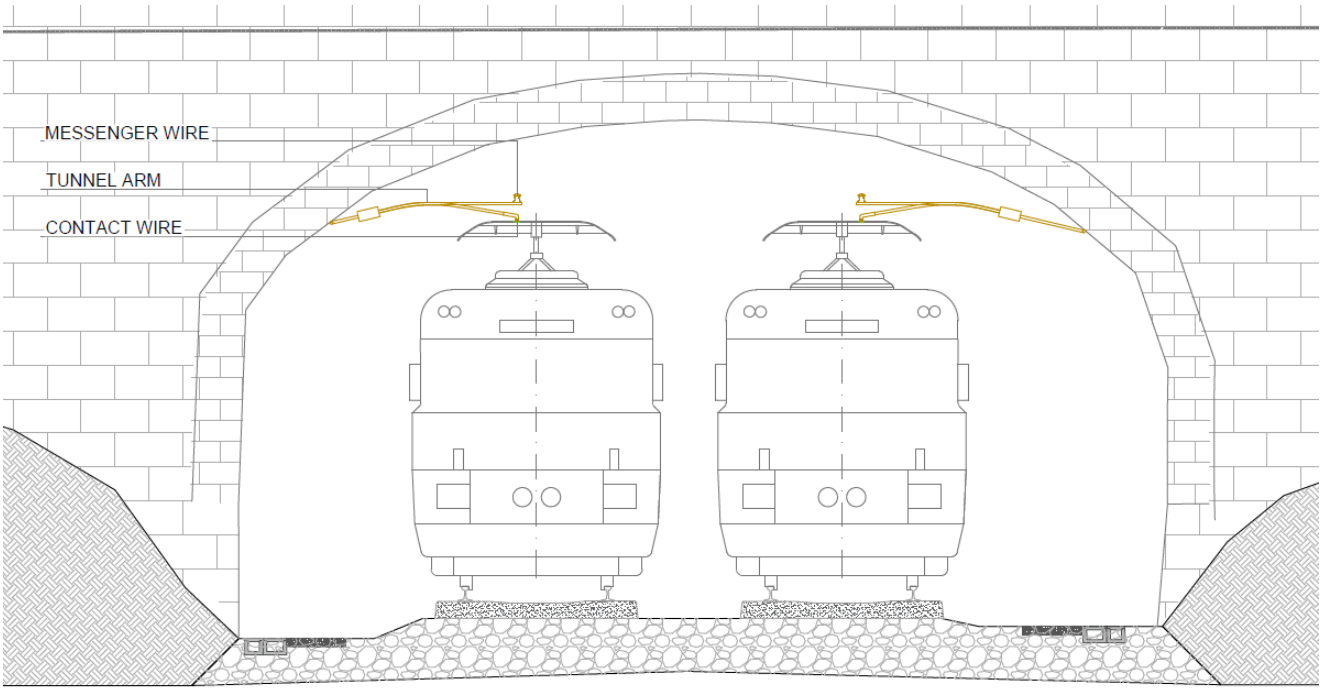


Figure 5-12 Alternative Bridge OHLE Arrangements

5.2.4.3 OHLE Protection Measures

The existing bridges along the route must comply with necessary safety requirements by providing suitable protection for the general public to prevent accidental contact with the OHLE. The existing bridges which are to be retained, have been assessed to determine if existing parapet heights comply with the safety requirements, details of the proposed bridge interventions are included in Volume 3.

Reasonable steps to prevent people from accidentally or otherwise falling onto or touching the OHLE are required to:

- Prevent access.
- Prevent falling.
- Prevent contact / sparking.

Two main options to achieve the necessary level of protection are currently under consideration and involve increasing the heights of existing bridge parapets (by either wall or panels) or installing safety screens over the OHLE.

Figure 5-13 Protection Works – Options

There are currently a number of options being evaluated for parapets and approach road containment walls for the new bridges.

The bridge parapets are required to provide an overall height of 1.8m above deck level. The options under consideration include full height precast reinforced concrete parapets, full height steel parapets, and 1.2m high Reinforced Concrete parapets with perforated or glazed sections to the remaining 0.6m to achieve the min height requirement. Two bridges on the Cork main line and one bridge on the Phoenix Park Tunnel Branch Line have been identified as potentially requiring bridge parapet modification works.

As the aesthetic is an important factor a number of finishes are being considered for the precast concrete options. These include introducing patterned concrete formers to replicate the existing masonry parapets currently in place. There a many different finishes available to use and the panels can be coloured. **Figure 5-15** illustrates some of the options available.

Figure 5-14 Parapets finishes for precast concrete

Other options under consideration are to fully clad the precast panels with masonry cladding to match the exiting parapets or to retain and repurpose the existing masonry in the parapets to be used as cladding for the new precast parapets. Other options being considered take into account landscape and visual considerations.

5.2.5 Permanent Way

The Permanent Way (PW) is a term used to describe the track or railway corridor and includes all ancillary installations such as rails, sleepers, ballast as well as lineside retaining walls, drainage, fencing and signage. Works to the track or railway corridor will arise from:

- Widening of the railway corridor and completing four-tracking between Park West & Cherry Orchard Station and Heuston Station.
- Bridge reconstructions arising from rail corridor widening.
- Track lowering arising from electrical clearance requirements.
- Improvements to the Phoenix Park Tunnel Branch Line to support the increased capacity.
- The sidings at Hazelhatch.

These works will include amongst other things:

- New / additional crossovers (when a train switches from one track to another across points), to accommodate the new operational model.
- The sidings strategy at Inchicore Works, to allow continuity of the operations.
- Track geometry improvements (within the current corridor's limits) to remove existing speed restrictions.
- Upgrades of the track safety for workers, implementing the prescribed separation between groups of two track and side space for walkways, where not available (i.e., at Inchicore and the three-track section between Inchicore and Heuston Station).

These are all captured in the Preferred Option presented in this OSR, based on the information and level of design detail to date. More information is provided in Volume 3.

5.2.6 Ancillary Works

5.2.6.1 Attenuation

Elements of the DART+ South West Project which can modify the performance of the current drainage system include track lowering, an increase in the rail corridor width (resulting in a larger catchment area for rainfall), and the introduction of slab track along parts of the corridor.

A preliminary assessment of existing drainage system along the Project route corridor and the attenuation requirements for the DART+ South West Project has been undertaken. Relevant considerations include:

- Existing and potential levels of run-off including the existing outfall to the River Liffey.
- The source and quantity of seepage into the Phoenix Park Tunnel.
- The possibilities for the existing attenuation system (including pumping stations, pressure pipes, attenuation tanks and soakaways) to cope with the potential changes.

Stormwater attenuation tanks are currently recommended for the following locations: Le Fanu Road, Inchicore, and Islandbridge. Where possible these will be accommodated along the railway corridor or on adjoining land owned by CIÉ.

Attenuation requirements for the Project are captured in Preferred Option presented in this OSR, based on the information and level of design detail to date. More information is provided in Volume 3.

5.2.6.2 Utility Diversions

The utilities that cross the existing rail corridor along the Project route corridor are generally concentrated in road bridges and train stations. There are also several utilities that cross underneath the tracks or run parallel to the tracks, such as Irish Water pipes (including both water supply and wastewater) and ESB ducts.

Utilities will be constraints during both the design and construction phases. As such, their treatment in the temporary and permanent situations has been carefully considered during the development of options.

Discussions are ongoing with service providers regarding the location and nature of existing utility services and structures, to determine whether diversion is required.

Utility diversions for the Project are captured in Preferred Option presented in this OSR, based on the information and level of design detail to date. More information is provided in Volume 3.

5.2.7 Retaining Walls

Several different retaining wall types are proposed for the Project depending on the height of the retained soil, the soil conditions and the proximity of buildings to the railway corridor**.** The locations are indicated in on the General Schematic Layouts in **Volume 1.** These options are described once below, and the approach for particular areas under consideration, will be set out in the following chapters.

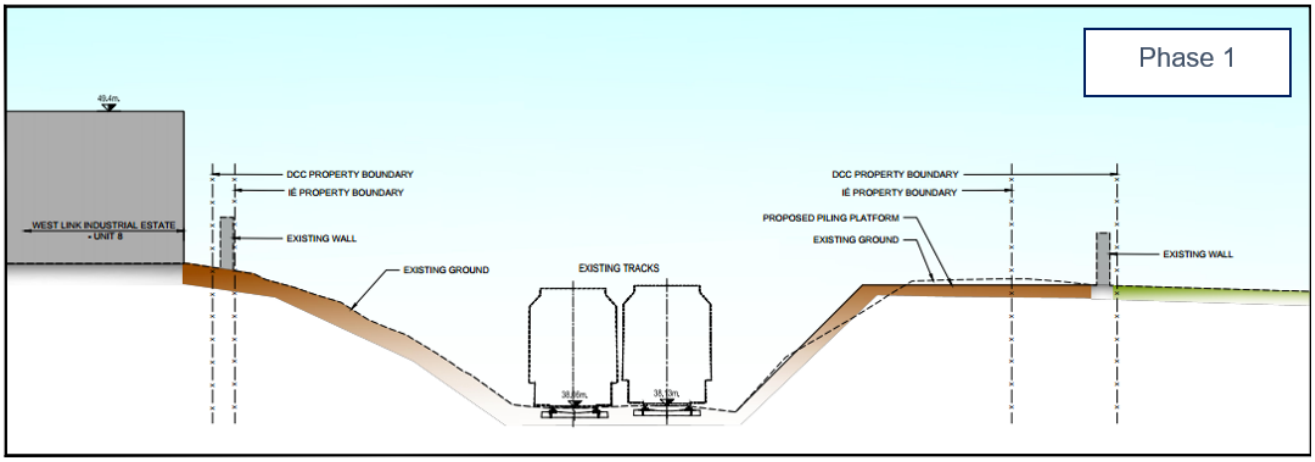
5.2.7.1 Secant piled walls and contiguous bored piled walls

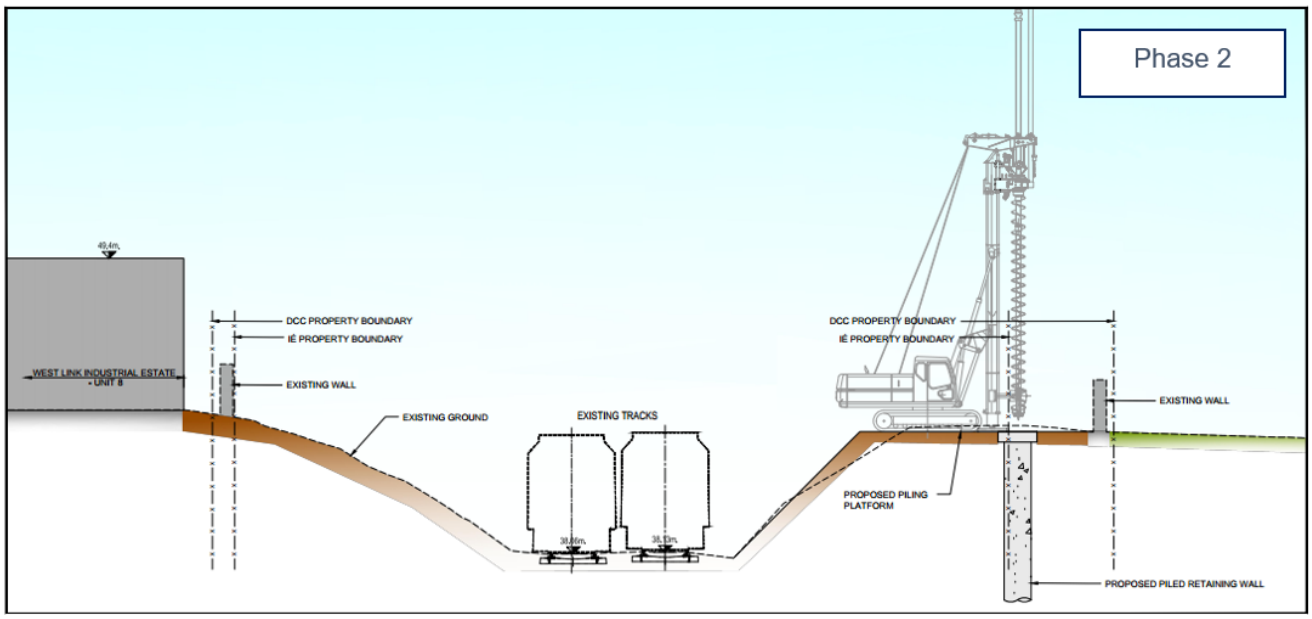
Secant and contiguous bored piled walls are constructed using a top-down method i.e. they are constructed through the soil and then the soil in front of the walls is removed. Large piling rigs are required to core large diameter holes through the soil using augers through soil and corers through rock. Once the soil is removed a reinforcement cage is lowered into the holes and concrete is poured. New piles are added to the side of the first

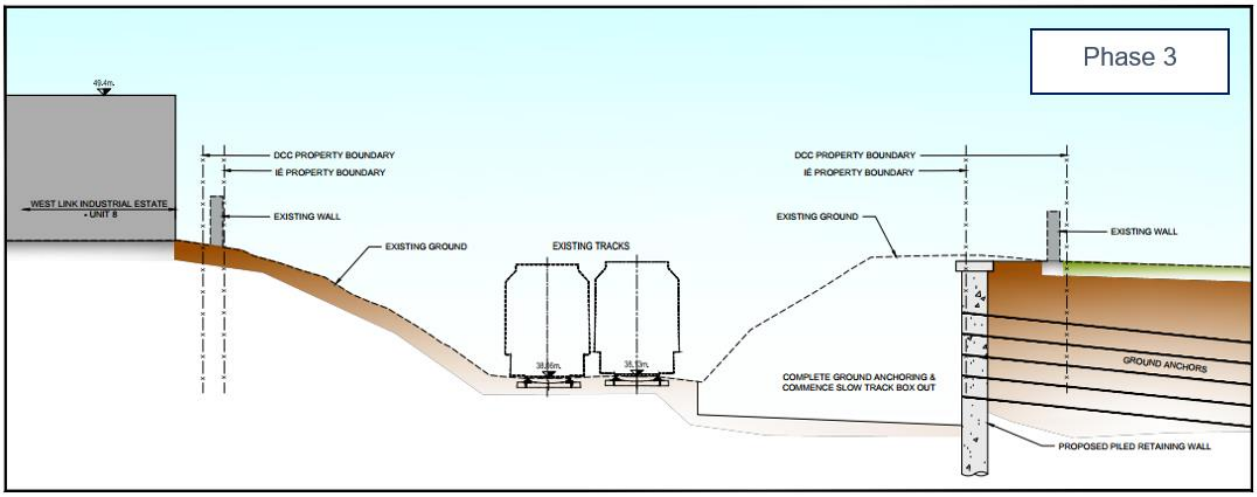
to create a wall. Secant pile walls have continuous piles interconnected with each other and contiguous piles have gaps between the piles and are infilled between to create continuous support.

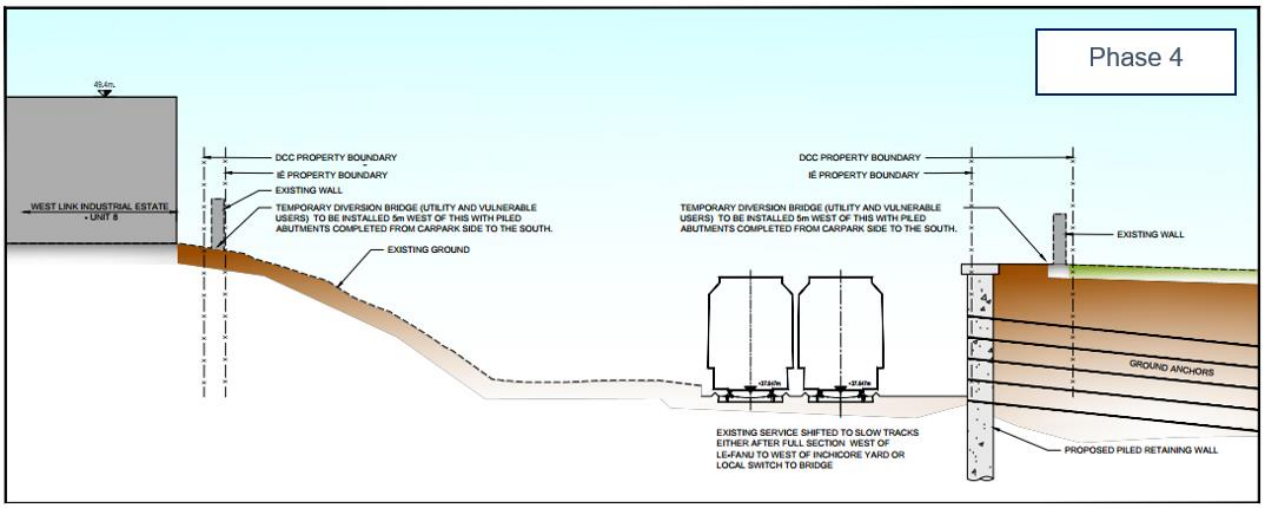
The boring of the piles, the removal of spoil, the supply of reinforcement cages and concrete to and from the wall position is a significant operation requiring large piling equipment, cranes, dump trucks, and large concrete and rebar supply and dump vehicles. These operations require good access and egress, a stable operational platform and significant working space.

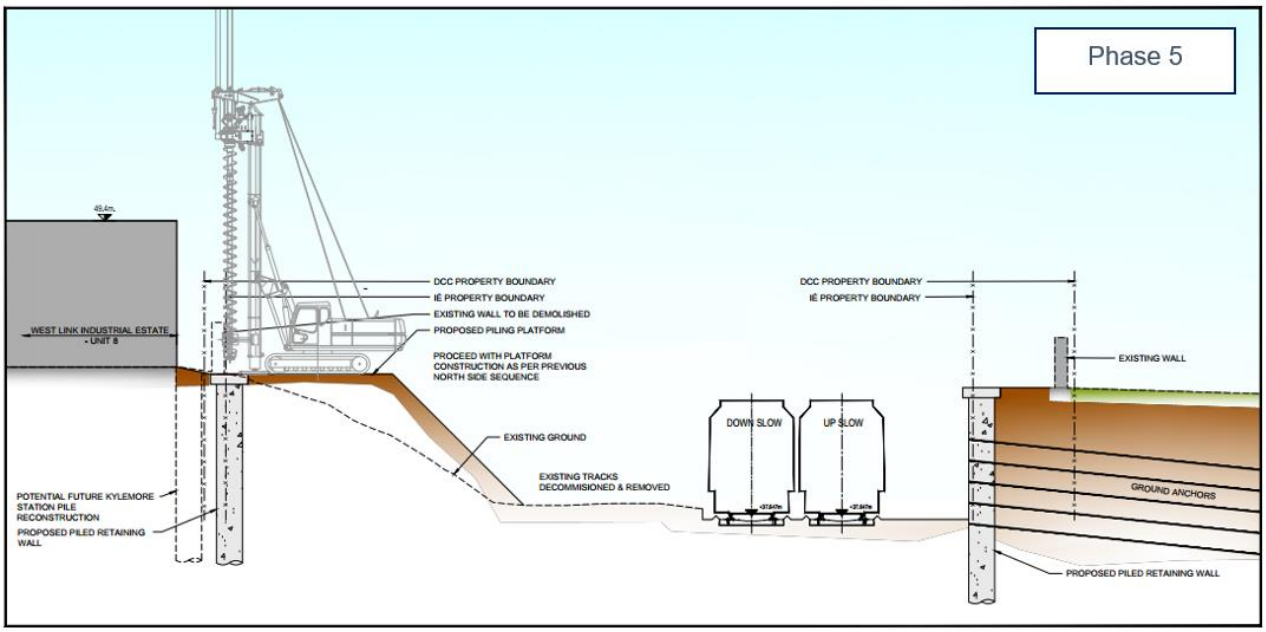
A typical construction methodology and phasing is illustrated below.






Phase 3
WEST LINK INDUSTRIAL ESTATE - UNIT 8
DCC PROPERTY BOUNDARY
IÉ PROPERTY BOUNDARY
EXISTING WALL
EXISTING GROUND
EXISTING TRACKS
COMPLETE GROUND ANCHORING & COMMENCE SLOW TRACK BOX OUT
GROUND ANCHORS
PROPOSED PILED RETAINING WALL


Phase 4
WEST LINK INDUSTRIAL ESTATE - UNIT 8
DCC PROPERTY BOUNDARY
IÉ PROPERTY BOUNDARY
EXISTING WALL
TEMPORARY DIVERSION BRIDGE (UTILITY AND VULNERABLE USERS) TO BE INSTALLED 5m WEST OF THIS WITH PILED ABUTMENTS COMPLETED FROM CARPARK SIDE TO THE SOUTH.
EXISTING GROUND
EXISTING SERVICE SHIFTED TO SLOW TRACKS EITHER AFTER FULL SECTION WEST OF LE-FANU TO WEST OF INCHICORE YARD OR LOCAL SWITCH TO BRIDGE
GROUND ANCHORS
PROPOSED PILED RETAINING WALL


Phase 5
WEST LINK INDUSTRIAL ESTATE - UNIT 8
DCC PROPERTY BOUNDARY
IÉ PROPERTY BOUNDARY
EXISTING WALL TO BE DEMOLISHED
PROPOSED PILING PLATFORM
PROCEED WITH PLATFORM CONSTRUCTION AS PER PREVIOUS NORTH SIDE SEQUENCE
EXISTING GROUND
EXISTING TRACKS DECOMMISIONED & REMOVED
DOWN SLOW
UP SLOW
POTENTIAL FUTURE KYLEMORE STATION PILE RECONSTRUCTION
PROPOSED PILED RETAINING WALL
GROUND ANCHORS

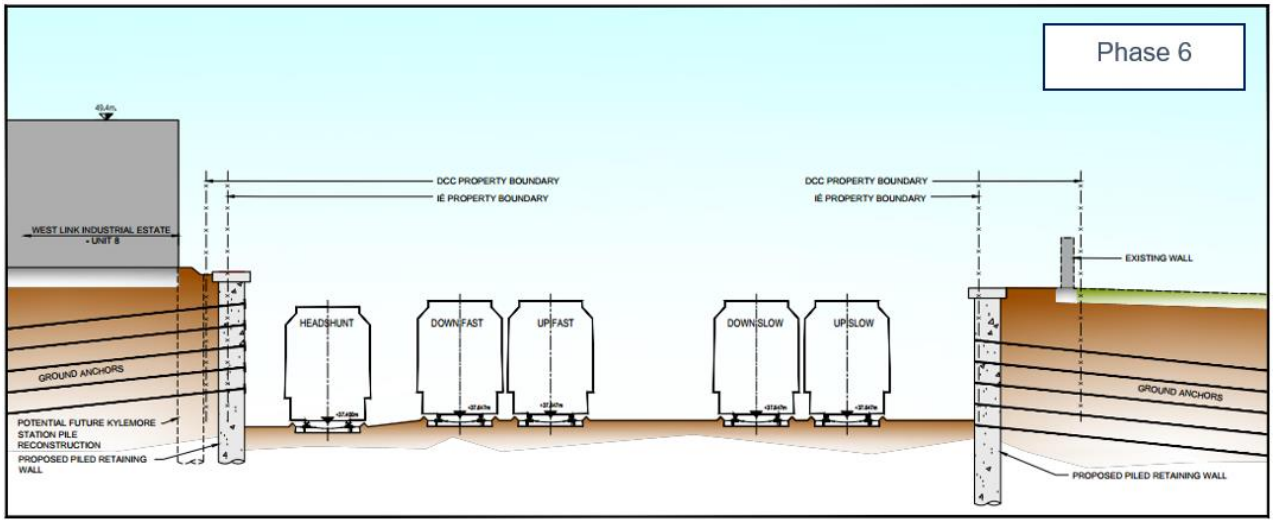


Figure 5-15 Typical Construction Methodology and Phasing

5.2.7.2 Cantilever Retaining Walls

Cantilever walls can be constructed by locally steepening the cut slopes. This will create the space for cast in place or precast construction. The working sites will require access for relatively heavy plant (small cranes, concrete trucks, dump trucks etc) and it is anticipated that this will be done by means of a bench at the base of the slope or using possessions of the railway to create access via temporary haul roads. Cantilever walls can be cast in situ or precast with precast being preferred on time-critical sites so as the rail environment.

5.2.7.3 Soil Nailing

Soil nailing is a top-down walling method. From the top, soil is excavated over a short height. The surface of the excavation can be spray concreted with steel mesh placed in position if required. When the concrete has cured sufficiently, long steel rods are driven into the retained soil and stressed to give the wall global stability and strength. The area beneath the constructed section of wall can then be excavated and the process repeated until the entire height is complete.

The main advantage of soil nailing is that, relative to other options, it has less impact on adjoining properties in terms of noise and disruption. It also does not need so much large plant to install the wall and is therefore considered safer to the railway operation.

The main disadvantage of this method is that vertical walls cannot generally be created so more land take is required to form the wall. Also, the nails are required to extend several metres past the face of the wall and may encroach into property outside of the ownership of CIÉ. In this case a wayleave or other ownership mechanism may be required under certain properties.

6 Hazelhatch & Celbridge Station to Park West & Cherry Orchard Station

6.1 Introduction

This section of the railway extends between Hazelhatch & Celbridge Station and Park West & Cherry Orchard Station.

The works carried out under the original Kildare Route Project between 2006 and 2009 provided the main groundwork for DART+ South West Project, including the installation of the four-track section which commences to the west of Hazelhatch Station, where the two running lines diverge into four lines; the four lines continue on through Park West & Cherry Orchard Station. A number of these structures were also upgraded or replaced as part of the original Kildare Route Project.

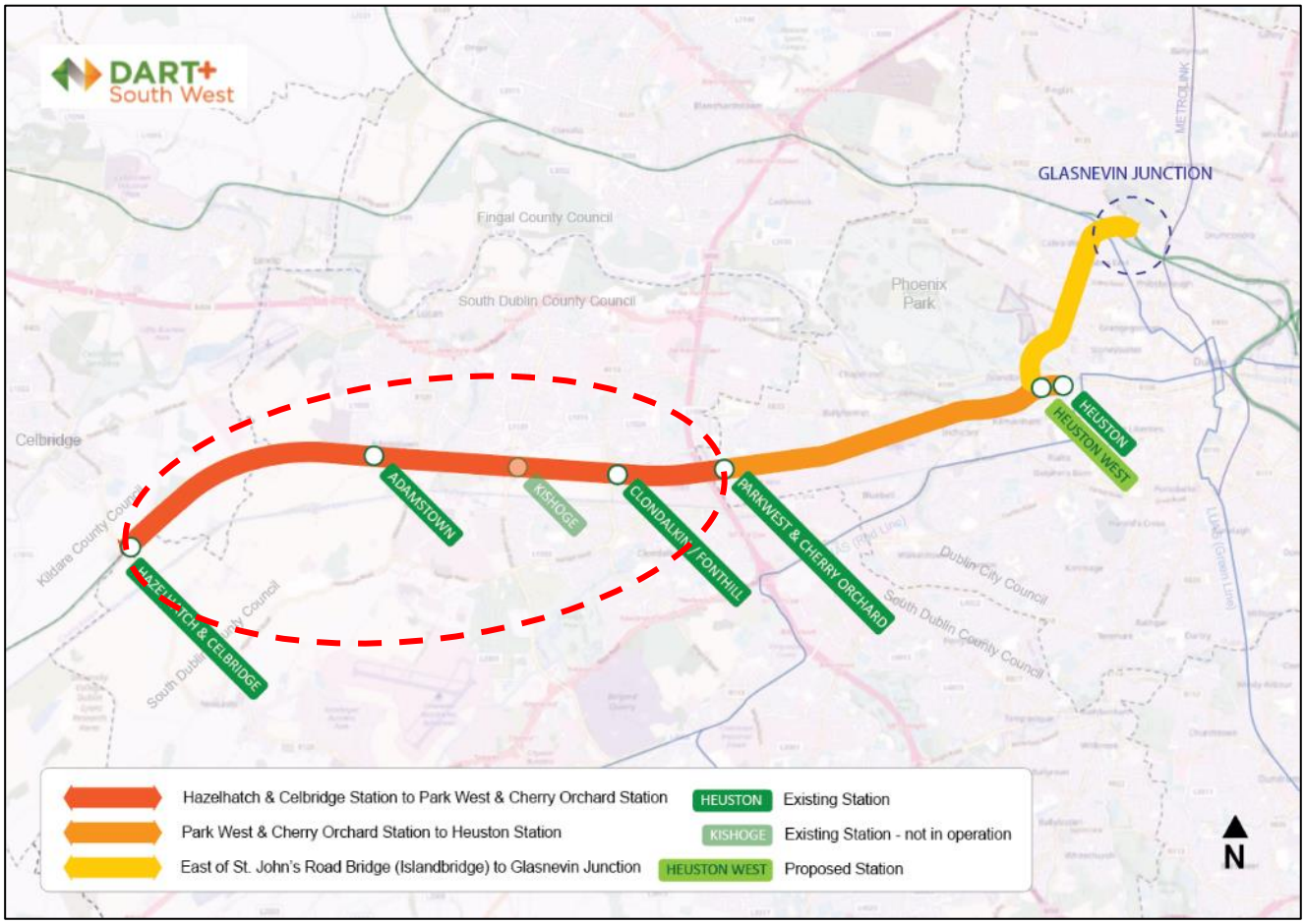


Figure 6-1 Hazelhatch & Celbridge Station to Park West & Cherry Orchard Station

6.2 Description of Railway Corridor

Hazelhatch, on the border between County Kildare and South Dublin, marks the western extent of the DART+ South West Project. Heading east from Hazelhatch & Celbridge Station passing through the townland of Stacumny and onwards towards Adamstown Station. North of the railway has witnessed significant residential development at Adamstown and west of the R120 (Newcastle Road, also known as Twelfth Lock Road and Adamstown Road)) at Hanstead and Tullyhall. Continuing east, the line heads towards Kishoge Station (currently not in operation) and onwards to Clondalkin / Fonthill Station. Although undeveloped, this area is the location of the Clonburris Strategic Development Zone (SDZ), where significant future development is envisaged, focused on the two railway stations. As the line continues east, the landscape changes from a more open area to built-up industrial areas. The line then passes under the M50 and heads into Park West & Cherry Orchard Station.

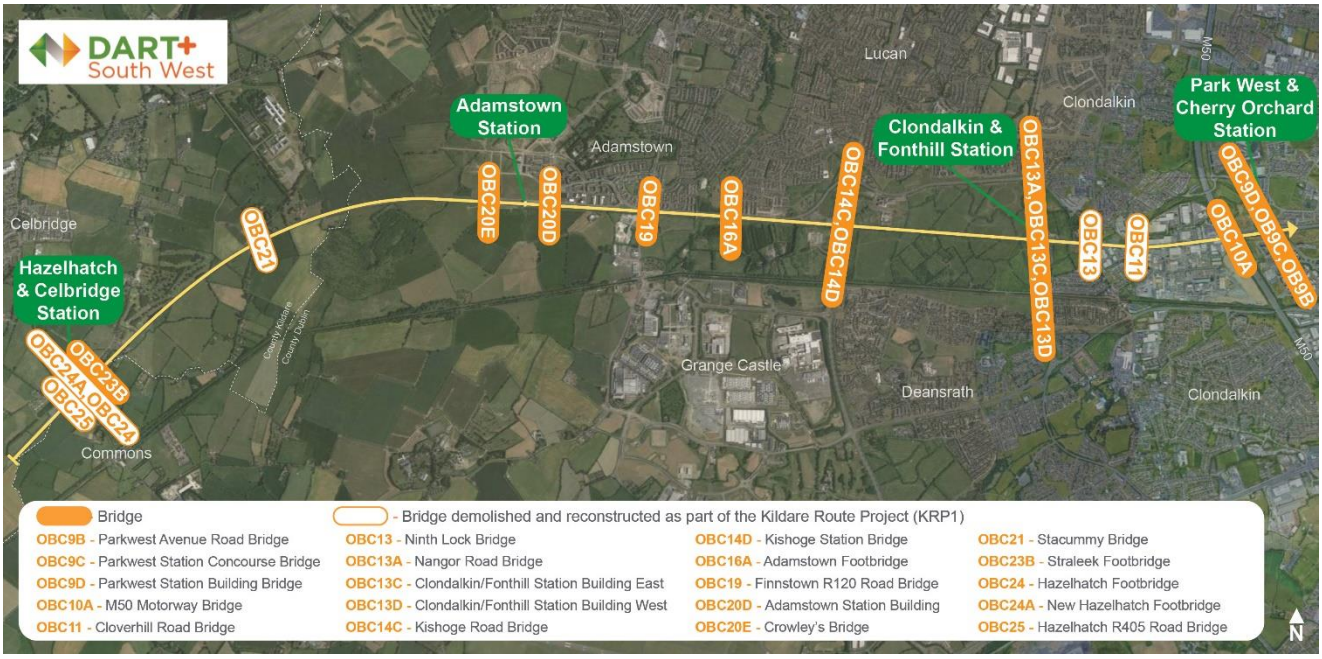


Figure 6-2 Bridge Locations between Hazelhatch and Park West

There are several road overbridges and footbridges along this section of the line. The bridges demolished and reconstructed as part of the Kildare Route Project were: Hazelhatch Footbridge, Hazelhatch Road Bridge, Stacumny Road Bridge, Ninth Lock Road Bridge and Station Road Bridge.

Hazelhatch R405 Road Bridge (OBC25)

Stacumny Road Bridge (OBC21)

Ninth Lock Road Bridge (OBC13)

Station Road / Cloverhill Road Bridge (OBC11)

Figure 6-3 Examples of Reconstructed Bridges Delivered by the Kildare Route Project

There are five existing stations along this section. From west to east, they are: Hazelhatch & Celbridge; Adamstown; Kishoge (not currently operational); Clondalkin/Fonthill; and Park West & Cherry Orchard. The station buildings illustrate the significant investment and enhancement delivered by the Kildare Route Project.

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Figure 6-4 Examples of Stations along this section of the Project Route Corridor

For more details on this section of the route refer to Volume 1 (Schematic Layout (Sheets 1-9)) and Volume 3A.

6.3 Review of Public Consultation No. 1 Feedback, Design Development and Preferred Option

The Project Team has analysed the submissions and considered all relevant information in the re-evaluation and further development of the design options for this section, leading to the selection of the Preferred Option.

The Preferred Option comprises the electrification of the two northern existing railway lines with the installation of overhead electrical equipment. Two Track Cantilever (TTC) support structures will be placed on the northern side of the track.

The majority of the existing overbridges and footbridges were upgraded or replaced as part of the original Kildare Route Project, and the electrification works can be run under the existing bridges with no / minimal intervention to the bridge structures. Only minor localised track lowering works are necessary to achieve the required clearance.

The line passes through a number of stations, including Hazelhatch & Celbridge Station, Adamstown Station, Kishoge Station (not currently in use), Clondalkin / Fonthill Station and Park West & Cherry Orchard Station. No works are envisaged to these stations as part the Project.

To facilitate the proposed increase in train frequency, it is proposed as part of the DART+ South West Project to modify the trackwork with additional crossovers and adjustments to the track alignment. Localised track modifications works are also required at Hazelhatch & Celbridge Station to facilitate the proposed DART service. To the west of the station, track modifications include the installation of a new a turnback siding (approx. 350m in length, to accommodate two full length train units). A new crossover on the slow lines will provide access into the siding from both Up and Down directions.

At Adamstown Station, the track layout requires modification to meet future operational requirements; the proposed works include the removal of an existing connection into the turnback on the central platform.

The lines continue from Adamstown and converge with the new four-tracking section to the west of Le Fanu Bridge.

6.4 Substations

The DART+ Programme Power Study determined the requirement for an electrical substation at Hazelhatch, Adamstown, Kishoge and Park West. The site selection process followed the two-stage optioneering process outlined in **Chapter 4**.

The final position of the substations will be subject to design development and confirmation from ESB in relation to suitability for incoming power supply connection. The purpose of the OSR is to determine the optimal location for the traction power substations

6.4.1 Hazelhatch

The general Hazelhatch area is predominantly agricultural in nature with the exception of Hazelhatch & Celbridge Station and a number of private dwellings located on the L5063 Lords Road to the northwest, and Railway Cottages to the southeast of the station.

6.4.1.1 Stage 1: Preliminary Assessment

The Feasibility requirements for substations are electrification, constructability, and safety. The Project objectives and Requirements are Proximity to the Railway Line, Vehicular Access and Site Size.

Two Options, including the 'Do Nothing' option, have been identified for the area. Full details of the initial sifting assessment are included in Volume 3. A summary of the findings of the sifting assessment is provided in **Table 6-1**.

Option 1 is a brownfield site to the north of the railway in the ownership of CIÉ. It is located adjacent to the Hazelhatch Station carpark and other disused dwellings, also owned by CIÉ. It is situated to the east of Hazelhatch Station with direct access to the local road network.

Option 2 is located within a CIÉ owned maintenance yard on the northern side of the railway and to the west of the Hazelhatch Station. Road access is via an existing Right of Way access track across private lands to the L5063 Lords Road. It is located to the rear of existing private dwellings.

Table 6-1 Preliminary Assessment (Sifting) Findings for Hazelhatch Substation

Preliminary Assessment (Sifting) Findings for Hazelhatch Substation		
Option	**Description**	**Findings**
Option 0: 'Do Nothing'	There is no substation.	Will not deliver Project objectives or requirements.
Option 1:	Brownfield site to the north of the railway in the ownership of CIÉ.	Feasible
Option 2:	Brownfield site to the west of the railway station, in the ownership of CIÉ.	Not Feasible - Does not comply with the power study requirements

Options 0 and 2 fail to meet the necessary Engineering Feasibility and Project Requirements for a substation location (highlighted in grey). Option 2: does not meet the necessary Engineering Feasibility and Project Requirements for a substation location as the proposed location is outside of the tolerances of the power study.

As only one option (Option 1) meets with the necessary Engineering Feasibility and Project Requirements, it is the Preferred Option. Stage 2: MCA was not required.

Figure 6-5- Hazelhatch Proposed Substation Locations

6.4.1.2 Preferred Option

The preferred site is located adjacent to the Hazelhatch Station carpark and other disused dwellings also owned by CIÉ. It is situated to the east of Hazelhatch & Celbridge Station with direct access to the local road network.

6.4.2 Adamstown

The general Adamstown area is predominantly rural in nature with the exception of the ongoing residential and mixed-use development at Adamstown Strategic Development Zone, to the north of the railway line.

6.4.2.1 Stage 1: Preliminary Assessment

The Feasibility requirements for substations are electrification, constructability, and safety. The Project objectives and Requirements are Proximity to the Railway Line, Vehicular Access and Size of Site.

Two Options, excluding the 'Do Nothing' option, have been identified for the area. Full details of the initial sifting assessment are included in Volume 3. A summary of the findings of the sifting assessment is provided in **Table 6-2**.

Table 6-2 Preliminary Assessment (Sifting) Findings for Adamstown Substation

Preliminary Assessment (Sifting) Findings for Adamstown Substation		
Option	**Description**	**Findings**
Option 0: 'Do Nothing'	There is no substation.	Will not deliver Project objectives or requirements.
Option 1	This is a greenfield site currently in private ownership to the north of the railway.	Feasible
Option 2	This is a greenfield site currently in Iarnród Éireann's ownership to the south of the railway.	Feasible

Option 0 'Do Nothing' fails to meet the necessary Engineering Feasibility and Project Requirements for a substation location (highlighted in grey).

Options 1 and 2 meet the necessary Engineering Feasibility and Project Requirements for a substation location and are brought forward to Stage 2: MCA for detailed assessment (highlighted in green).

Figure 6-6 Adamstown Proposed Substation Location Options

6.4.2.2 Stage 2: Multi Criteria Analysis

Two options met the necessary Engineering Feasibility and Project Requirements and were brought forward to Stage 2: MCA for detailed assessment, namely Option 1 and Option 2. They are described briefly below:

Option 1 – located in a greenfield site currently in private ownership to the north of the railway. There are currently no access roads to Option 1, potentially limiting access in and out.

Option 2 – located in a greenfield site currently in CIÉ's ownership. It is located to the south of the railway and adjacent to an existing pump station. There is an existing access track that runs adjacent / parallel to the railway providing an established access route between the proposed site and the public road network to the west. However, currently this track does not have any physical separation from the live railway.

Table 6-3 shows the summary findings of the comparative assessment undertaken during Stage 2: MCA.

Table 6-3 Adamstown Substation Location MCA Summary

CAF Parameters	Option 1 Assessment	Option 2 Assessment
1. Economy	Significant Comparable Disadvantage over Other Options	Significant Comparable Advantage over Other Options
2. Integration	Significant Comparative Disadvantage over Other Options	Significant Comparable Advantage over Other Options
3. Environment	Some Comparative Disadvantage over Other Options	Some Comparable Advantage over Other Options
4. Accessibility and Social Inclusion	Significant Comparative Disadvantage over Other Options	Significant Advantage over Other Options
5. Safety	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral
6. Physical Activity	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral
Conclusion		Preferred Option

In terms of Economy, Option 2 performs favourably due to ease of access and constructability. Option 2 can be accessed via a CIÉ-owned track which joins the public road network at Stacumney Bridge. It is assumed this track would require work to effectively separate it from the permanent way and thus permit access by ESB Networks personnel (unaccompanied by CIÉ TSCs). The site for Option 2 is also currently owned by CIÉ.

In terms of Integration, Option 2 offers a significant comparative advantage due to the ease of access to the adjacent road network and preferred buildability due to the existing access track.

With regard to Environmental criteria, Option 2 performs marginally better due to an expected lesser noise impact as this Option is located further away from existing and proposed residential developments.

Option 2 performs favourably in terms of Accessibility and Social Inclusion as it is located further away from nearby residential developments.

Both options are comparable in terms of Safety.

6.4.2.3 Preferred Option

Option 2 is the Preferred Option for the location of the proposed Adamstown Substation. It is located to the south of the railway and adjacent to an existing access road. The property is in CIÉ ownership.

6.4.3 Kishoge

The general Kishoge area comprises an existing station at this location which is currently not in use pending future / planned development in the area. A carpark has been constructed for the new station and is located on the southern side of the railway corridor. Located to the west of the station and on the southern side of the track is an existing halting site. To the north of the tracks and east of the station is an existing education facility.

The area is located within the Clonburris Strategic Development Zone (SDZ), specifically Development Area 6 – Kishoge Urban Centre.

6.4.3.1 Stage 1: Preliminary Assessment

The Feasibility requirements for substations are electrification, constructability, and safety. The Project objectives and Requirements are Proximity to the Railway Line, Vehicular Access and Site Size. Given the requirements of the Clonburris SDZ with regard to the development of high quality buildings, options that retain the substation structure in close proximity to the existing station and bridge has been a particular Project Requirement for a substation at this location.

Three options, excluding the 'Do Nothing' option, have been identified for the area. Full details of the initial sifting assessment are included in Volume 3. A summary of the findings of the sifting assessment is provided in **Table 6-4**.

Table 6-4 Preliminary Assessment (Sifting) Findings for Kishoge Substation

Preliminary Assessment (Sifting) Findings for Kishoge Substation		
Option	**Description**	**Findings**
Option 0: 'Do Nothing'	There is no substation.	Will not deliver Project objectives or requirements.
Option 1	Site is located to the west of the R136 regional road and to the south of the railway corridor. It is in a greenfield site in private ownership	Feasible
Option 2	Site is located to the east of the R136 regional road, on the southern side of Kishoge station. It is located within the existing carpark. The proposed site is in the ownership of CIÉ.	Feasible
Option 3	Site is located to the west of the R136 regional road and to the north of the railway corridor. It is in a brownfield site in private ownership.	Feasible

Option 0 'Do Nothing' fails to meet the necessary Engineering Feasibility and Project Requirements for a substation location (highlighted in grey).

Options 1, 2 and 3 meet the necessary Engineering Feasibility and Project Requirements for a substation location and are brought forward to Stage 2: MCA for detailed assessment (highlighted in green).

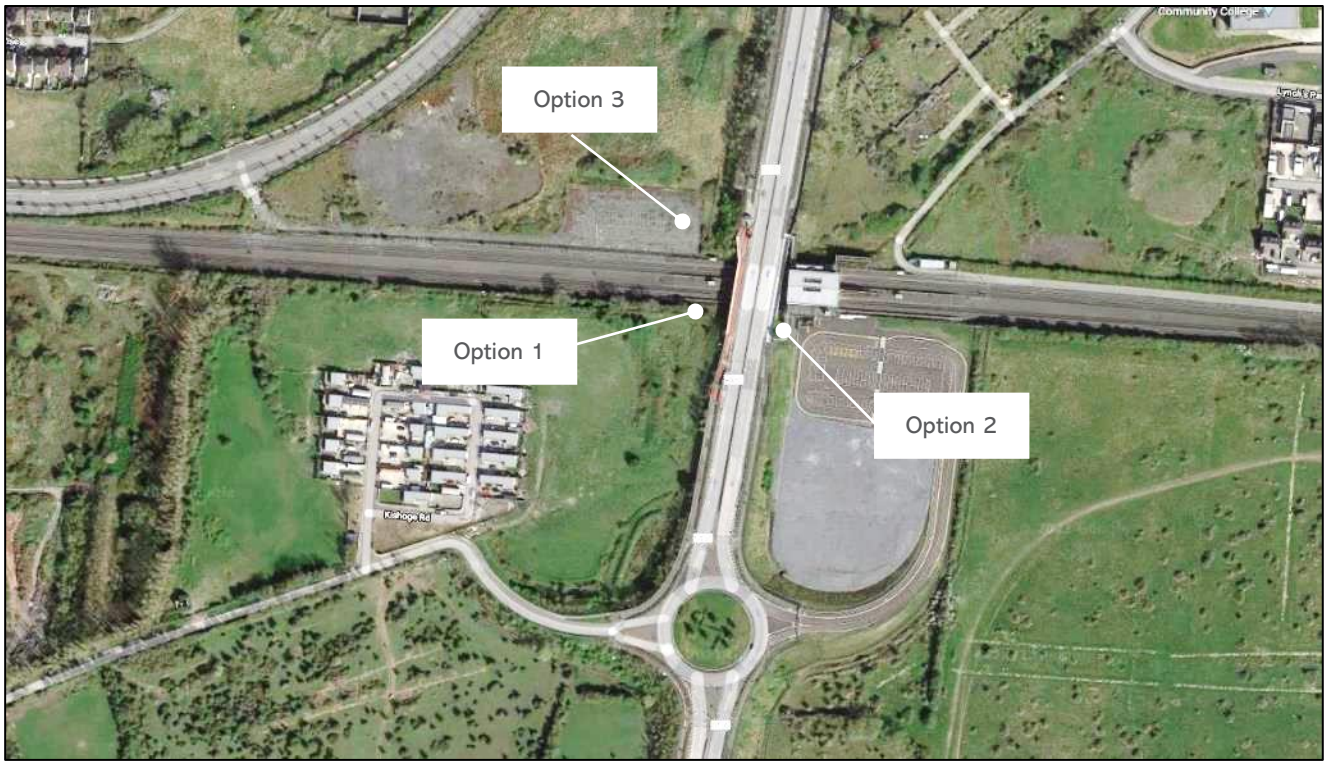

Figure 6-7 Kishoge Proposed Substation Location Options

6.4.3.2 Stage 2: Multi Criteria Analysis

Options 1, 2 and 3 were put forward for detailed assessment. Full details of the assessment matrix are available in Volume 3. The table below provides a summary of the MCA findings.

- **Option 1 –** located to the west of the R136 regional road and to the south of the railway corridor. It is in a greenfield site in private ownership in close proximity to the existing halting site. Access to the adjacent road network would be provided via a newly constructed access road.
- **Option 2 –** located to the east of the R136 regional road and on the southern side of Kishoge Station. It is located within the existing carpark. The proposed site is in the ownership of CIÉ. Access to the road network would be via the carpark entrance.
- **Option 3 –** located to the west of the R136 regional road and to the north of the railway corridor. It is in a brownfield site in private ownership. Access to the adjacent road network would be provided via a newly constructed access road.

Table 6-5 Kishoge Substation MCA Assessment Summary

CAF Parameters	Option 1 Assessment	Option 2 Assessment	Option 3 Assessment
1. Economy	Some Comparative Disadvantage over Other Options	Some Comparative Advantage over Other Options	Some Comparative Disadvantage over Other Options
2. Integration	Significant Comparative Disadvantage over Other Options	Significant Comparative Advantage over Other Options	Some Comparative Advantage over Other Options
3. Environment	Some Comparative Disadvantage over Other Options	Some Comparative advantage over Other Options	Some Comparative Disadvantage over Other Options
4. Accessibility and Social Inclusion	Significant Comparative Disadvantage over Other Options	Significant Advantage over Other Options	Some Comparative advantage over Other Options
5. Safety	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral
6. Physical Activity	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral
Conclusion		Preferred Option	

In terms of Economy, Option 2 performs favourably due to ease of access and constructability due to close proximity and existing access to the R136. ESB grid connection is likely to be comparable to other options.

All options are comparative in terms of Integration with Option 2 offering some comparative advantage over other options due to the ease of access to the adjacent road network.

With regard to Environmental criterion, Option 2 performs marginally better due to an expected lesser noise impact as this option is located further away from existing residential developments when compared to the other options. This option can be most easily incorporated into the existing station building envelope, with the objectives of the SDZ met through appropriate design and siting.

Option 2 performs favourably in terms of Accessibility and Social Inclusion as it is located further away from nearby residential developments.

All Options are comparable in terms of Safety.

6.4.3.3 Preferred Option

Option 2 is the Preferred Option for the proposed Kishoge substation.

6.4.4 Park West

The general Park West area is densely populated to the north, while south of the rail corridor is characterised mainly by industrial units, and to the east and west is a mixture of both industrial units and brownfield sites. The M50 motorway runs in a north – south direction and effectively splits the study area.

6.4.4.1 Stage 1: Preliminary Sifting

The Feasibility requirements for substations are electrification, constructability, and safety. The Project objectives and Requirements are Proximity to the Railway Line and Vehicular Access.

Two options, excluding the 'Do Nothing' option, have been identified for the area. Full details of the initial sifting assessment are included in Volume 3. A summary of the findings of the sifting assessment is provided in **Table 6-6**.

Table 6-6 Preliminary Assessment (Sifting) Findings for Park West Substation

Preliminary Assessment (Sifting) Findings for Park West Substation		
Option	**Description**	**Findings**
Option 0: 'Do Nothing'	**There is no substation.**	Will not deliver Project objectives or requirements.
Option 1	This site is located to the north of the railway and immediately east of the M50 motorway.	Feasible
Option 2	This site is located south of the railway corridor and immediately west of the M50 motorway. This is a brownfield site and was formerly in use as a maintenance depot by a major telecommunications provider.	Is located too far from the railway.
Option 3	This site located south of the railway corridor and immediately west of the M50 motorway. It is located within existing industrial estate premises / yards.	Feasible
Option 4	This site is located immediately adjacent to the south of the railway corridor, midway between the M50 bridge to the east and Station Road to the west. It is located within existing industrial estate premises / yards.	Feasible

Option 0 and Option 2 fail to meet the necessary Engineering Feasibility and Project Requirements for a substation location (highlighted in grey).

Options 1, 3 and 4 meet the necessary Engineering Feasibility and Project Requirements for a substation location and are brought forward to Stage 2: MCA for detailed assessment (highlighted in green).

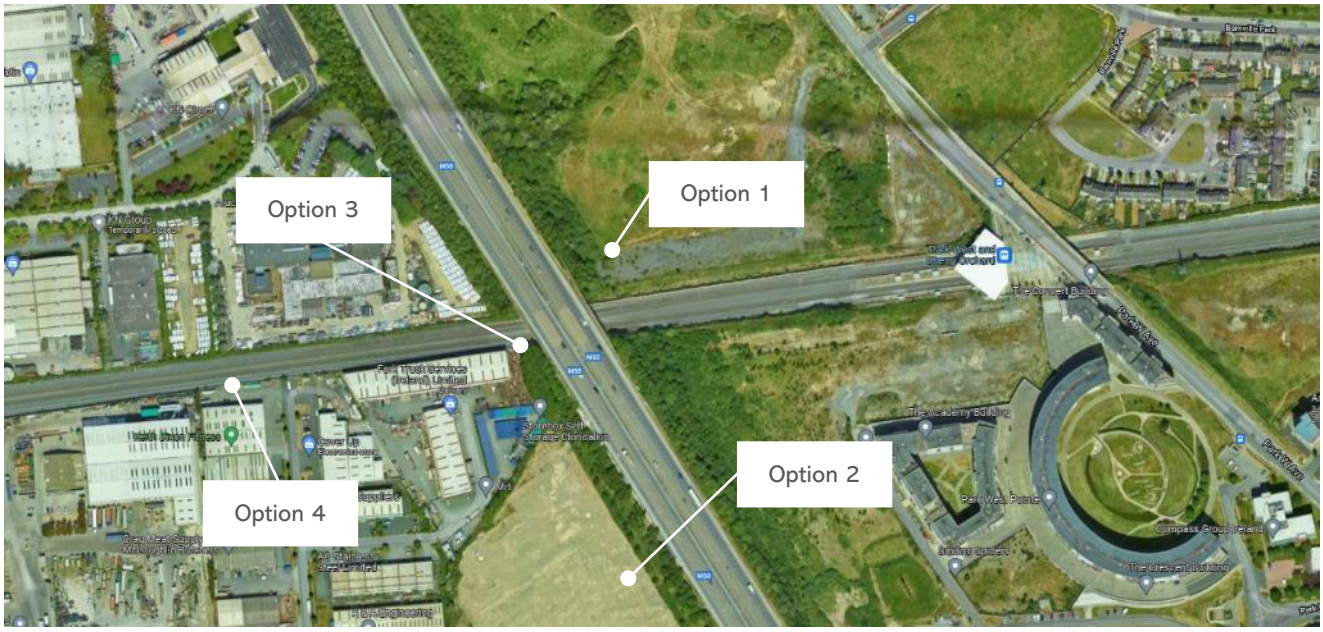

Figure 6-8 Park West Substation Location Options

6.4.4.2 Stage 2: Multi Criteria Assessment

Options 1, 3 and 4 were brought forward for detailed assessment. Full details of the assessment matrix are available in Volume 3. The following table provides a summary of the MCA findings

- **Option 1:** Option 1 is located to the north of the railway and immediately east of the M50 motorway. This is a brownfield site with direct road access is via Park West Avenue to the east. The existing Park West Station is located to the east and existing housing developments in the Cherry Orchard area are located further east of Park West Avenue. Existing ESB 38kV network is located immediately east of Park West Avenue.

  The area around Option 1 is identified within the Dublin City Development Plan as a Strategic Development Regeneration Area (SDRA 4) and is zoned Z14: "to seek the social, economic and physical development and/or rejuvenation of an area with mixed use, of which residential and Z6 (employment/enterprise uses) would be the prominent uses" in the Cherry Orchard / Park West Local Area Plan 2019 in the LAP. The area for Option 1 forms a small part of this to the north of the railway and is suggested as a good location for a convenience store in the LAP.

- **Option 3:** Option 3 is located south of the railway corridor and immediately west of the M50 motorway. It is located within existing industrial estate premises / yards. Hence, this option is closer to the railway boundary fence than Option 2. Road access is more complex insofar as maintenance / operation personnel would be required to cross existing private yards / property. ESB 220kV and 38kV networks are located further to the south.

- **Option 4:** Option 4 is located immediately adjacent to the south of the railway corridor, midway between the M50 bridge to the east and Station Road to the west. It is located within existing industrial estate premises / yards. Road access is more complex insofar as maintenance / operation personnel would be required to cross existing private yards / property. There is little availability in terms of existing ESB 38kV or MV network.

Table 6-7 Park West Substation MCA Summary

CAF Parameters	Option 1 Assessment	Option 3 Assessment	Option 4 Assessment
1. Economy	Some Comparative Advantage over Other Options	Some Comparative Disadvantage over Other Options	Some Comparative Disadvantage over Other Options
2. Integration	Some Comparative Advantage over Other Options	Some Comparative Disadvantage over Other Options	Some Comparative Disadvantage over Other Options
3. Environment	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral
4. Accessibility and Social Inclusi	Some Comparative Advantage over Other Options	Some Comparative Disadvantage over Other Options	Some Comparative Disadvantage over Other Options
5. Safety	Some Comparative Advantage over Other Options	Some Comparative Disadvantage over Other Options	Some Comparative Disadvantage over Other Options
6. Physical Activity	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral
Conclusion	Preferred Option		

In terms of Economy, Option 1 performs favourably due to ease of access and constructability due to close proximity to Park West Avenue. An ESB grid connection is likely to be comparatively simple when compared to the other options. While all options considered are owned by third parties, this location is in public ownership (Dublin City Council), thus offering the potential for a simplified acquisition / negotiation process.

In terms of the Integration criterion, Option 1 is located on the northern side of the tracks and hence provides a more favourable trackside location for the connection of feeder wires for OHLE equipment. It provides a better option in terms of constructability and ease of access for both the construction and operation phases.

With regard to the Environmental criterion, all options performed comparably.

As distance to neighbouring residences is maximised, Option 1 offers some comparable advantage over other options regarding Accessibility and Social Inclusion.

In terms of Safety, Option 1 preforms better as the location is away from members of the public in an open brownfield site; other options are located with industrial estates in close proximity to members of the public.

6.4.4.3 Preferred Option

Option 1 is the Preferred Option for the proposed Park West traction power substation.

6.5 Construction Compounds

Construction Compounds are required at specific construction sub-sites; they are distributed along the scheme by location specific features. For example, compounds will be required at each of the bridge reconstruction locations. The Construction Compounds will be used to support earthworks, enabling works, site clearance, utility diversions work, civil works, the demolition of bridges, OHLE, track installation, signalling and telecoms equipment and all ancillary works. They also provide facilities for the contractor (offices, staff facilities, etc.).

The selection process for construction compounds that will facilitate bridge reconstructions and other location-specific interventions did not go through optioneering as there were no alternative site locations evident, and as they needed direct localised access to the work site.

As noted previously, the OSR has been drafted to focus on those elements which extend beyond the boundary of the existing railway corridor for which alternative options, which are different from one another, manifest. It is the case that there were no or limited options having regard to the Project requirements in respect of construction compounds.

6.5.1 Hazelhatch Construction Compound

A Construction Compound is required at Hazelhatch. It is required for undertaking electrification works along the corridor, along with localised works including the installation of new trackwork to facilitate the turnback of trains at the station. The preferred location for the site is on the north side of the corridor, on CIÉ owned land within the existing station car park. A portion of the car park would be utilised for the Construction Compound, leaving the remainder of the parking for regular users of the station.

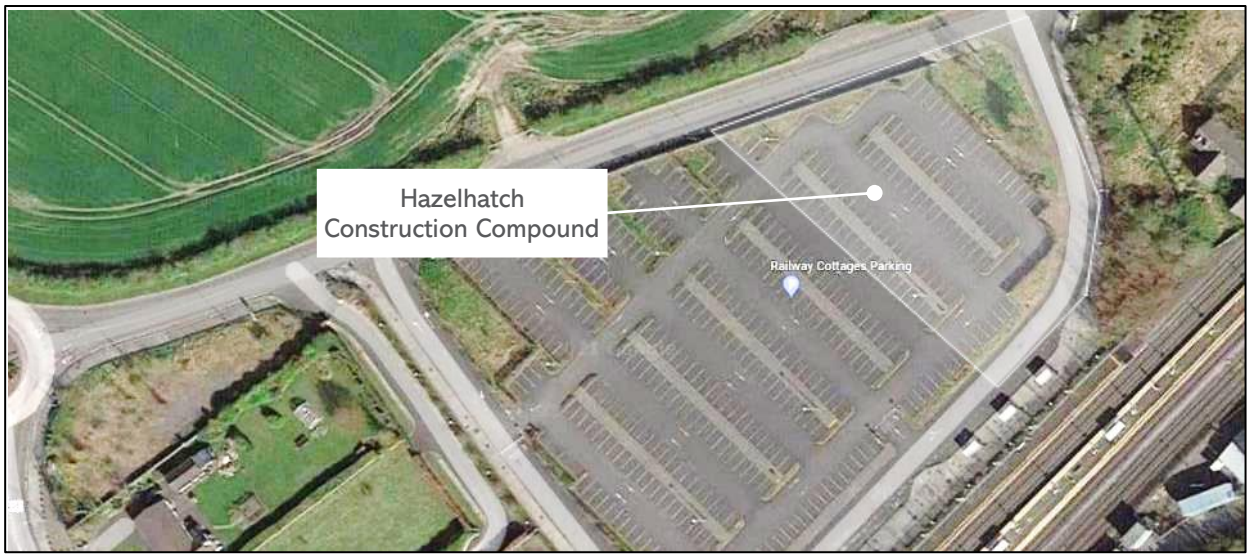

Figure 6-9 Hazelhatch Preferred Construction Compound Location

6.5.2 Park West Construction Compound

A Construction Compound is also required at Park West to facilitate the electrification works and the construction of a new electrical substation. The preferred location for this is on a brownfield site in the ownership of Dublin City Council. Direct road access is via Park West Avenue to the east. The existing Park West Station is located to the east and existing housing developments in the Cherry Orchard area are located further east of Park West Avenue.

This area is also the preferred location for a new electrical substation, and it is envisaged that the construction support site will also be used to facilitate the construction of the new electrical substation.

Figure 6-10 Park West Preferred Construction Compound Location

6.6 Construction

This section of the report sets out the approach in relation to the construction technologies and methodology for the works in the area along this section of the railway, between Hazelhatch & Celbridge Station sidings and up to the Park West & Cherry Orchard Footbridge, so that the public may understand the approach being considered. It is acknowledged that this information is based on information and a level of design available at this time, and it will continue to be developed as part of the Railway Order package and supporting documentation.

6.6.1 Summary of the Proposed Works

This section includes the reconstruction of siding turnouts as well as associated Points and Crossings (P&Cs) adjacent to Hazelhatch & Celbridge Station, as well as Adamstown Station. Most of the works will be constructed at levels close to the existing track levels. In addition, work in the section includes the electrification of the two slow tracks along this existing four-track section, and the construction of four new substations to facilitate the new electrified lines.

6.6.2 Bridges

No bridge work or associated road closures are currently anticipated in this section of the Project.

6.6.3 Permanent Way

Works will comprise:

- Diversion or closure of the operational track, utilities and ancillary infrastructure.
- Where excavations are significant, support of adjacent operational track to be facilitated.
- Excavation of trackbed.
- Excavation of sub strata.
- Replacement of utilities and ancillary infrastructure.
- Construction of new trackbed.

6.6.4 OHLE Infrastructure

Structures will be required at a maximum spacing of 60m along the track to support the catenary cables. The support structures are generally supported from one side of the track (cantilever) or from both sides (portal), depending on the permanent way layout. Where there are adjacent walls, the support structure can be fixed to the walls, negating the need for vertical supports (stanchions).

Support structures will be founded by means of either piles or spread foundations, depending on soil conditions or the contractor's preferred methodology.

It is envisaged that the OHLE will be constructed in safe zones adjacent to the live railway or in night-time possessions.

6.6.5 Substations

Four new substations will be constructed in this area. From a constructability perspective, the substations are relatively straightforward; the main consideration for each site is the large equipment that needs to be brought to site and installed within the buildings. This may necessitate cranage from either within the site or in an adjacent, suitable position. The buildings will need to be designed for constant access for maintenance and equipment replacement. Secure fencing will be required around each site to prevent unauthorised entry.

6.6.6 Temporary Traffic Management

No temporary traffic management has been defined along this section of the Project. Local track access points may be further requested by a contractor. However, any such proposals would require associated traffic management submissions, further public engagement and approval from the appropriate authority.

6.6.7 Restrictions

There are restrictions associated with working on or adjacent to the live railway line. Iarnród Éireann will mandate a safe system of work which will invariably include barriers between the live tracks and the working area or full possession of the railway (no trains running).

Every attempt will be made to restrict materials delivery times to outside peak traffic hours; particularly for construction HGVs that are known to restrict the natural flow of traffic. In addition, where possible, long duration night works will be limited in residential areas unless appropriate noise mitigation can be provided.

A full methodology of the setup and construction methods will need to be sympathetic to both the railway operations and local residents and/or employers in the area. The methodologies will be fully reviewed by the Iarnród Eireann Project Team before the works are given approval to proceed (taking account of all stakeholder concerns from the public consultation phases as well as planning compliance criteria stipulated in the Railway Order).

6.7 Permanent and Temporary Land Requirements

The majority of works along this 11km section of the railway line can be accommodated within the existing rail corridor. The Preferred Option for the Hazelhatch Substation, Adamstown Substation and Kishoge Substation are also located on land in the ownership of CIÉ. The Preferred Option for the Park West Substation is outside the landownership boundary of CIÉ and land acquisition will be required. This location is also identified for a construction compound and temporary land acquisition will also be required.

7 Park West & Cherry Orchard Station to Heuston Station

7.1 Introduction

A key requirement of the DART+ South West Project is to separate InterCity and fast regional services from the future DART services. The last remaining constraint is where the four tracks reduce to two tracks between Park West & Cherry Orchard Station and Heuston Station. The upgrading of this section of railway to include four tracks will remove this limitation allowing InterCity / regional and freight services to operate efficiently alongside DART services.

Expanding from two tracks to four tracks will require a horizontal width extension across the railway corridor. Where possible the extension will be contained within CIÉ's land ownership, however in specific locations it will affect adjoining property owners.

Also, the bridge structures along this section were constructed to accommodate non-electric trains spanning two tracks. Therefore, existing bridges will require interventions to provide the necessary span to accommodate the expanded four-track configuration and the vertical clearance for overhead electrification apparatus.

Along this section of the rail corridor, significant works and interventions are required to meet the Project objectives and requirements, including potential infringement of property rights (on a permanent and / or temporary basis) outside the rail corridor / CIÉ's property boundary.

Due to the complexity of the works and number of interventions on this part of the scheme, this section of the line has been further broken down into the following areas:

- Park West & Cherry Orchard Station to Le Fanu Road Bridge
- Le Fanu Road Bridge to Kylemore Road Bridge
- Kylemore Road Bridge to Sarsfield Road Bridge (including Inchicore Works)
- Sarsfield Road Bridge to Memorial Road Bridge
- Memorial Road Bridge to South Circular Road Junction
- South Circular Road Junction to East of St. John’s Road (Islandbridge)
- Heuston Station and Yard

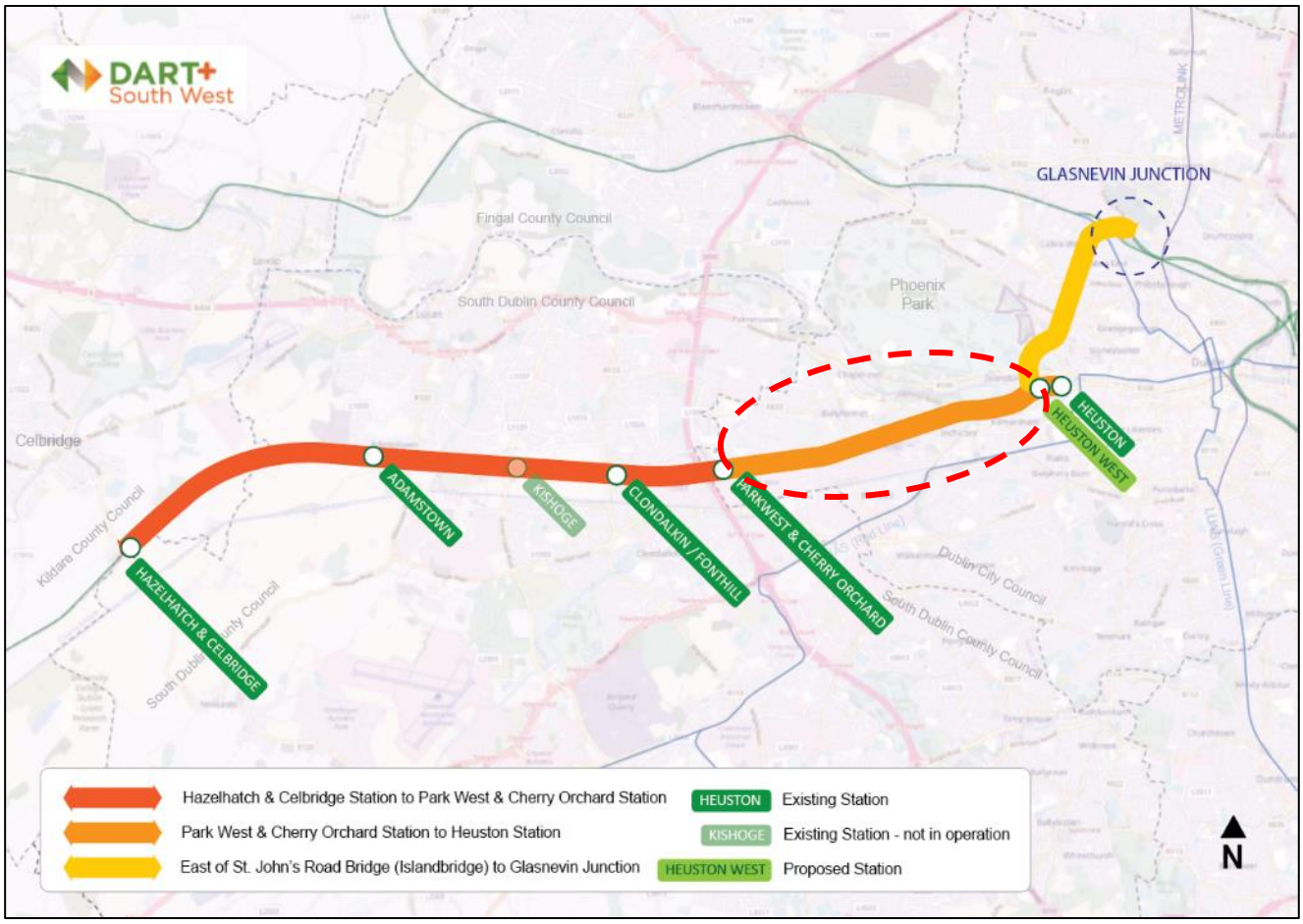

Figure 7-1 Park West & Cherry Orchard Station to Heuston Station

7.2 Description of Railway Corridor

The western end of this section begins at Park West & Cherry Orchard Station and runs east, through an area that is generally characterised by residential properties to the north (including Cherry Orchard Park) and industrial properties to the south (including Park West). The line passes under a footbridge at Cherry Orchard and continues to Le Fanu Road Bridge and Kylemore Road Bridge. Inchicore Works front onto the existing rail line for approx. 1km. The complex includes several track infrastructure and related facilities for the maintenance of rolling stock, and offices for Iarnród Éireann.

From here, the rail line continues east to pass under Khyber Pass Footbridge, over Sarsfield Road and under Memorial Road Bridge where the line runs parallel to the Chapelizod Bypass. The line then approaches the South Circular Road at one of Dublin's busiest road junctions, with two bridges carrying traffic over the railway – South Circular Road Bridge and St John's Road Bridge. The line then takes a more northerly direction as it approaches the area where the Phoenix Park Tunnel Branch Line merges with lines into/out of the existing Heuston Station.

Figure 7-2 Aerial View of the Section of the Railway Corridor

7.3 Park West & Cherry Orchard Station to Le Fanu Road Bridge

This section of the rail corridor initially comprises of four tracks at Cherry Orchard Footbridge where it transitions to three tracks and again to two tracks before passing through Le Fanu Road Bridge (. The rail corridor is primarily in cutting (i.e. the rail level is below the surrounding ground level).

There are two overbridges in the area, Cherry Orchard Footbridge, which is a single-span pedestrian overbridge and Le Fanu Road Bridge, which is a single-carriageway road bridge carrying road traffic over the rail corridor in a north-south direction.

Increasing to four tracks requires the realignment of the existing tracks and an increase in the overall railway corridor width. Le Fanu Road Bridge is a narrow arch structure and is inadequate in both span length and height for the four tracks and electrification infrastructure.

For more details on this section of the route refer to Volume 1 (Schematic Layout (Sheet 10)) and Volume 3B.

Figure 7-3 Le Fanu Road Bridge - West Elevation

Figure 7-4 Proposed Indicative Road Alignment at Le Fanu Road Bridge

7.3.1 Review of Public Consultation No. 1 Feedback, Design Development and Preferred Option

The Project Team has analysed the submissions and considered all relevant information in re-evaluation and further development of design options leading to the selection of the Preferred Option.

The proposed Permanent Way layout realigns the existing two track layout on the south side of the rail corridor to become the fast lines (to facilitate the operation of InterCity services), with two new tracks provided to the north and serving as the electrified slow lines (to facilitate the operation of new DART services). Two Track Cantilever (TTC) support structures will be placed on the northern side of the track.

Retaining walls are required to both the north and south sides of the rail corridor as the four-track corridor enters the cutting.

The Preferred Option replaces the bridge with a longer span or spans to facilitate the additional width required for the additional tracks. To overcome the lack of height available for the electrification infrastructure, the road level will be raised in combination with lowering the rail track. Retaining walls are required to the north and south of the corridor adjacent to the new bridge to allow the widening of the corridor while minimising the impact on the adjacent properties. The raising of the road level will also mean that retaining walls will be required along the road to the north of the railway.

The proposed replacement bridge will be a modern structure that will provide segregation for pedestrians, cyclists and improved sightlines and will be a significant improvement on the existing situation for all road users.

The proposed new bridge is presented below in sectional elevation looking east.

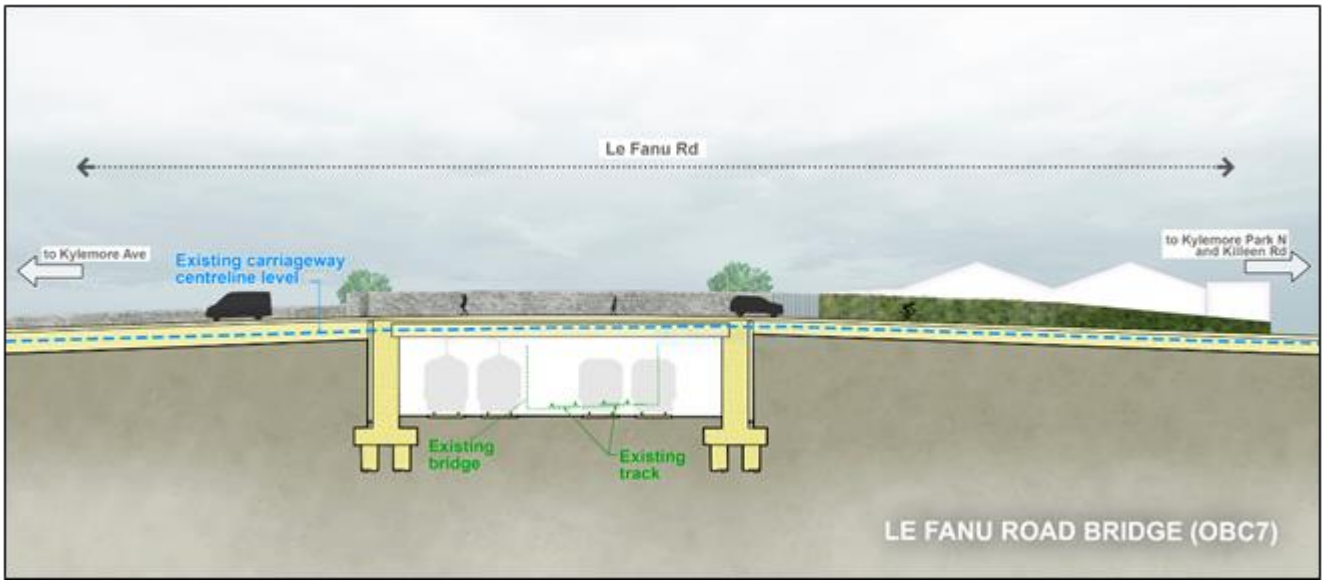

Figure 7-5 Preferred Option for Le Fanu Road Bridge (OBC7)

7.3.2 Construction Compounds

As detailed in **Section 6.5**, Construction Compounds are required at specific construction sub-sites and are also distributed along the scheme by location specific features. Compounds that are required for bridge reconstructions and other discrete locations have not gone through the optioneering process as there were no alternative site locations evident, and as direct localised access to the work site is required.

Four compounds are required along this section of the Project.

Table 7-1 Proposed Construction Compound Locations between Park West & Cherry Orchard Station and Le Fanu Road Bridge

Construction and Maintenance Compound	Nature	Landownership	Alternatives
Friel Avenue	Access and transfer of materials and plant for the construction of the new retaining wall on the north side of the corridor west of Le Fanu Bridge. [I believe this is incorrect – I think this should read 'The excavation and widening of the rail corridor and materials processing']	Private landownership	No alternatives – localised access required.
Cherry Orchard Avenue	Access and transfer of materials and plant for the construction of the new retaining wall on the north side of the corridor west of Le Fanu Bridge.	DCC	No alternatives – localised access required.
Le Fanu Road Bridge	Le Fanu Bridge compound for bridge reconstruction works and construction of the new retaining wall structures.	Private landownership	No alternatives. Localised access required.
Le Fanu Road Bridge	Main Contractor Offices.	Private landownership	Alternatives considered but failed sifting.

7.3.2.1 Friel Avenue Construction Compound

A Construction Compound is required at Friel Avenue on the south side of the rail corridor to facilitate access and transfer of materials and plant for the construction of the new retaining wall on the north side of the corridor, west of Le Fanu Road Bridge. Access is via Friel Avenue, the proposed site is currently a green area with direct access to the rail corridor. The site is located on privately owned greenfield land and would need to be temporarily acquired for the duration of the works.

The proposed location for the compound is required to facilitate this localised work. As there are no other suitable alternative locations in the area, the selected compound location at Friel Avenue is the Preferred Option. Stage 2: MCA not necessary.

Figure 7-6 Friel Avenue - Preferred Construction Compound Location

7.3.2.2 Cherry Orchard Avenue Construction Compound

Works in the Cherry Orchard Avenue area include the excavation and widening of the rail corridor. To facilitate this work, a suitable construction compound is required for materials processing and to provide the necessary support infrastructure.

The preferred construction compound site is located on green space, adjacent to the rail line and Cherry Orchard Avenue. The site is owned by Dublin City Council and would need to be temporarily acquired for the duration of the works.

The proposed location for the compound is required to facilitate this localised work. As there are no other suitable alternative locations in the area, the selected compound location at Cherry Orchard Avenue is the Preferred Option. Stage 2: MCA not necessary.

Figure 7-7 Cherry Orchard Ave - Preferred Construction Compound Location

7.3.2.3 Le Fanu Bridge Construction Compound

The works in this area include reconstruction of Le Fanu Road Bridge and widening of the rail corridor. There is a requirement for one compound at this location, and it will comprise four separate elements on each corner of the bridge, which will provide access to the work areas and to act as transfer / laydown areas for plant and materials. The approach under consideration includes:

- **North east corner of the bridge:** This comprises a triangular green open space and is required to facilitate the reconstruction works to the bridge and also the construction of the northern retaining wall between Le Fanu Road Bridge and Kylemore Road Bridge.
- **North west corner of the bridge:** This comprises a green open space area that will be required to facilitate access from the haul road between Le Fanu and the Cherry Orchard Avenue compound.
- **South east corner of the bridge:** This comprises a small access point and transfer area is required to facilitate construction of the walls from Le Fanu Bridge to Kylemore Road Bridge on the southern side.
- **South west corner of the bridge:** Access to the south west corner of Le Fanu Bridge is required to facilitate bridge reconstruction works and also the construction of the new retaining wall structures, material movement can be undertaken via a haul route to Friel Road. The existing 110kV ESB electricity pylon to the south west of Le Fanu Road Bridge will need to be removed and the existing supply cables diverted to facilitate track widening works. The area is currently a green space adjacent to a hardstanding area that is used for truck parking.

The proposed location for the compound is required to facilitate localised work relating to the reconstruction of Le Fanu Road Bridge and widening of the rail corridor. As there are no other suitable alternative locations in the area, the selected compound location at Le Fanu Bridge is the Preferred Option. Stage 2: MCA not necessary.

Figure 7-8 Le Fanu Bridge - Preferred Construction Compound Location

7.3.2.4 Le Fanu Main Contractor Offices

This has also been identified as suitable for the main contractor office and storage area for the Project.

7.3.2.4.1 Stage 1: Preliminary Sifting

The Feasibility requirements for compounds are Proximity to the Railway Line / Works, Site Size and Vehicular Access.

Three Options excluding the 'Do Nothing' option have been identified for the area. Full details of the initial sifting assessment are included in Volume 3B. A summary of the findings of the sifting assessment is provided in **Table 7-2**. Three options were considered for the location of the main compound to the south west of Le Fanu Bridge, the options are shown in **Figure 7-9**.

Table 7-2 Preliminary Assessment (Sifting) Findings for Le Fanu Main Contractor's Offices

Preliminary Assessment (Sifting) Le Fanu Main Contractor's Offices		
Option	**Description**	**Findings**
Option 0: 'Do Nothing'	There is no project there is no Compound.	Will not deliver Project objectives or requirements.
Option 1	This site is located on private land, it is a hardstanding area, currently used for truck parking. The current access is via Friel Avenue.	Feasible
Option 2	This site is located on private land, it is also a hardstanding area, currently vacant. The site is accessed via Friel Avenue.	This site is further from the work site than Option 1 making material and equipment movement more difficult with potential safety implications associated with moving bulky construction materials and equipment along a public road.
Option 3	This site located on a green area to the front of Mitsubishi Fuso on Friel Avenue, the area is adjacent to the track.	This site is small with insufficient space to accommodate the necessary facilities.

Option 0, 2 and 3 fail to meet the necessary Engineering Feasibility and Project Requirements for the main contractor office and storage area (highlighted in grey).

Options 1 meets the necessary Engineering Feasibility and Project Requirements for the main contractor office and storage area and is the Preferred Option. Stage 2 (highlighted in Green): MCA is not necessary.

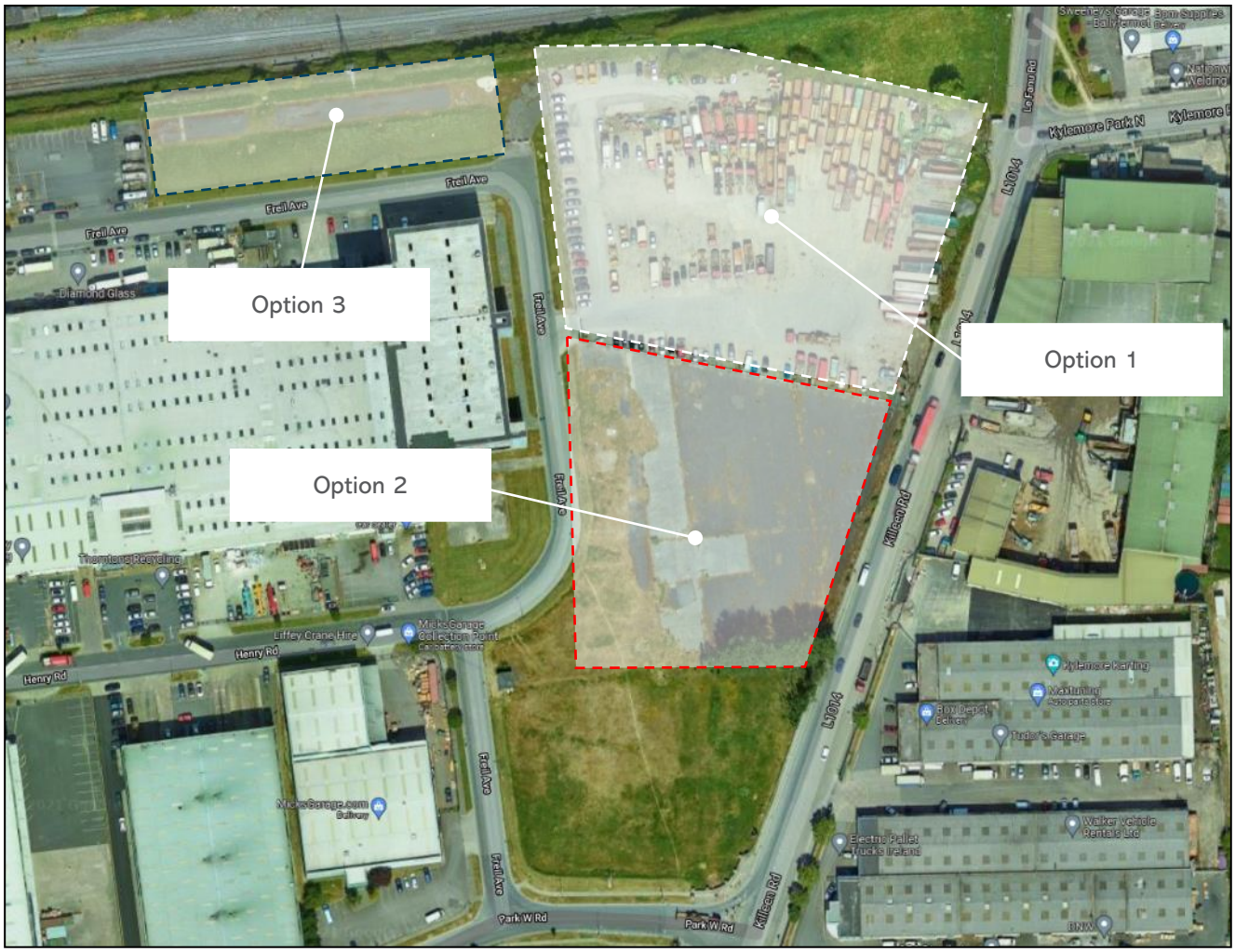

Figure 7-9 Main Construction Compound Options at Le Fanu

7.3.3 Construction

This section of the report sets out the approach in relation to the construction technologies and methodology for the works in the area along this section of the railway so that the public may understand the approach being considered. It is acknowledged that this information is based on information and level of design available at this time and it will continue to be developed as part of the Railway Order package and supporting documentation.

7.3.3.1 Summary of the Proposed Works

The section of the railway corridor has to be widened from Cherry Orchard Footbridge to Le Fanu Road Bridge to accommodate the additional two tracks for the new DART service. In addition, the two northern tracks through this area (Slow Tracks) will be electrified. The cross section varies through this area but is predominantly in cutting, with property boundaries close to the top of the cut slopes. The widening operation is further complicated by the need to lower the tracks through this area so that roads that cross the corridor at Le Fanu Road Bridge and Kylemore Road Bridge.

7.3.3.2 Retaining Structures

To achieve the widened cross section, and to limit the impact of the construction works on adjacent properties and to reduce land acquisition, it is proposed to construct walls along each side of the corridor where there is a level difference between the tracks and the adjacent land.

7.3.3.3 Bridges

The Le Fanu Road Bridge is required to be reconstructed to enable a greater span over the railway, with the number of tracks going from 2 no. to 4 no. under the bridge.

Le Fanu Road Bridge will be fully closed for a large proportion of an estimated 8-12 month period required to allow construction of the new bridge, approach roads and associated advanced work to facilitate the same.

As a result of the full closure, a temporary vulnerable user (pedestrians, cyclists and wheelchair) bridge would be provided in advance of said works to provide an uninterrupted direct access (at this location) between the residential area to the north and the industrial area to the south of the bridge. The same temporary bridge will include utility diversions.

The Le Fanu Road Bridge will be constructed in advance of Kylemore Road Bridge. Le Fanu Road itself will also be closed to allow construction of the new bridge.

Works will focus on the north side first; the proposed northern abutment wall is sufficiently distant from the existing tracks to pile in advance of the bridge demolition and is adjacent to public open space available for access (the public open space is intended for temporary occupation and reinstatement as part of this project). Following demolition, the southern abutment walls will be constructed in a safe zone. Beams, slabs and parapets will then be placed during nightime possessions to limit impact on rail operations.

Following demolition of the existing bridge, lowering of the slow tracks zone and finishing the abutment seating construction works to both north and south abutments, abutting precast concrete beams will be placed using a cranes located each side of the bridge. A deck slab will be poured over the beams and at the end diaphragms to tie the walls into the deck. Craning of precast beams would also be undertaken under a track possession, but deck slab and diaphragm stitches could possibly be done during live operations.

7.3.3.4 Permanent Way

Track lowering will be required through this area to facilitate the provision of four-tracking and electrification. Works will comprise:

- Diversion or closure of the operational track, utilities and ancillary infrastructure.
- Where excavations are significant, support of adjacent operational track.
- Excavation of trackbed.
- Excavation of sub strata.
- Replacement of utilities and ancillary infrastructure.
- Construction of new trackbed.

7.3.3.5 OHLE Infrastructure

OHLE Structures will be required at a maximum spacing of 60m along the track to support the catenary cables. The support structures are generally supported from one side of the track (cantilever) or from both sides (portal) depending on the permanent way layout. Where there are adjacent walls, the support structure can be fixed to the walls negating the need for vertical supports (stanchions).

Support structures will be founded by means of either piles or spread foundations, depending on soil conditions or the contractor's preferred methodology.

It is envisaged that the OHLE will be constructed in safe zones adjacent to the live railway or in night-time possessions.

7.3.3.6 Temporary Traffic Management

Le Fanu Road Bridge reconstruction requires a full closure of the existing bridge on Le Fanu Road. A temporary vulnerable user bridge is to be provided on the western side of the Le Fanu Road Bridge. This will cater for all pedestrian movements across the rail line during the construction period. The proposed measures are shown in **Figure 7-10**.

Figure 7-10 Le Fanu Rd Full Closure – Mitigation Measures

The southbound and northbound traffic is anticipated to be distributed onto the surrounding network. Heavy Goods Vehicles (HGV's) will be restricted from using Kylemore Avenue and will be required to travel via Ballyfermot Road instead.

Owing to the lengthy duration of this closure, vehicular users are anticipated to experience initial congestion at the start of the closure, followed by a gradual decrease in total vehicle volumes and congestion.

Overall pedestrian and cycling connectivity are expected to be maintained throughout the closure period and, as a result, it is expected to maintain a high level of service. Shared pedestrian, cyclist and wheelchairfacilities are expected to be provided on the western side of the construction area via a single temporary bridge.

No bus routes are known to utilise Le Fanu Road and will therefore not require any diversions.

7.3.4 Permanent and Temporary Land Requirements

The Preferred Option for construction compounds along this section at Friel Avenue, Cherry Orchard Avenue and Le Fanu Road Bridge (including temporary vulnerable user bridge) is on lands in third party ownership (including Dublin City Council and private landowners) and would need to be temporarily acquired for the duration of the works.

The Preferred Option for the Main Contractor's Offices and Compound is on lands in third party ownership and would need to be temporarily acquired for the duration of the works. The site is accessed via Friel Avenue and there is also an old access point from Killeen Road.

The retaining wall solution along both the north and south sides of the rail corridor may require the temporary acquisition of lands in third party ownership for the duration of the works to facilitate construction of the retaining structures.

7.4 Le Fanu to Kylemore Road Bridge

This section of the rail line extends from just west of Le Fanu Road Bridge to east of Kylemore Road Bridge (OBC5A). The rail corridor consists of two tracks primarily below the surrounding ground level with the residential properties of Kylemore Drive and Landen Road backing onto the railway to the north, and the industrial units of Park West Industrial Estate and Westlink Industrial Estate backing onto the railway to the south.

The Kylemore Road overbridge is a single-carriageway road bridge carrying road traffic over the rail corridor in a north-south direction. The bridge does not have the adequate span to fit four tracks and it is not high enough for the DART line electrification infrastructure to pass under. There are a number of constraints in this area including.

- The railway corridor is bounded on both sides by soil slopes.
- To the north and south of the bridge are road junctions and access points that significantly restrict alterations that may be required to the road geometry.
- Kylemore Road is a potential route for a future Luas line. Therefore, the design must consider this potential new infrastructure.
- The west of Kylemore Road Bridge has been identified for a potential future railway station (not part of the DART+ South West Project scope). The bridge designs for this area must not prejudice its delivery in the future.

For more details on this section of the route refer to Volume 1 (Schematic Layout (Sheet 11)) and Volume 3C.

7.4.1 Review of Public Consultation No. 1 Feedback, Design Development and Preferred Option

The Project Team has analysed the submissions and considered all relevant information in re-evaluation and further development of design options leading to the selection of the Preferred Option.

In terms of Permanent Way, the Preferred Option realigns the existing two track layout on the south side of the rail corridor to become the fast lines, with two new tracks provided to the north, serving as the slow lines, which will be electrified as part of the DART+ South West Project. The OHLE configuration will comprise Two Track Cantilevers (TTCs) placed on the north side of the line, to support OHLE on the northern two tracks.

The steep nature of the existing cutting slopes, proximity of the adjacent domestic and industrial properties and height of the cutting slope to be retained, necessitates retaining wall solution along both the north and south sides of the rail corridor between Le Fanu Road Bridge and Kylemore Road Bridge. Additional minor retaining or earthwork structures may be required at road level surrounding Kylemore Road Bridge to facilitate the proposed road level raising. Further details in relation to these structures will be provided as part of the Railway Order application.

The west of Kylemore Road Bridge has been identified for a potential future railway station (not part of the DART+ South West Project scope). The Permanent Way designs for this area must not prejudice its delivery in the future.

The Preferred Option for Kylemore Road Bridge is for a bridge reconstruction that replaces the existing bridge with a longer span to facilitate the additional track width. To overcome the lack of height available for the electrification infrastructure, the road level will be raised in combination with lowering the rail track. The Preferred Option is designed to include passive provision for a potential future railway station at this location. However, the provision of a railway station at this location is not within the scope of the DART+ South West Project.

Retaining walls are required to the north and south of the corridor to allow the widening of the corridor while minimising the impact on the adjacent properties. The raising of the road level will also mean that retaining walls will be required along the road to the north and south of the railway.

The proposed new bridge is presented below in sectional elevation looking east.

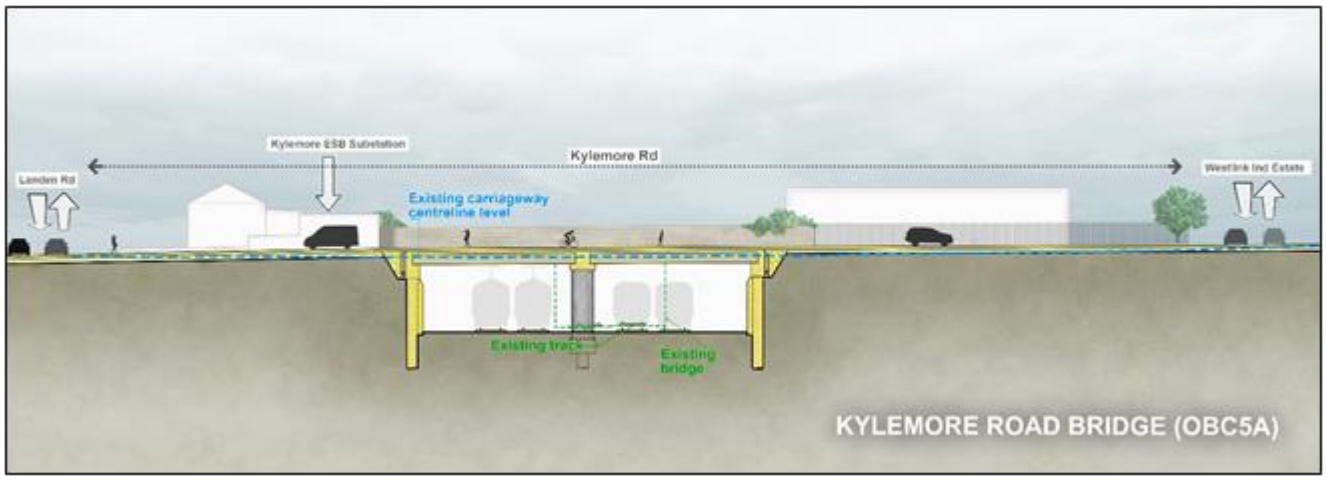

Figure 7-11 Preferred Option for the Kylemore Road Bridge (OBC5A)

Options for Le Fanu Road Bridge were subject to optioneering. Following MCA, both Option 9 and Option 10 were assessed as 'comparable / neutral' and were combined and presented at PC1 as a single option.

A summary of the Emerging Preferred Option as presented at PC1 is as follows:

- Kylemore Road Bridge will be replaced by a new bridge with a longer span to facilitate the additional width required for the additional tracks.

- The new bridge structure would also incorporate passive provision for Luas loading over the bridge.
- The new bridge structure would also incorporate passive provision for a future station at Kylemore (not part of the DART+ South West Project scope).
- The road level will be raised in combination with lowering the rail track. This option assumes raising the road and lowering the track in equal proportion to achieve the additional height.
- Retaining walls are required to the north and south of the corridor to allow the widening of the corridor.

Based on the level of information and design available at PC1, the extent of permanent and construction related works was considered to potentially extend into the 3m strip of land between the existing railway corridor and the rear of properties along Kylemore Drive. There may also be temporary interference of other property rights during construction along the rail corridor and works around the bridge however technical and construction related solutions will seek to minimise these.

7.4.2 Kylemore Substation

The DART+ Programme Power Study determined the requirement for an electrical substation at Kylemore. It is included within this section, albeit acknowledging that options considered are located in the next section of the railway (i.e. Kylemore to Sarsfield). The site selection process followed the two-stage optioneering process outlined in **Chapter 4**.

The final position of the substations will be subject to design development and confirmation from ESB in relation to suitability for incoming power supply connection. The purpose of the OSR is to determine the optimal location for the traction power substation.

The options for the substation at Kylemore include locations in both the Le Fanu to Kylemore Road Bridge section and the Kylemore to Sarsfield Road section. For the purpose of describing the optioneering process, the findings are presented in this section; however, the preferred location is in the Kylemore to Sarsfield Road section.

7.4.2.1 Stage 1: Preliminary Assessment

The Feasibility requirements for substations are electrification, constructability, and safety. The Project objectives and Requirements are Proximity to the Railway Line, Vehicular Access and Site Size.

The main constraints for this location include:

- Existing and proposed land use – the urban / city centre setting and presence of the adjacent industrial units means that the local area is dominated by privately owned developments / infrastructure and residential/commercial developments. Potential open field options are limited due to the surrounding infrastructure and residential/commercial developments
- Road Network – the adjacent road network is busy, with a mix of HGVs serving the surrounding industrial units and privately-owned vehicles. There is a significant level differential between the trackside environment and the adjacent road network, which is in the order of 5m in the area around Le Fanu Road and Kylemore Road.

Three Options including the 'Do Nothing' option have been identified for the area. Full details of the initial sifting assessment are included in **Volume 3C**. A summary of the findings of the sifting assessment is provided in **Table 7.3**.

Table 7-3 Preliminary Assessment (Sifting) Findings for Kylemore Substation

Preliminary Assessment (Sifting) Findings for Kylemore Substation		
Option	**Description**	**Findings**
Option 0: 'Do Nothing'	There is no substation.	Will not deliver Project objectives or requirements.
Option 1	This site is located to the south of the railway corridor and west of Kylemore Road Bridge adjacent to a commercial/industrial property. It is currently in private ownership.	Constrained site, significant impact on adjoining businesses
Option 2	This site is located to the south of the railway corridor and east of Kylemore Road Bridge adjacent to a disused commercial/industrial property. It is currently in private ownership.	Feasible

- Option 0 'Do Nothing' fails to meet the necessary Engineering Feasibility and Project Requirements for a substation location (highlighted in grey).
- Option 1 is located on private land to the south of the railway line, adjacent to Kylemore Road Bridge. The proposed site is located in the car park of a commercial unit where there is insufficient space in this area to accommodate the electrical substation. As such, the commercial unit would need to be acquired and demolished; there would also be a potential impact on adjoining businesses during the construction of the substation.
- Whilst Option 2 is also located on private land, it is located in a derelict/unused site and as such the impacts on adjoining businesses and the costs associated with this option are deemed to be more favourable

As only one option met with the necessary Engineering Feasibility and Project Requirements, it is the Preferred Option. Stage 2: MCA was not required.

Figure 7-12 Kylemore Proposed Substation Options

7.4.2.2 Preferred Option

The preferred site is located on private land adjacent to the rail corridor; it is located on a currently unused site. While this Option will necessitate land acquisition, it remains favourable for its proximity to the local road network and proximity to the railway. The proposed permanent way alignment additional tracks and headshunt will also necessitate some land acquisition in this area.

Figure 7-13 Proposed Location for Kylemore Substation

7.4.3 Construction Compounds

The bridge at Kylemore is being replaced by a larger structure to facilitate electrification and also the widening of the track corridor. As part of the rail corridor widening works, new retaining walls will be constructed, requiring plant access and construction materials processing. A Construction Compound is required along this section of the scheme to facilitate localised work.

While one compound is required at this location, it will comprise four separate elements on each corner of the bridge, which will provide access to the work areas and to act as transfer / laydown areas for plant and materials. The approach under consideration includes:

- **North east side of the bridge:** An area will be required to facilitate the drop off and load up of materials with good access to the road network. It is proposed to utilise the existing open space in this area for use as a temporary compound.
- **North west side of the bridge:** Access to the north west side of the bridge is not as constrained as there is potential access via a haul route from the north eastern Le Fanu Road compound to this area. The railway corridor is also less constrained, as the new headshunt terminates on the eastern of the bridge. Therefore, a smaller compound is required in this location.
- **South east side of the bridge:** The construction of a new retaining wall necessitates access from Kylemore and egress from Inchicore Works via a haul road. A compound will be required at the south east corner of the bridge to serve as an access point, storage and transfer area for materials and plant.

- **South west corner of the bridge:** Access will be required to facilitate construction of the retaining wall between Kylemore and Le Fanu. Access to the site on the northern side is via Kylemore Road to the Naas Road. Access to the southern compounds is via Kylemore Road to the Chapelizod Bypass.

The proposed location for the compound is required to facilitate localised work relating to the reconstruction of Kylemore Road Bridge and widening of the rail corridor. As there are no other suitable alternative locations in the area, the selected compound location is the Preferred Option. Stage 2: MCA not necessary.

Figure 7-14 Proposed Construction Compound Location at Kylemore

7.4.4 Construction

This section of the report sets out the approach in relation to the construction technologies and methodology for the works in the area along this section of the railway so that the public may understand the approach being considered. It is acknowledged that this information is based on information and level of design available at this time and it will continue to be developed as part of the Railway Order package and supporting documentation.

This section of the report sets out the approach in relation to the construction methodology for the works in the area of Kylemore Road Bridge.

7.4.4.1 Summary of the Proposed Works

Kylemore Road Bridge will be demolished and reconstructed. The section of the railway corridor from Le Fanu Road Bridge to Kylemore Road Bridge has to be widened to accommodate the additional two tracks for the new DART service. In addition, the two northern tracks through this area (Slow Tracks) will be electrified. The cross section varies through this area but is predominantly in cutting, with property boundaries close to the top of the cut slopes. The widening operation is further complicated by the need to lower the tracks through this

area so that roads that cross the corridor on bridges are not raised too much (creating significant impact on local properties and road infrastructure).

7.4.4.2 Retaining Structures

To achieve the widened cross section, to limit the impact of the construction works on adjacent properties and to reduce land acquisition, it is proposed to construct walls along each side of the corridor where there is a level difference between the tracks and the adjacent land. Refer to **Section 5.2.7** for a description of the different retaining walls under consideration.

It is proposed that a bored secant pile wall solution will be adopted for the section of retaining wall along the perimeters to form the northern and southern tracks cess edge. The retaining walls vary between 4m and 7.5m in height and will be constructed utilising access from the trackside within Irish Rail lands.

To minimise the pile size and associated lateral movement of the upper portion of the walls and to maintain the integrity of the infrastructure beyond the crest of the retained slope, the retaining walls along this section shall be anchored using soil nails extending into the existing slope substratum beneath the properties on both the northern and southern side of the rail corridor. The length of the soil nails/ground anchors will vary based on the height of the cutting slope to be retained and are anticipated to be approximately 10m to 15m in length.

The soil nails/ground anchors will be installed utilising access from the trackside within CIÉ lands.

Existing nearby walls, buildings, structures and earthworks may require monitoring (e.g. vibration monitoring) during any nearby piling works for new structures to ensure no structural damage or instability is caused.

7.4.4.3 Bridges

In order to demolish and reconstruct Kylemore Road Bridge, a full road and bridge closure is necessary. The plan would be to limit the duration of impact on existing residential unit driveway accesses north west of the bridge by balancing the implementation of discrete works packages versus the imperative to complete the whole structure and road reinstatement as quick as possible. See Temporary Traffic Management section.

Before any such demolition and/or long-term closure of the road can commence, two temporary bridges have been identified as being necessary:

- A temporary vulnerable user bridge (with min. 3.15m operational width) would be required in advance of said works to provide an uninterrupted direct access (at this location) between the residential area to the north and the industrial area to the south of the bridge. It is proposed to locate this bridge to the east of the existing structure as close as is deemed safe while limiting impact on the residential service road adjacent. The same temporary bridge will include the majority of the temporary utility diversions.
- To the west of the structure a single lane temporary vehicular bridge (with min. 4.5m operational width) will be provided with an additional 1.5m protected pedestrian space. This will provide additional pedestrian only relief as well as flexibility during demolition and construction operations.

The piled retaining wall on the northern side of the widened corridor for four-tracking would need to be installed in advance of the two. temporary bridge installations. This would be necessary to provide the abutment support on the north side of the track for the temporary bridges; and also to complete the major piling works which involves large construction plant, in advance of the temporary diversion for vulnerable users. To the south, the temporary bridges will also require the permanent piling retaining walls to be completed in advance of their installation; to allow for the track works to continue concurrently with the bridge construction. The latter piling requires mobilising

the piling rigs within the carparks of the existing industrial units south of the bridge (between the buildings and the boundary of the road corridor). The rail corridor piled retaining walls would be constructed from the trackside for the majority of the section

The abutments for the new Kylemore Road Bridge are currently assumed to be piled abutments, while the central pier would be constructed using rising formwork over a piled foundation. There is potential for the initial abutment piling work to be installed prior to the bridge demolition. This would be completed using local road diversions to the works.

7.4.4.4 Permanent Way

Track lowering will be required through this area to facilitate the provision of four-tracking and electrification. Works will comprise:

- Diversion or closure of the operational track, utilities and ancillary infrastructure.
- Where excavations are significant, support of adjacent operational track.
- Excavation of trackbed.
- Excavation of sub strata.
- Replacement of utilities and ancillary infrastructure.
- Construction of new trackbed.

7.4.4.5 OHLE Infrastructure

Structures will be required at a maximum spacing of 60m along the track to support the catenary cables. The support structures are generally supported from one side of the track (cantilever) or from both sides (portal) depending on the permanent way layout. Where there are adjacent walls the support structure can be fixed to the walls negating the need for vertical supports (stanchions).

Support structures will be founded by means of either piles or spread foundations, depending on soil conditions or the contractor's preferred methodology.

7.4.4.6 Temporary Traffic Management

Kylemore Road Closure

Kylemore Road Bridge reconstruction requires a full closure of the existing bridge on Kylemore Road. The temporary traffic management solutions being considered at this time are set out below:

- Provision of a northbound single directional vehicle bridge on the western side of the proposed bridge structure. This bridge is anticipated to accommodate northbound traffic while southbound traffic will be required to be re-routed. The bridge will also provide a 1.5m footpath to cater for pedestrians on the western side of Kylemore Road.
- The proposed layout and associated temporary bridge locations are shown below, different configurations of the bridge approach and exit roads are under consideration. Alternatives to reduce the impact locally will be investigated further.

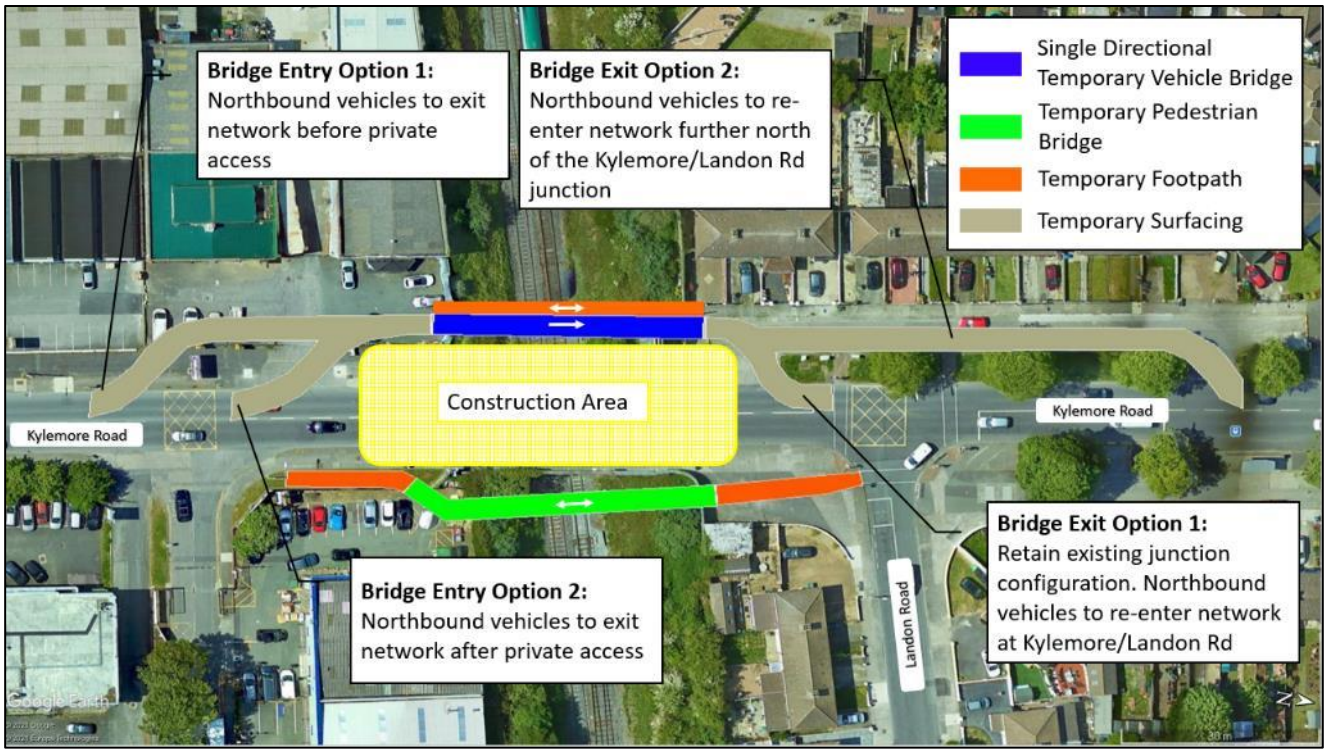

Figure 7-15 Northbound Traffic Diversion – Mitigation Measures

The southbound traffic is anticipated to be distributed onto the surrounding network via the Le Fanu Road Bridge. Heavy Goods Vehicles (HGVs) will be restricted from using Kylemore Ave and will be required to travel via Ballyfermot Road instead.

Figure 7-16 Temporary Traffic Diversion Routes

7.4.5 Permanent and Temporary Land Requirements

The Preferred Option for the construction compound on each corner of Kylemore Bridge is on lands in third party ownership and temporary land acquisition for the duration of the works will be required.

The retaining wall solution along both the north and south sides of the rail corridor may also require the temporary acquisition of lands in third party ownership (including Dublin City Council and private landowners) for the duration of the works to facilitate the construction of retaining structures.

7.5 Kylemore to Sarsfield Road (including Inchicore Works and Khyber Pass Bridge)

This section of the rail line is dominated by Inchicore Works to the south. It fronts onto the existing rail line for approx. 1km. The complex provides several facilities for the maintenance of rolling stock (InterCity trains), the track infrastructure and offices for Iarnród Éireann. Residential properties are also present further to the south of the railway and east of Inchicore Works, particularly at St. George's Villas, Inchicore Parade.

The area to the north of the railway corridor is broadly residential in nature, with a focus on properties along Landen Road. Currently the rear gardens of these properties back onto the rail corridor with a retaining wall providing separation. There are also apartment blocks located to the north as the corridor approaches Sarsfield Road.

The railway along this section comprises two main line tracks which are joined by two sidings (used to access the depot and for train storage).

The western extent of this section is located within a steep cutting on both sides. A retaining wall provides separation between the railway and the residential properties at Landen Road to the north. A retaining wall also sits behind the cutting slope on the southern boundary between Kylemore and Inchicore Works and terminates at the sidings where the railway reaches ground level.

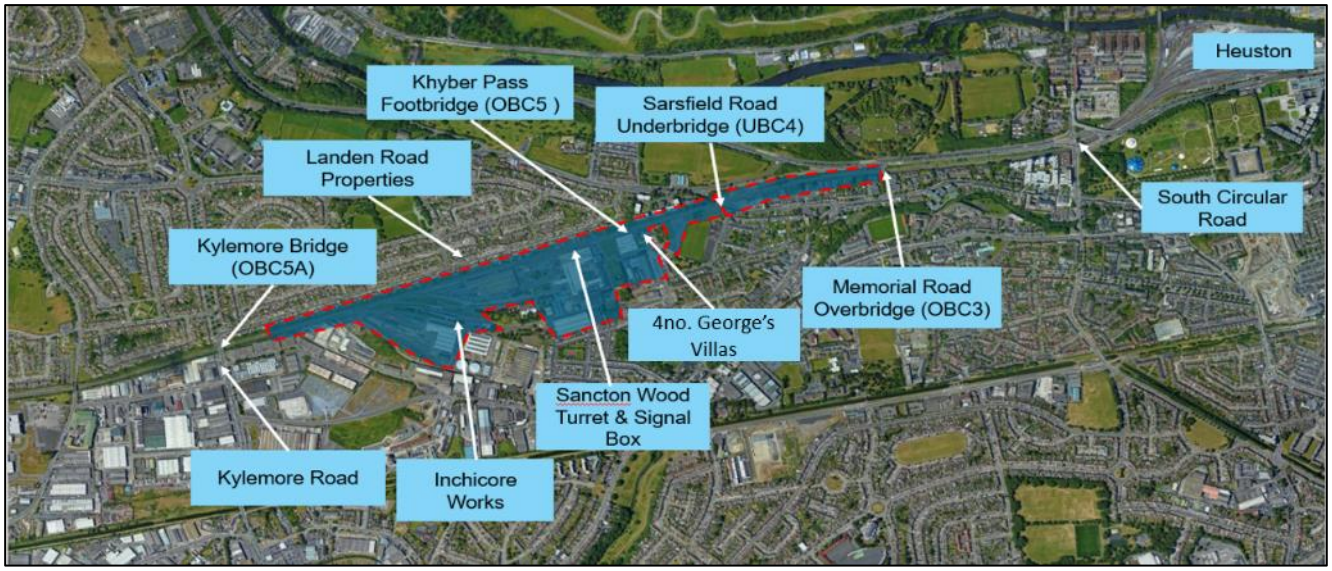

Figure 7-17 Aerial view with Infrastructural Features

A number of the buildings within the Inchicore Railway Works are identified on the National Inventory of Architectural Heritage (NIAH). Key features include a signal box within the rail corridor to the immediate north of the rail line (Regional Rating Reg. No. 50080417) and a turret associated with a locomotive shed to the south of the line (Regional Rating Reg. No. 50080418).

For more details on this section of the route refer to Volume 1 (Schematic Layout (Sheet 12)) and Volume 3D.

7.5.1 Review of Public Consultation No. 1 Feedback, Design Development and the Preferred Option

The Project Team has analysed the submissions and considered all relevant information in re-evaluation and further development of design options leading to the selection of the Preferred Option.

The railway in this area (between Kylemore Road Bridge and Sarsfield Road Bridge) comprises two mainline tracks which are joined by an additional short track (or siding) connected to the Inchicore Depot. This section also includes the Khyber Pass Footbridge, which is located in Inchicore Depot. The existing tracks through the area would not provide the required four-tracking while maintaining the functionality of the depot. Therefore, the laying of additional tracks is required, which in turn requires the realignment of the existing tracks and an increase in the railway corridor width in this area.

The proposed layout realigns the existing two track layout on the south side of the rail corridor to become the fast lines, with two new tracks provided to the north which would serve as the electrified DART lines. Multiple crossovers will provide the necessary train pathways to access Inchicore Depot.

Sections of the line are in a cutting with steep slopes. The adjacent domestic and industrial properties are in close proximity, and the height of the cutting slope is to be retained – necessitating a retained wall solution along sections to the north and south sides of the rail corridor.

Design development has resulted in a permanent way solution which negates the requirement to remove a turret associated with a locomotive shed to the south of the line. This structure is listed in the National Inventory of Architectural Heritage (NIAH) (Reg. No. 50080418). It is not a Protected Structure.

It will, however, still be necessary to remove a signal box on the north side of the line. This structure is listed in the NIAH (Reg. No. 50080417). It is not a Protected Structure.

As part of the rail corridor widening works, an administrative and maintenance building adjacent to the southern tracks must be removed to provide room for a new train siding. This extension has offices, toilets, lockers and plant rooms which house tanks and pumps for the train wash. All these elements contained in the ancillary bay attached to the north of the maintenance shed are to be demolished and relocated. The shunters hut to the west will also be affected.

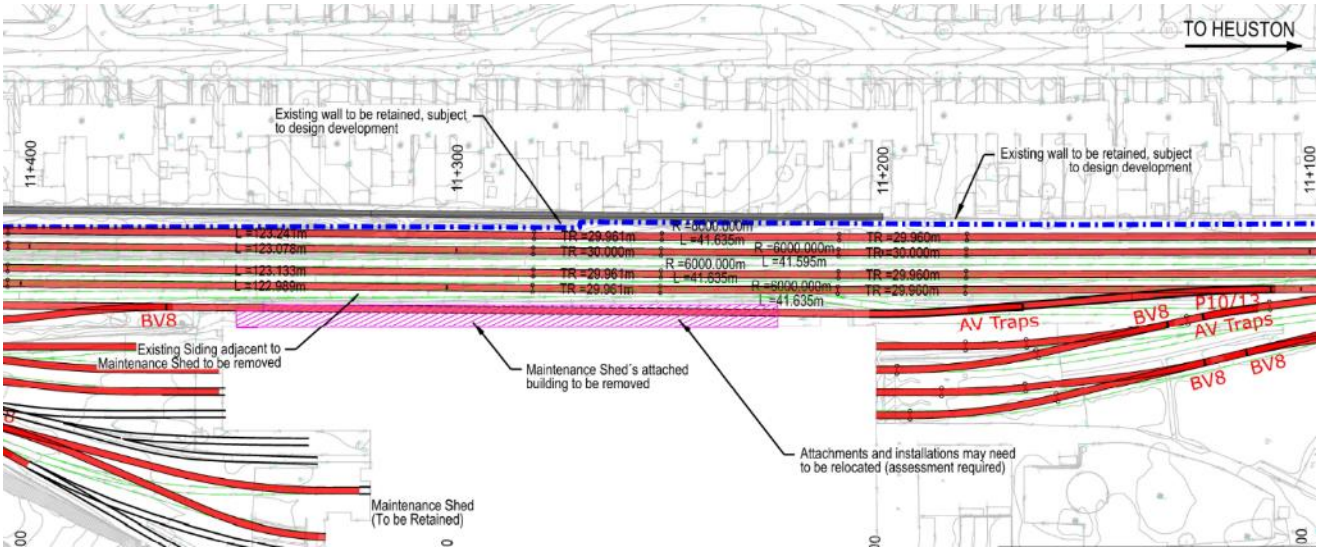

Figure 7-18 Ancillary Bay Affected by Trackwork

Apart from some rearrangement of the maintenance shed, the areas affected by the demolition will be relocated as follows:

- A new building will be built, in the area east of the maintenance shed, providing accommodation over two stories for:
    - The administration rooms and facilities for staff currently located in the bay to be demolished.
    - Other administrative offices, currently located in small prefab units in this same area.

- Plant rooms and other maintenance services are to be relocated into the existing maintenance shed
- The shunter building to be relocated to the south west of the main maintenance building

The ancillary bay is not listed in any record of protected structures. However, the maintenance shed is shown on early 1900s and its stonework, adjacent to the ancillary bay, is a feature of potential heritage interest. Demolition works will need careful consideration to preserve original construction features.

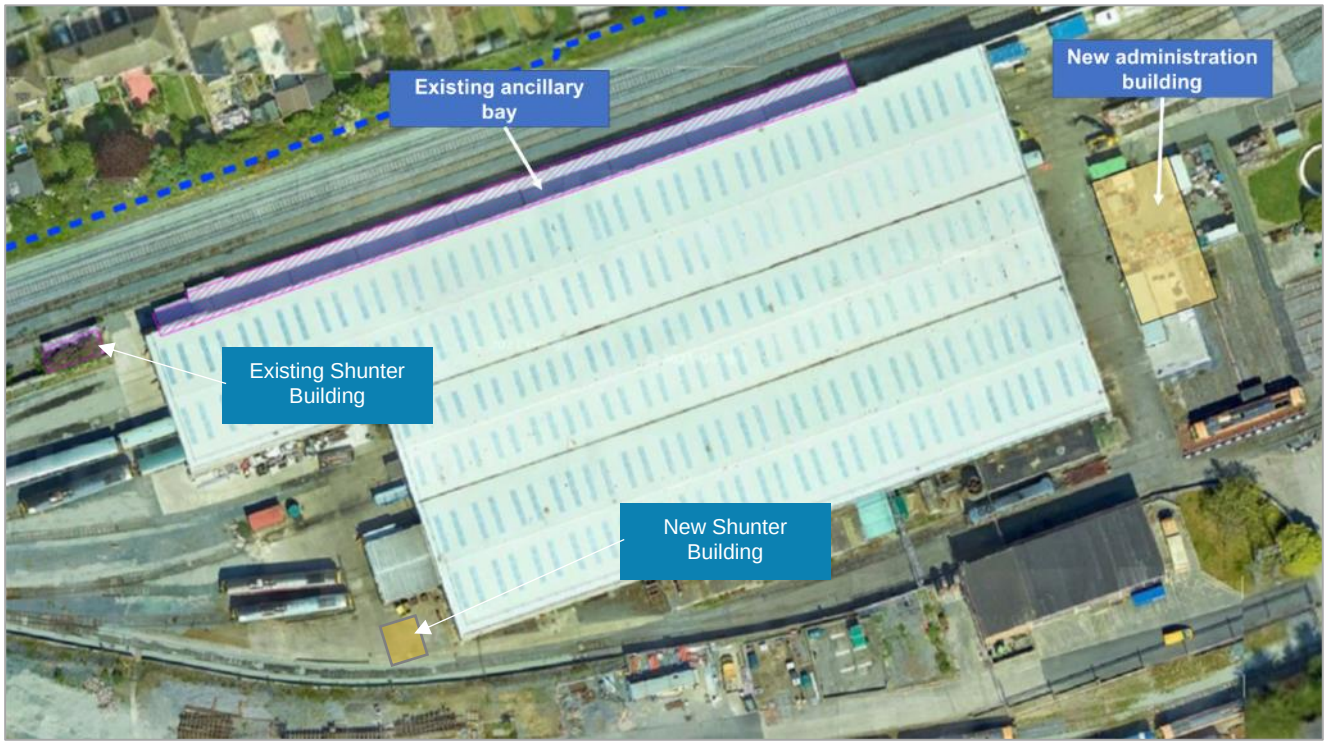

Figure 7-19 New Administrative Building Preferred Location

The Preferred Option includes a new drainage system which will be put in place as part of the new track arrangement to collect and drain all surface water runoff. Additional retention structures will also be provided to attenuate the peak runoff flows and meet the necessary discharge requirements. An area to the south of the railway has been identified for proposed attenuation facilities. A potential additional attenuation tank at Inchicore Depot, and outfall to an existing surface water drain that crosses the railway corridor has also been identified.

Khyber Pass Footbridge is an existing pedestrian overbridge linking Inchicore Depot to Sarsfield Road to the north. The existing structure has three tracks beneath it and is not wide enough to safely accommodate an increase to four tracks.

The Preferred Option provides a new pedestrian bridge with sufficient height and width to meet the requirements for four-tracking and electrification. The extent of works may potentially interfere with property rights in the immediate area, but further design development and construction related solutions will seek to minimise this impact.

The proposed new pedestrian bridge is presented below in sectional elevation looking east towards Heuston Station.

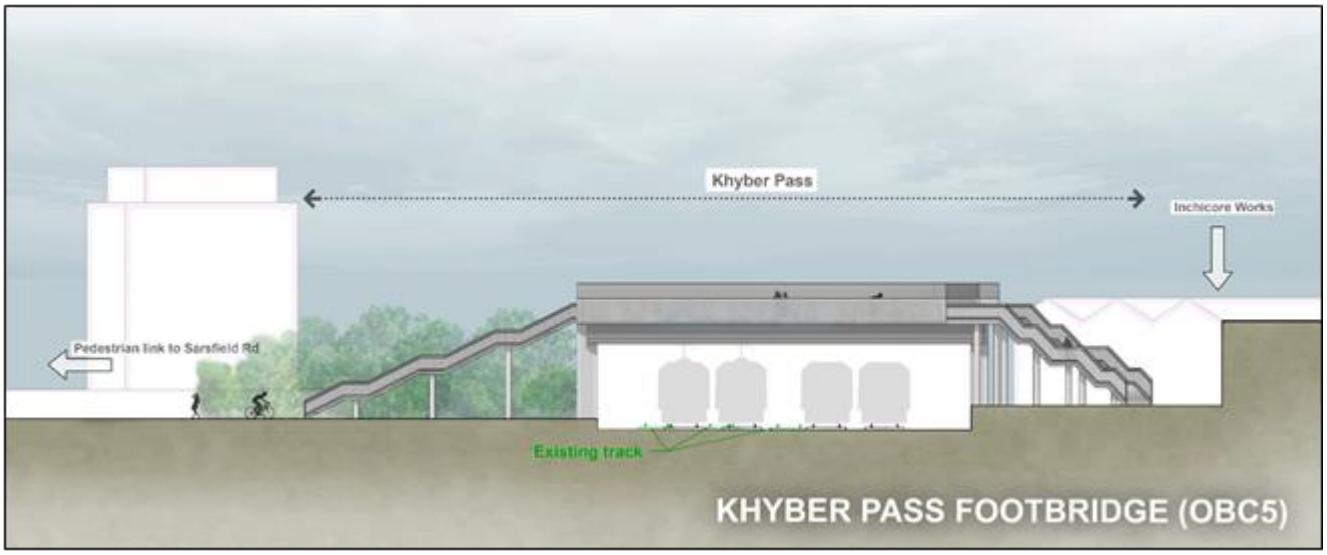

Figure 7-20 Preferred Option for Khyber Pass Footbridge (OBC5)

As described in **Section 7.4.2**, the Preferred Location for the Kylemore Substation is located to the south of the railway corridor and east of Kylemore Road Bridge adjacent to a disused commercial/industrial property. It is currently in private ownership.

7.5.2 Re-evaluation of Optioneering for Area Around Inchicore Depot

Following feedback and more detailed design of the four-tracking requirements between Kylemore Road Bridge and Khyber Pass Footbridge, the Emerging Preferred Option was re-evaluated and it was possible to avoid removing a turret associated with a locomotive shed to the south of the line. This structure is listed in the National Inventory of Architectural Heritage (NIAH) (Reg. No. 50080418).

In the MCA, Option 4 was identified as the Emerging Preferred Option; determined to have 'Some Comparative Advantage' over Option 3 in respect of the CAF criteria of Economy, Integration and Environment. However, due to the removal of both the Signal Box and Turret in Option 4, Option 3 (which only involved removal of the Signal Box) was found to have 'Some Comparative Advantage' in respect of the specific Cultural Heritage and Architectural Heritage and Biodiversity (potential for bat roosts) sub criterion; however, this did not change the overall assessment findings for Environment favouring Option 4.

The Stage 2: MCA was re-run in respect of the options for Inchicore Depot to account for the fact that following more detailed design it is possible to avoid impacting the Turret. Both options are now found to be 'Comparable to the other option / neutral' in respect of the Cultural Heritage and Architectural Heritage. This did not change the overall assessment findings of Option 4 as the preferred option and it was subject to more detailed design leading to the identification of the Preferred Option, which is presented in this report. Refer to **Volume 3D** for details.

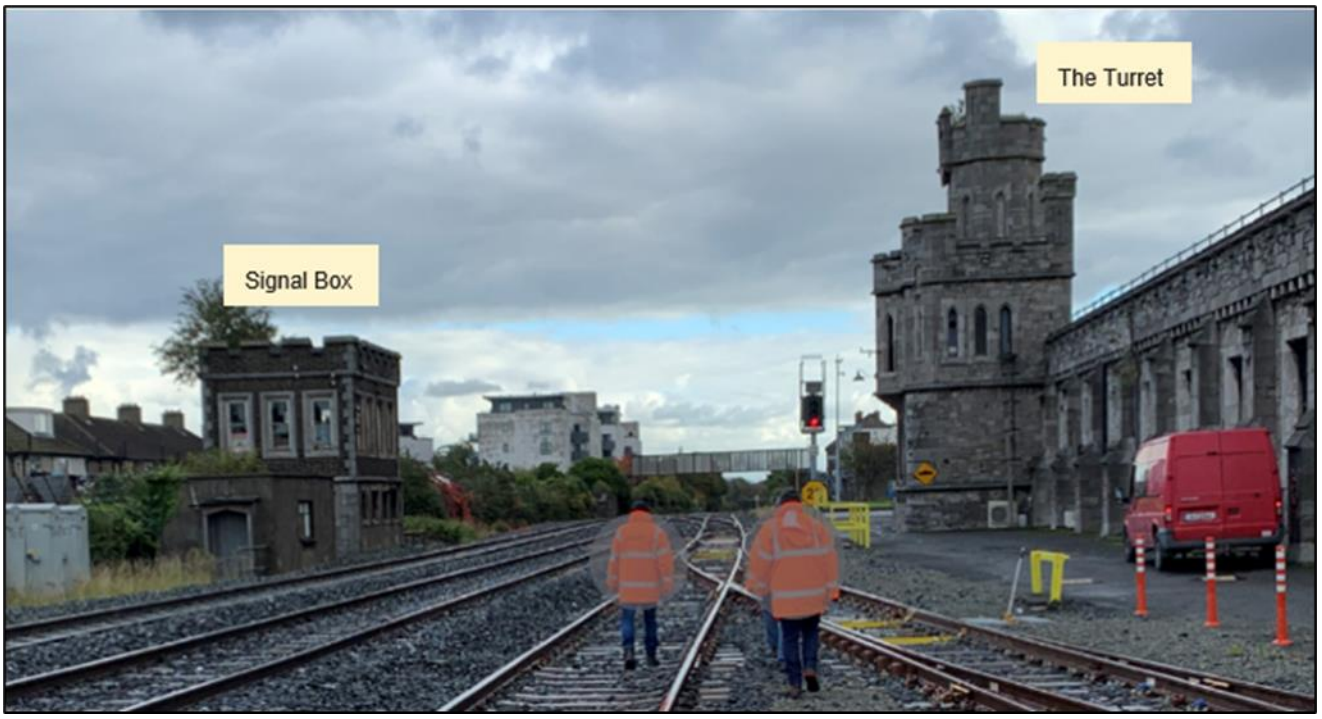

Figure 7-21 The Railway Corridor along Inchicore Depot

7.5.3 Construction Compounds

Two Construction Compounds are required along this section of the scheme to facilitate this work. There are no alternative site locations evident as direct localised access to the railway and Khyber Pass Footbridge is required.

7.5.3.1 Inchicore Depot Construction Compound

A compound is required at Inchicore to facilitate the construction works in this area. Works include the widening of the rail corridor, construction of retaining walls and installation of new trackwork.

The compound will be used as the main materials storage, processing and recycling area on this section of the route. It will also be used to provide site offices, welfare facilities and contractor parking and equipment storage.

The compound is located within Iarnród Eireann's Inchicore Depot, it is the most suitable location convenient for much of the excavation and widening work between Kylemore and Sarsfield Road. As the site is within the Inchicore Depot, no additional land will need to be acquired.

Personnel and machinery access to the railway on the south side of the works will use this compound, but access to the north side will also be via alternative locations at either Sarsfield Road or Kylemore. Access to the site is through the Inchicore Depot to Jamestown Road, Kylemore Way, Kylemore Road to the Naas Road.

Figure 7-22 Inchicore Preferred Construction Compound Location

7.5.3.2 Khyber Pass Construction Compounds

Khyber Pass Footbridge is being replaced with a new structure to facilitate the widening of the rail corridor. 2 no. discrete compounds are required in this area (one either side of the tracks) to facilitate the bridge reconstruction, and also localised works in the rail corridor. The works required in this area include the demolition of the existing footbridge, the construction of the ramps and stairs, and the lifting in of a prefabricated bridge.

The site located to the south will accommodate offices, parking for workers vehicles and site vehicles and a materials storage and laydown area. The site is located within Irish Rail's Inchicore Depot, on CIÉ property. Construction traffic can travel through the Inchicore Depot to Inchicore Terrace, Sarsfield Road, and on to Chapelizod Bypass (Con Colbert Road). However, Inchicore Terrace is quite narrow, so an alternative is to travel through the Inchicore Depot to Jamestown Road, Kylemore Way, Kylemore Road to the Naas Road.

Access and a suitable working space is also required on the north side of the bridge. There is an existing pedestrian access route, this may require localised alterations to facilitate material and equipment access. The north side of the bridge is constrained by private properties on both sides of the access route.

Figure 7-23 Khyber Pass Footbridge Preferred Construction Compound Locations

7.5.4 Construction

This section of the report sets out the approach in relation to the construction technologies and methodology for the works in the area along this section of the railway so that the public may understand the approach being considered. It is acknowledged that this information is based on information and a level of design available at this time and it will continue to be developed as part of the Railway Order package and supporting documentation.

This section of the railway corridor has to be widened to accommodate the additional two tracks for the new DART service. The cross section varies through this area but is predominantly at grade, with property boundaries close to the rail corridor on both sides

7.5.4.1 Summary of the Proposed Works

Khyber Pass Footbridge is to be demolished and reconstructed. The section of the railway corridor has to be widened from Kylemore Road Bridge to Sarsfield Road Bridge to accommodate the additional two tracks for the new DART service. In addition, the two northern tracks through this area (Slow Tracks) will be electrified. Localised alterations are required to the track layout to maintain operations and access to the maintenance depot. Works also include the installation of a new underground drainage attenuation tank adjacent to the main depot entrance off Inchicore Parade.

7.5.4.2 Retaining Structures

To achieve the widened cross section, to limit the impact of the construction works on adjacent properties and to reduce land acquisition, it is proposed to construct walls along each side of the corridor where there is a level difference between the tracks and the adjacent land.

A number of different wall types are proposed depending on the height of the retained soil, the soil conditions and the proximity of buildings to the corridor. Refer to **Section 5.2.7** for a description of the different retaining walls under consideration.

It is proposed that a bored secant pile wall solution will be adopted for the section of retaining wall immediately east of Kylemore Road Bridge along the perimeters to form the northern and southern tracks cess edge. The retaining walls vary between 4m to 6 m in height and will be constructed utilising access from the trackside within Irish Rail lands.

To minimise the pile size and associated lateral movement of the upper portion of the walls and to maintain the integrity of the infrastructure beyond the crest of the retained slope, the retaining walls along this section shall be anchored using soil nails extending into the existing slope substratum on both the northern and southern side of the rail corridor. The length of the soil nails/ground anchors will vary based on the height of the cutting slope to be retained and are anticipated to be approximately 10 to 15 m in length. The soil nails/ground anchors will be installed utilising access from the trackside within Irish Rail lands.

Existing nearby walls, buildings, structures and earthworks may require monitoring (e.g. vibration monitoring) during any nearby piling works for new structures to ensure no structural damage or instability is caused.

Cantilever walls are proposed at the wall locations east of the secant pile wall towards Khyber Pass Footbridge. The cantilever walls will typically range from 0.5m to 3 m in height.

7.5.4.3 Bridges

The construction of the Khyber Pass Footbridge will require a small portion of permanent land take to accommodate the new foundations of the abutment to the north of the rail corridor (note the foundation outline in **Error! Reference source not found.**). The proposed bridge and stair would be predominantly comprised of e lements that are pre-cast or prefabricated off site due to the installation site constraints and to reduce the installation period. The site occupation would be associated with the foundation construction, jointing and protection of stairway sections as well as the lifting and finishing of the off-site fabricated elements.

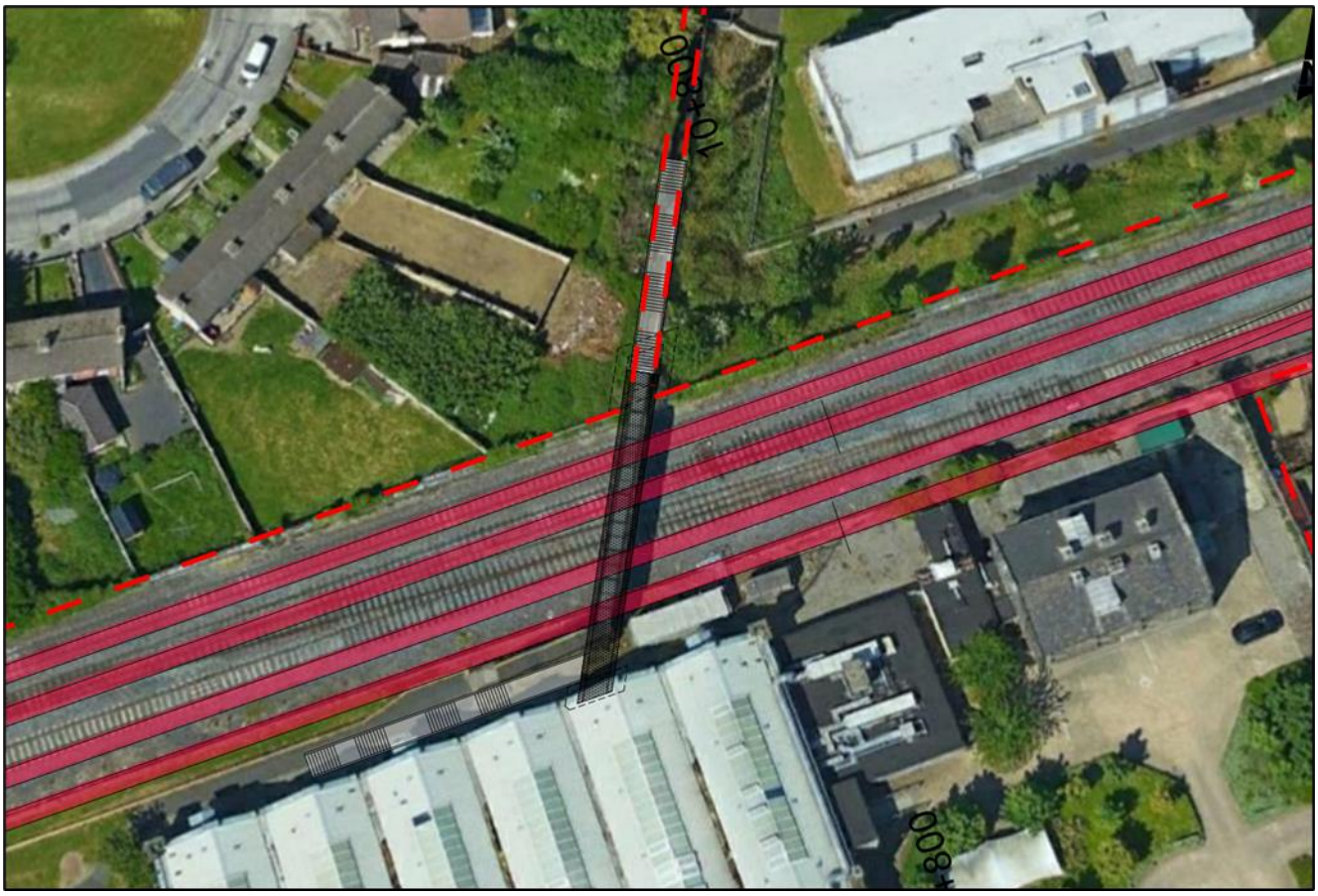

Figure 7-24 Khyber Pass Footbridge

7.5.4.4 Permanent Way

Some minor track lowering will be required through this area to facilitate the provision of four-tracking and electrification. Works will comprise:

- Diversion or closure of the operational track, utilities and ancillary infrastructure.
- Where excavations are significant, support of adjacent operational track.
- Excavation of trackbed.
- Excavation of sub strata.
- Replacement of utilities and ancillary infrastructure.
- Construction of new trackbed.
- Significant track realignment required within the depot area to facilitate the widening of the rail corridor and provision of four tracks, sidings and access points to the depot to be reconfigured
- Installation of a new shunt siding on the western approach to the depot.

A number of temporary P&Cs will be required in this section:

- Between Khyber Pass Footbridge and Sarsfield Road Bridge to facilitate the phased construction of the 2 no. bridge decks of Sarsfield Road Bridge in the adjacent section.
- Between Kylemore Road Bridge and Khyber Pass Footbridge to facilitate the construction of the retaining walls along the north of the track which are a future precursor to reconstructing Kylemore Road Bridge.

Where feasible, the numerous existing crossings associated with Inchicore Depot will be used to minimise disruption to the existing railway operations and avoid unnecessary works.

7.5.4.5 OHLE Infrastructure

Structures will be required at a maximum spacing of 60m along the track to support the catenary cables. The support structures are generally supported from one side of the track (cantilever) or from both sides (portal) depending on the permanent way layout. Where there are adjacent walls the support structure can be fixed to the walls negating the need for vertical supports (stanchions).

Support structures will be founded by means of either piles or spread foundations, depending on soil conditions or the contractor's preferred methodology.

It is envisaged that the OHLE will be constructed in safe zones adjacent to the live railway or in night-time possessions.

7.5.4.6 Temporary Traffic Management

While no public road diversions or closures are envisaged for this section of railway construction; there are a number of compounds earmarked for the critical area. This is one of the few areas where the railway corridor has a substantial southern proportion that is not within a cutting, but the northern section will for the most part not be accessible from the south due to the operational needs of the railway. Accordingly, access will be required through:

- The proposed plot north west of Kylemore Road Bridge in order to construct piling platforms and retaining walls along the northern boundary to the railway corridor behind the Landen Road properties.
- In addition, the pan-handle access road to the west of the Seven Oaks Apartment Complex (which also serves as a secondary fire tender access/egress point) would be required for a period of time for the construction of the Kyber Pass Footbridge. The Inchicore Depot operational personnel that currently use this bridge will diverted temporarily via Sarsfield Road and in through the main entrances of the Inchicore Depot; or alternative internal transport arrangements made with IÉ.

7.5.5 Permanent and Temporary Land Requirements

The Preferred Option focuses on the enhancement of the corridor to the south, requiring the demolition / modification of some CIÉ facilities within the Inchicore Depot, minimising the impact to third party properties to the north of the rail corridor.

The widening of the corridor towards the south will impact a third-party residential property at St George's Villas and commercial properties at Westlink Industrial Estate. The replacement of the Khyber Pass Footbridge will require a small portion of permanent land take to accommodate the new foundations of the abutment to the north of the rail corridor. Further design development and construction related solutions will seek to minimise these impacts.

The preferred location for the Kylemore Substation is on lands in third party ownership and land acquisition will be required.

The preferred location of the construction compound for Khyber Pass north of the railway will require temporary land acquisition for the duration of the works. The retaining wall solution along both the north and south sides of the rail corridor may also require the temporary acquisition of lands in third party ownership the duration of the works to facilitate the construction of retaining structures. In particular boundary walls, sheds and gardens may be impacted along Landen Road and the rear of commercial properties at Westlink Industrial Park. Further design development and construction related solutions will seek to minimise this impact.

7.6 Sarsfield Road Bridge to Memorial Road

This section extends from the west side of Sarsfield Road Bridge (UBC4) to just west of Memorial Road Bridge.

The railway corridor along this section comprises three tracks and it includes Sarsfield Road Bridge which carries the three rail tracks over the single-carriageway Sarsfield Road below. The road is in a deep cutting that is supported by masonry retaining walls on all four sides. The carriageway width is narrow, and a yield system is in operation which permits only a single lane of traffic beneath the structure.

There is a commercial property located on the south-east side of the bridge retained along Sarsfield Road by a masonry wall. Its northern boundary with the rail corridor is a masonry and blockwork retaining wall. A horse sanctuary/field is located on the opposite side (northern side of the corridor).

Further to the east, the railway is at grade before generally returning to a cutting formed by retaining walls along the south side, and an earthwork cutting slope along the north side between the railway and the Chapelizod Bypass (Con Colbert Road)..

At Sarsfield Road Bridge, the rail corridor is on an embankment. Further to the east, the railway is at grade then generally returns to a cutting which gradually steepens on approach to Memorial Road Bridge. The south side of the rail corridor is retained with a battered masonry retaining wall. The north side of the rail corridor is formed with earthwork cutting slope. The area does not currently have any provisions for electrification. The major infrastructure features of the area are illustrated in the **Figure 7-25** below.

For more details on this section of the route refer to Volume 1 (Schematic Layout (Sheet 13)) and Volume 3E.

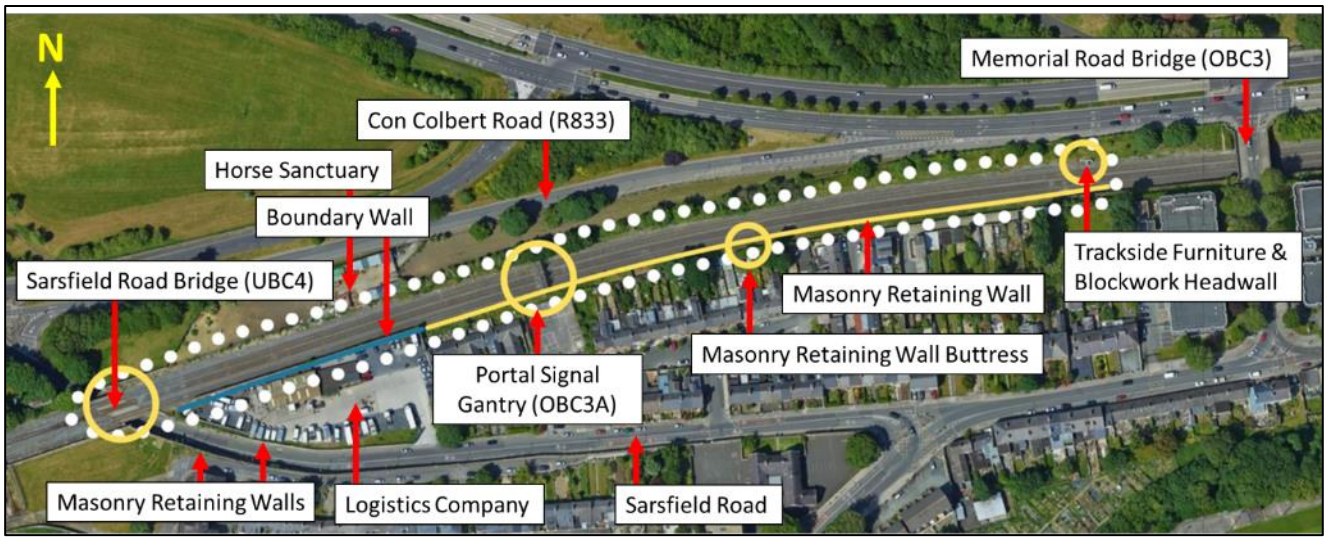

Figure 7-25 Aerial view (white dotted outline of area)

Figure 7-26 Sarsfield Road Bridge

7.6.1 Review of Public Consultation No.1 Feedback, Design Development and the Preferred Option

The Project Team has analysed the submissions and considered all relevant information in re-evaluation and further development of design options leading to the selection of the Preferred Option.

The railway corridor transitions from being at grade at the east side of Sarsfield Road Bridge to a cutting (tracks at a lower level than the surroundings). The rail corridor will need to be widened to accommodate the increase

from three tracks to four tracks. The track will also need to be lowered to provide sufficient clearance under the new Memorial Road Bridge. The modifications to railway corridor will necessitate the construction of retaining structures along sections to the north and south of the corridor.

It is proposed that a new track drainage system would be installed and connected to a proposed attenuation facility located near Heuston Station, before discharging to the River Liffey.

Sarsfield Road Bridge carries the railway over Sarsfield Road. Both the bridge and the railway corridor in this area comprises of three mainline tracks which are not wide enough to carry the fourth track that is required.

The Preferred Option involves the replacement of the existing bridge deck with two parallel bridge decks, one for the InterCity service and one for the DART service. The existing abutments and supporting structures below deck level will be retained. This Preferred Option also avoids works to the road alignment by increasing the track and deck levels to achieve required clearance underneath.

Heading east of the bridge the corridor will predominantly be widened to the north to add a fourth track (into the embankment between the railway and Chapelizod Bypass (Con Colbert Road). There is potential interference to third party property rights but further design development and construction related solutions will seek to minimise this impact.

The proposed bridge is presented below in sectional elevation looking east towards Heuston Station.

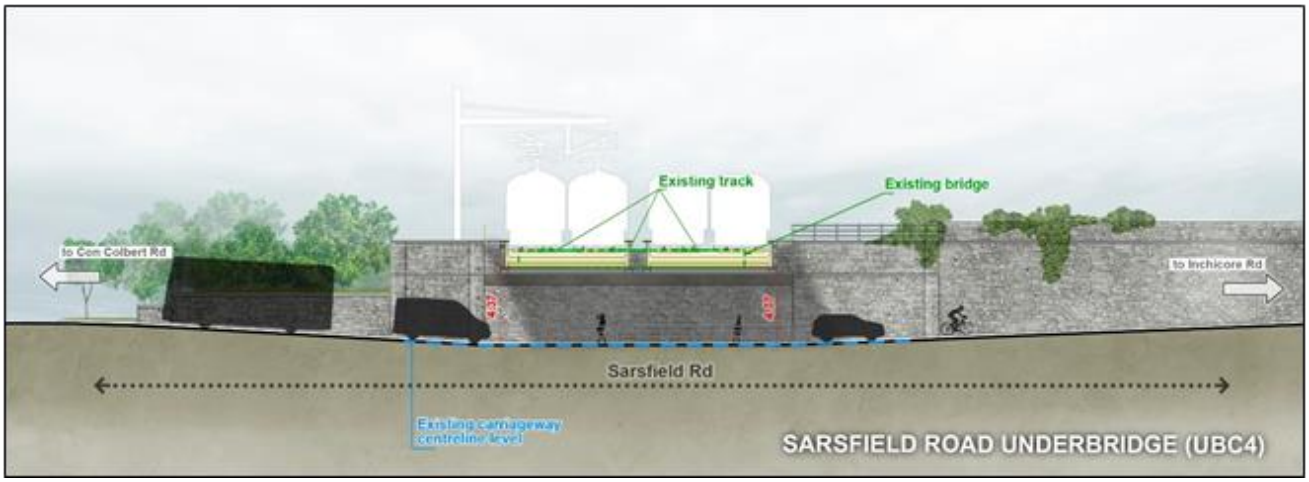

Figure 7-27 Preferred Option for Sarsfield Road Bridge

7.6.2 Sarsfield Construction Compounds

The underbridge located at Sarsfield Road needs to be reconstructed to accommodate the widened track corridor. A new underground attenuation tank is also required in this area, as part of the modifications to the drainage system. The new tank will be located adjacent to the car park at the entrance to Inchicore Depot. A construction compound is required at this location.

As access is required for these localised works, in particular the bridge reconstruction where three discrete compounds are required, located at each corner of the bridge. The site to the north west of the bridge was initially considered as part of Stage 1: Preliminary Sifting; however, it is constrained by private property and would necessitate significant works to provide suitable access. It therefore failed to meet the necessary Engineering Feasibility and Project Requirements. As there are no other suitable alternative locations in the area, the selection process did not include optioneering, and the three other sites were brought forward.

- **The Construction Compound located at south west corner of Sarsfield Road Bridge:** This is an existing flat grassed area; a compound is required at this location to provide access to the works on the south west of the bridge and for craning in of bridge beams. This area will be used to provide site offices, welfare facilities and storage. This compound extends to the east to facilitate construction of the new underground attenuation tank. Construction traffic can travel through the Inchicore Depot to Inchicore Terrace, Sarsfield Road, and on to Chapelizod Bypass (Con Colbert Road). However, Inchicore Terrace is quite narrow, so an alternative is to travel through the Inchicore Depot to Jamestown Road, Kylemore Way, Kylemore Road to the Naas Road.
- **The Construction Compound to the north east of Sarsfield Road Bridge**: This site is also required for the construction of the bridge in addition to the track works, the site is a green area, which can be accessed from Chapelizod Bypass (Con Colbert Road).
- **The Construction Compound located at the South East corner of the bridge.** This site (occupied by Dan Ryan Truck Rental) is located adjacent to Sarsfield Road Bridge, and will potentially be impacted by the works in this area, primarily due to the widening of the rail corridor. As such, the site has been identified as a potential location for a construction compound. This site would provide access to the works on the south east corner of the Sarsfield Road Bridge and the boundary wall to the south of the corridor.

Figure 7-28 Sarsfield Road Preferred Construction Compound Locations

7.6.3 Construction

This section of the report sets out the approach in relation to the construction technologies and methodology for the works in the area along this section of the railway so that the public may understand the approach being considered. It is acknowledged that this information is based on information and a level of design available at this time and it will continue to be developed as part of the Railway Order package and supporting documentation.

7.6.3.1 Summary of Proposed Works

This section of the railway corridor has to be widened to accommodate the additional two tracks for the new DART service. The cross section varies through this area but is predominantly at grade, with property boundaries close to the rail corridor on both sides

7.6.3.2 Retaining Structures

To achieve the widened cross section, to limit the impact of the construction works on adjacent properties and to reduce land acquisition, it is proposed to construct walls along each side of the corridor where there is a level difference between the tracks and the adjacent land. A number of different wall types are proposed depending on the height of the retained soil, the soil conditions and the proximity of buildings to the corridor.

It is proposed that a bored secant pile wall solution will be adopted for the section of retaining wall west of Memorial Road Bridge along the perimeter of the northern tracks cess edge. The secant pile walls vary between 5 to 7 m in height and will be constructed utilising access from track side within CIÉ lands.

To minimise the pile size and associated lateral movement of the upper portion of the walls and to maintain the integrity of the infrastructure beyond the crest of the retained slope, the retaining walls along this section shall be anchored using soil nails extending into the existing slope substratum on the northern side of the rail corridor. The length of the soil nails/ground anchors will vary based on the height of the cutting slope to be retained and are anticipated to be approximately 15 m in length.

The soil nails/ground anchors will be installed utilising access from track side within CIÉ lands.

Existing nearby walls, buildings, structures and earthworks may require monitoring (e.g. vibration monitoring) during any nearby piling works for new structures to ensure no structural damage or instability is caused.

Cantilever walls are also proposed along to the western end of this section and will typically range from 1 to 3.5 m in height. These walls are still subject to further design development.

7.6.3.3 Bridges

The proposed replacement of Sarsfield Road Bridge comprises two independent decks; the construction of which will be managed independently. The southern deck is proposed to be constructed first; which will require demolition of the southern portion of the existing deck through a 48-72hr possession (assuming a weekend road closure). The existing two northernmost tracks are proposed to remain operational during the abutment construction of the southern deck. The abutment piling will be carried out in sequence (one after the other, to the east and west of the road) behind the existing stone masonry retaining walls.

Once the seating beam is constructed and a layer of upper stone masonry removed to provide access to the future bearing shelf, the steel portal frame will be craned into place using cranes located in the proposed compounds adjacent to the bridge. The portal frame will essentially include a permanent formwork and parapets allowing the remaining steel works and concrete preparatory works to continue while road traffic is unhindered.

The removal and installation of the northern deck will only commence once the northern tracks are diverted to the proposed new southern deck and brought into operation under a temporary track configuration to the east and west of the bridge. After the track diversion is brought into operation the remainder of the existing deck (to the north) would be demolished. Thereafter the existing bearings would be removed and the decks new bearing plinths with bearing arrangements installed followed by the same cranage and operations associated with the southern steel portal frame deck.

The duration of the construction associate with the bridge itself is anticipated be 4-5months (approx.) however the work in the locality of the bridge will be substantially longer owing to the temporary track arrangements and retaining wall construction required both east and west of the bridge. This would include the utility diversions at road level in order to facilitate the phased construction and limit impact to road, rail and public utility users.

7.6.3.4 Permanent Way

Track works will be required through this area to facilitate the provision of four tracking and electrification. Works will comprise:

- Diversion or closure of the operational track, utilities and ancillary infrastructure.
- Where excavations are significant, support of adjacent operational track.
- Excavation of track bed.
- Excavation of sub strata.
- Replacement of utilities and ancillary infrastructure.
- Construction of new track bed.

7.6.3.5 OHLE Infrastructure

Structures will be required at a maximum spacing of 60m along the track to support the catenary cables. The support structures are generally supported from one side of the track (cantilever) or from both sides (portal) depending on the permanent way layout. Where there are adjacent walls the support structure can be fixed to the walls negating the need for vertical supports (stanchions).

Support structures will be either founded by means of piles or spread foundations, depending on soil conditions or the contractor's preferred methodology.

It is envisaged that the OHLE will be constructed in safe zones adjacent to the live railway or in night-time possessions.

7.6.3.6 Temporary Traffic Management

Construction works at Sarsfield Road Bridge will require two types of closure of Sarsfield Road underpass over a potential 6 months period (approx.) as follows:

- 24-72hr for existing deck demolition and portal frame installation. Restricted to off-peak periods e.g. weekends.
- 30mins-2hrs for material cranage or concrete pours. Restricted to off-peak hours e.g. 10am-2:30pm or late night subject to other considerations.

A number of proposed temporary traffic management solutions for the road closure periods are set out in summary below. For further details refer to Volume 3E.

Private and Commercial Vehicles

During periods of closure, it is anticipated that vehicle users would have to pre-plan their own diversion routes either back to M50 via N4/Chapelizod Bypass or west via Kylemore or Le Fanu or Park West crossings or east along Con Colbert Chapelizod Bypass and turn into South Circular Road (among many other alternative subject

to their destination of choice). As the longest closures would only be anticipated to be over a weekend, it is assumed that users would be distributed onto the surrounding network over the limited period.

Many Heavy Goods Vehicles (HGVs) are already restricted from using Sarsfield Road due to the existing constrained bridge clearance. Full restriction on HGV's may be prudent during abutment piling works.

Vulnerable Users (Pedestrians, Wheelchair users and Cyclists)

Cyclists currently use vehicular lanes and this is not intended to change during construction works associated with the abutments. The intention would be to divert pedestrians well in advance of the bridge to the opposite side of the road to which the abutment piling is taking place.

These short duration closures will be planned and communicated in advanced and require the necessary lane closure approvals. They will typically be off-peak closures and where alternative arrangements could not be made the diversion route would add to a pedestrian or cyclists' journey (subject to their final destination). Refer to Volume 3 for further details on potential diversions.

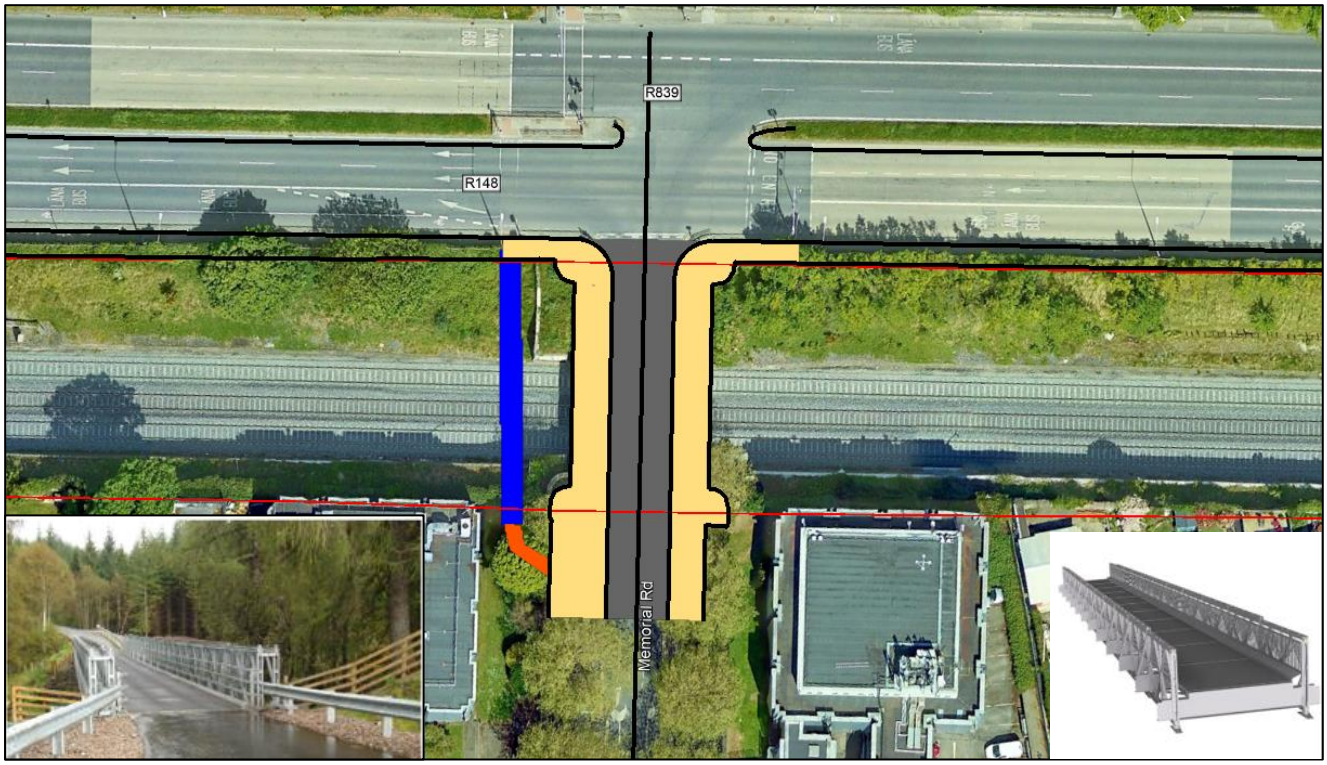

Figure 7-29 Proposed temporary vulnerable user diversion (incl. bridge)

Public Transport

Sarsfield Road (westbound lane) currently is designated for bus use only, but traffic counts suggest it is already used regularly by other forms of transport. As Sarsfield Road and Memorial Roads are not planned to be closed at the same time during the Project, Dublin Buses (Routes 40 & 79) could be diverted. Refer to Volume 3E for further details on potential diversions.

7.6.4 Permanent and Temporary Land Take

The widening of the corridor towards the south will impact a third-party commercial property fronting onto the railway line to the south east of Sarsfield Road Bridge (Dan Ryan Truck Rental).

The preferred location of the construction compounds will include temporary land acquisition for the duration of the works.

The retaining wall solution along both the north and south sides of the rail corridor may also require the temporary acquisition of lands in third party ownership the duration of the works to facilitate the construction of retaining structures. In particular boundary walls, sheds and gardens backing onto the railway may be impacted along Murray's Cottages, Sarsfield Road, Woodfield Avenue and Woodfield Place.

7.7 Memorial Road Bridge to South Circular Road Junction

This area is focused on Memorial Road Bridge (OBC3). The rail corridor consists of three tracks below the surrounding ground level. Refer to **Figure 7-30**.

Memorial Road Bridge carries two lanes of northbound traffic over the railway from Inchicore Road (R839) to Chapelizod Bypass (Con Colbert Road - R148). There are no southbound traffic lanes on the bridge. The signalised junction of Memorial Road and the Chapelizod Bypass (Con Colbert Road) is immediately adjacent to the north side of the bridge.

The bridge is a highly trafficked pedestrian route providing access between Memorial Park and the Kilmainham Gaol historical sector and community facilities.

For more details on this section of the route refer to Volume 1 (Schematic Layout (Sheet 13)) and Volume 3F.

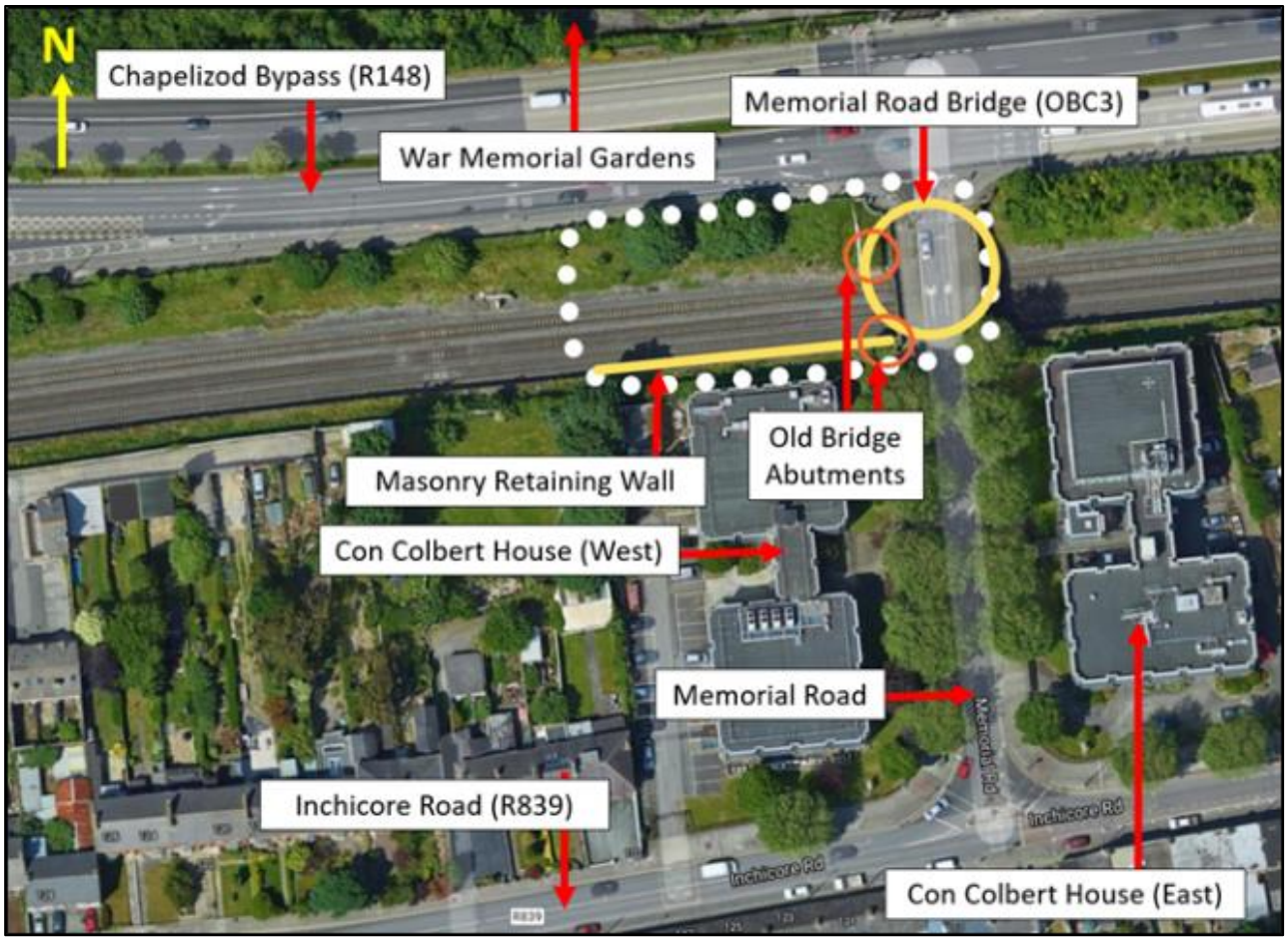

Figure 7-30 Aerial View (White Dotted Outline)

7.7.1 Review of Public Consultation No. 1 Feedback, Design Development and the Preferred Option

The Project Team has analysed the submissions and considered all relevant information in the re-evaluation and further development of the design options, leading to the selection of the Preferred Option.

The existing Memorial Road Bridge is too short in span length to accommodate the additional fourth track, so a longer span bridge is required. The existing bridge also does not have the height required to accommodate the electrification infrastructure beneath the bridge. The bridge is very close to the Chapelizod Bypass (Con Colbert Road), so any increase in the height of the road would have an impact on this dual carriageway.

The Preferred Option replaces the bridge with a longer span bridge. In addition, the rail tracks will be lowered to facilitate the electrification infrastructure beneath the new bridge. The masonry retaining walls on the southern side would need to be strengthened due to the lowering of the track, and new retaining walls would be required along the northern side.

The permanent way boundary wall along Chapelizod Bypass (Con Colbert Road) will need to be reconstructed to a higher containment standard and height, as it will be removed to provide retaining wall construction access. The proposed bridge is presented below in sectional elevation looking east towards Heuston Station.

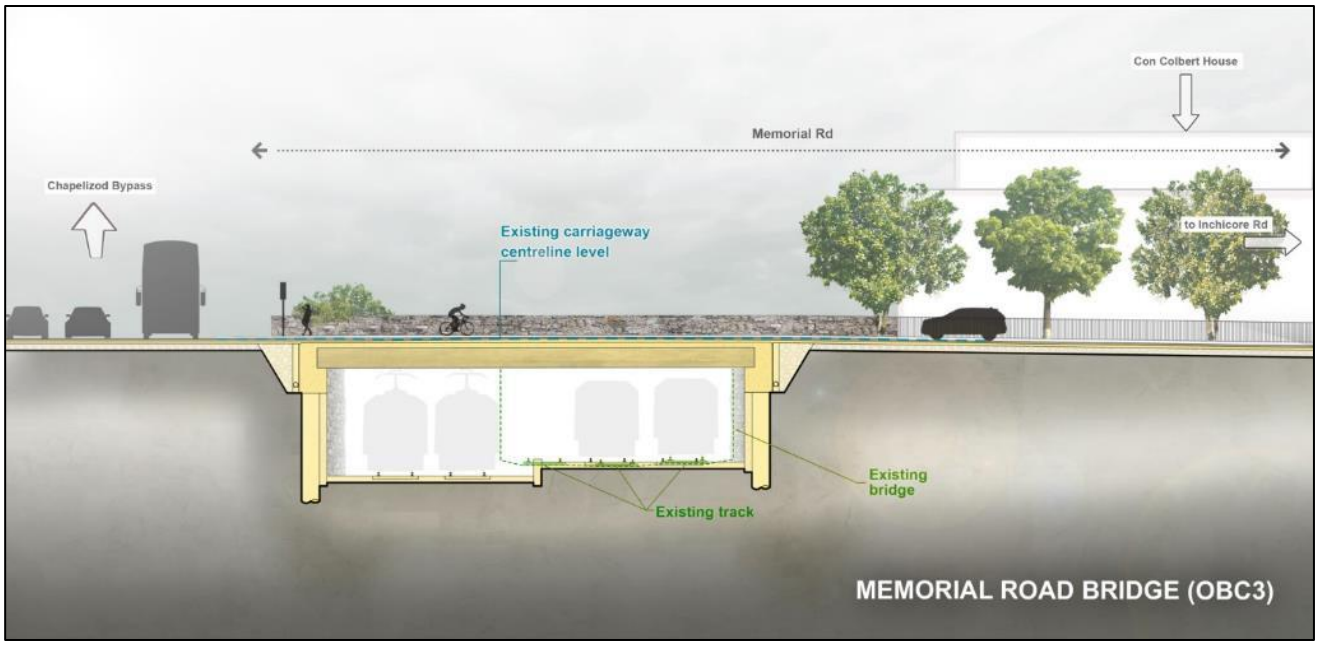

Figure 7-31 Preferred Option for Memorial Road Bridge

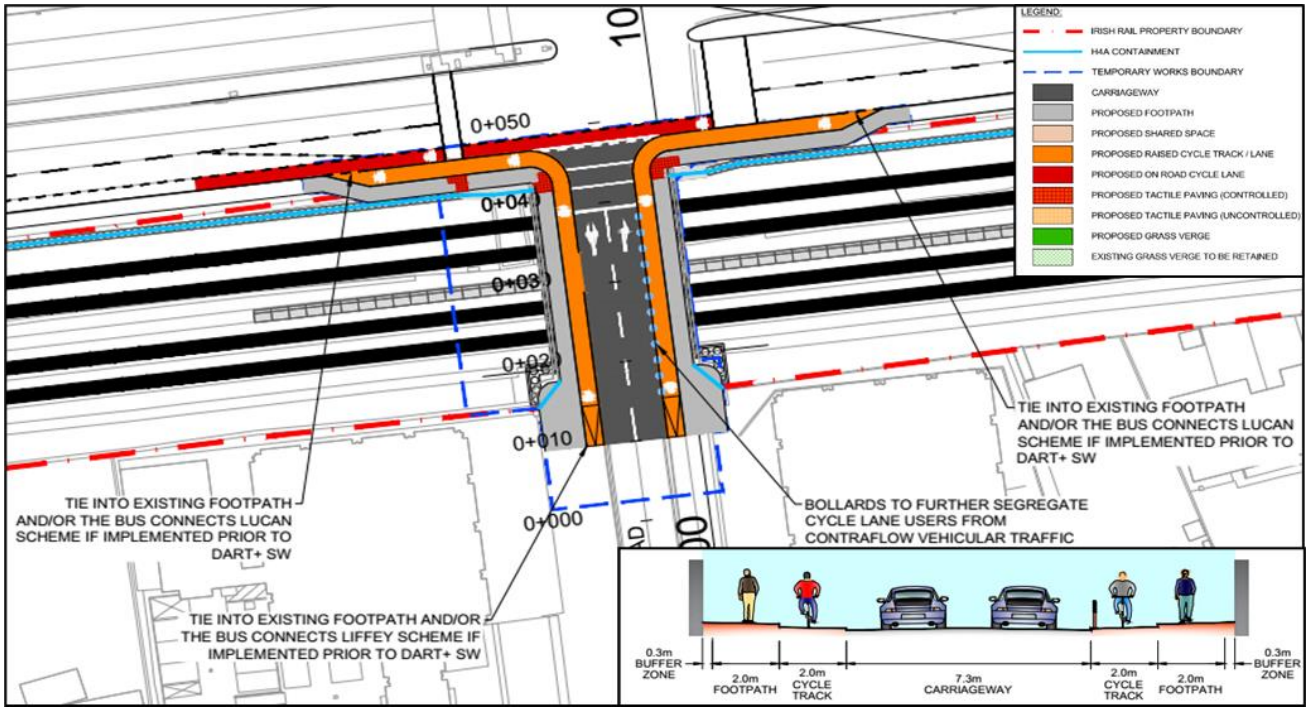

Figure 7-32 Memorial Road Bridge Proposed Plan

After consultation with BusConnects, it was agreed that the proposal to reinstate a widened carriageway would be preferable for their design intent. This would remove the carriageway narrowing that exists over the bridge and would align the new cycle lane kerb line over the bridge with existing kerb line along the remainder of Memorial Road to the south.

7.7.2 Memorial Road Construction Compound

The current preferred option is to replace Memorial Road Bridge with a wider structure. There is insufficient space in the area to provide a temporary road bridge for temporary diversion of the road traffic; as such, Memorial Road will need to be closed for a period of time. A temporary pedestrian and cycle bridge is proposed.

It is proposed to utilise the remainder of Memorial Road as a construction compound. This site will accommodate offices, parking for workers' vehicles and site vehicles, and a materials storage and laydown area.

A platform will be required to accommodate a crane which will be used to move materials to their permanent locations from roadside positions, in particular bridge beams. The first lane (bus lane) of Chapelizod Bypass (Con Colbert Road) will be required for access to the rail corridor to facilitate soil excavation and the construction of retaining structures. It is therefore proposed to close the first lane of this road from the South Circular Road Junction to beyond Memorial Road and to utilise this space as a construction compound.

The site does provide good access to the road network, located adjacent to Chapelizod Bypass (Con Colbert Road) which leads directly to the M50 by means of a dual carriageway.

The works are taking place in a spatially constrained location, and the proposed location for the construction compound is the only available space in this area. As there are no other suitable alternative locations in the area, the selected compound location did not require optioneering.

Large sections of the westbound bus lane will require closure to facilitate access and egress to the construction compound, as well as the works itself. Shorter sections have the potential to pose a greater hazard.

Figure 7-33 Memorial Road Bridge (OBC3) Preferred Construction Compound Location

7.7.3 Construction

This section of the report sets out the approach in relation to the construction technologies and methodology for the works in the area along this section of the railway so that the public may understand the approach being considered. It is acknowledged that this information is based on the information and level of design that is available at this time, and it will continue to be developed as part of the Railway Order package and supporting documentation.

7.7.3.1 Summary of the Proposed Works

The section of the railway corridor between Cherry Orchard & Park West Station and Heuston Station must be widened to accommodate the additional two tracks for the new DART service. The cross section varies through this area but is predominantly in a cutting, with property boundaries close to the top of the cut slopes. The widening operation is further complicated by the need to lower the slow tracks through much of the four-tracking area so that roads that cross the corridor on bridges are not raised too much (creating significant impact on local properties and road infrastructure); this is particularly relevant to this section as it is linked to the adjacent section to its east (the approach to the South Circular Road Buried Portal).

7.7.3.2 Retaining Structures

To achieve the widened cross section, and limit the impact of the construction works on Chapelizod Bypass (Con Colbert Road), it is proposed to construct retaining walls along the northern corridor boundary where there will be a level difference between the proposed tracks and the adjacent land (Chapelizod Bypass / Con Colbert Road corridor).

Several different wall types and /or earth retaining methodologies are proposed across the project depending on the height of the retained soil, the soil conditions and the proximity of buildings to the corridor. . Refer to **Section 5.2.7** for a description of the different retaining walls under consideration.

It is proposed that a bored secant pile wall solution will be adopted for the section of retaining wall along the northern perimeter to form the northern (slow) tracks cess edge. The retaining wall will be approximately 4.5m to 7m in height and will be constructed utilising access from the trackside within Irish Rail lands.

The over steepened nature of the existing cutting slopes, proximity of the adjacent Chapelizod Bypass (Con Colbert Road) and height of the cutting slope to be retained, necessitates a piled wall solution with the inclusion of soil nails or ground anchors.

To minimise the pile size and associated lateral movement of the upper portion of the walls and to maintain the integrity of the infrastructure beyond the crest of the retained slope along Chapelizod Bypass (Con Colbert Road), the retaining wall along this section shall be anchored using soil nails extending into the existing slope substratum beneath Chapelizod Bypass (Con Colbert Road). The length of the soil nails/ground anchors will vary based on the height of the cutting slope to be retained and are anticipated to be approximately 15m to 20m in length.

The soil nails/ground anchors will be installed utilising access from the trackside within CIÉ lands.

7.7.3.3 Bridges

The Memorial Road Bridge is to be reconstructed to enable a greater span over the railway, with the number of tracks going from two to four.

The Memorial Road Bridge will require full closure over the duration of its construction, estimated to be 14 months. The road works required are limited and it is expected that they will only extend 10-15m from the bridge abutments, by way of tie ins. A temporary bridge will be provided in advance of the works to provide an uninterrupted direct access (at this location) between Inchicore/Kilmainham and Memorial Park and St. John of God Special School for vulnerable road users (pedestrians, cyclists and wheelchair). The same temporary bridge will include the watermain and critical data centre fibre optic diversions, unless an alternative arrangement is sought for the watermain.

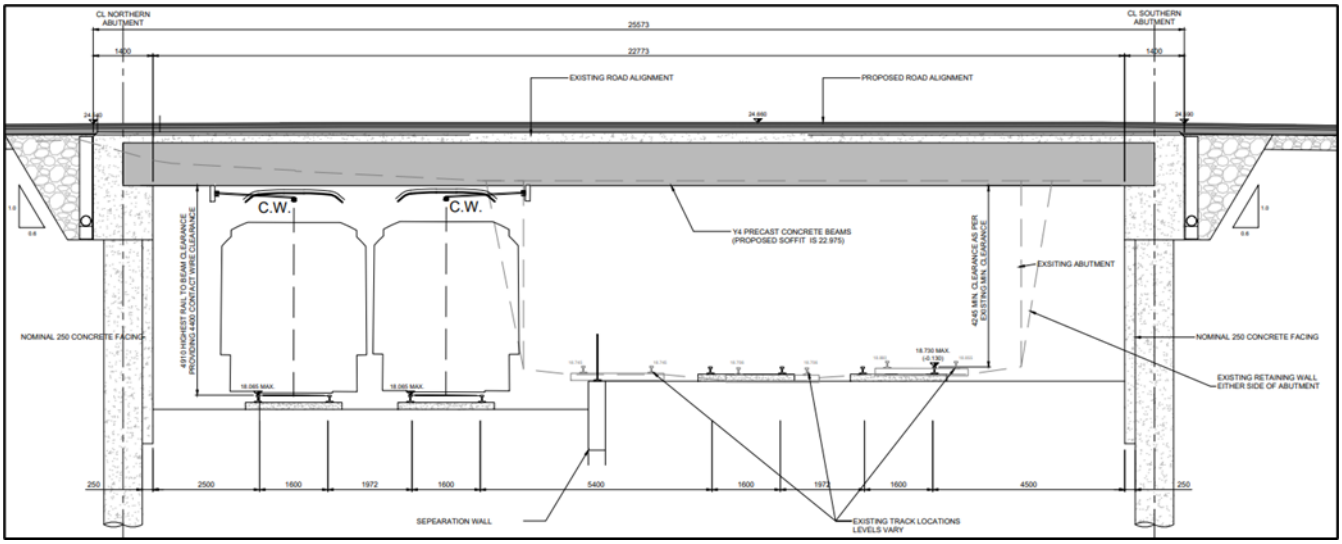

Figure 7-34 Proposed Memorial Road Bridge Cross Section

It is preferable that the Memorial Road Bridge is not constructed at the same time as the South Circular Road Buried Portal or the Sarsfield Road Bridge embankment retaining structures. Memorial Road itself will also be closed to allow construction of the new bridge in addition to the Chapelizod Bypass (Con Colbert Road) bus lane, which is needed for localised closure to allow removal of material from the trackside to road level, piling and cranage

Following demolition of the existing bridge with a track possession, bored piled walls will be constructed along both sides to form abutments. Abutting precast concrete beams will be placed on each side using a crane. A deck slab will be poured over the beams and at the end diaphragm walls to tie these into the deck. It is envisaged that boring the piles for the south side abutment will be done under possession from an enhanced safety perspective, but piles on the north side should be far enough away from the live carriageway to enable daytime safe zone working. Craning of precast beams would also be undertaken under a track possession, but deck slab and diaphragm stitches could possibly be done during live operations.

Both abutments and piers are currently assumed to be piled. Alternatives might be proposed by contractor. Works will focus on the north side and material will be moved using the transfer conveyors.

7.7.3.4 Permanent Way

Track lowering will be required through this area to facilitate the provision of four-tracking and electrification. Works will comprise:

- Diversion or closure of the operational track, utilities, and ancillary infrastructure.

- Where excavations are significant, support of adjacent operational track.
- Excavation of trackbed.
- Excavation of sub strata.
- Replacement of utilities and ancillary infrastructure.
- Construction of new trackbed.

Between Memorial Road Bridge (OBC3) and Heuston West, a retaining wall separating the existing tracks and the new DART tracks will be required. Due to the proximity of this wall to the existing track, it is probable that a few staging phases may be required to facilitate construction. Alternatively, the supporting wall will need to be constructed during night-time possession

7.7.3.5 OHLE Infrastructure

Structures will be required at a maximum spacing of 60m along the track to support the catenary cables. The support structures are generally supported from one side of the track (cantilever) or from both sides (portal) depending on the permanent way layout. Where there are adjacent walls the support structure can be fixed to the walls negating the need for vertical supports (stanchions).

Support structures will be founded by means of either piles or spread foundations, depending on soil conditions or the contractor's preferred methodology.

It is envisaged that the OHLE will be constructed in safe zones adjacent to the live railway or in night-time possessions. The phasing of the works will endeavour to keep a minimum of two working railway tracks through the Cork Mainline. It is envisaged that a safe zone will be possible for construction in this area.

7.7.3.6 Temporary Traffic Management

Private and Commercial Vehicles

The reconstruction of Memorial Road Bridge requires a full closure of the crossing from Inchicore Road to Chapelizod Bypass (Con Colbert Road) for up to a year. The temporary traffic management solutions being considered at this time are set out below:

Sarsfield Road's (westbound lane) currently is designated for bus use only, but traffic counts suggest it is already used regularly by other forms of transport. It is anticipated that these traffic patterns would be retained with no additional traffic as a result of the diversions. The R833 (Ballyfermot Rd) / Sarsfield Rd junction is restrictive (only allows a left-turn) and is therefore not anticipated to serve as a practical diversion route for Memorial Road traffic.

Traffic from Naas Road via Tyrconnell Road (all the R810) through Grattan Crescent that would typically use Memorial Road to head east into the City Centre or down South Circular Road would likely divert initially using Emmet Road as well as the South Circular Road (R111) as represented by the yellow route in **Figure 7-35**.

Road users which originate from the areas surrounding Inchicore Road Sarsfield Road and Grattan Crescent are anticipated to follow a similar routing to the vehicles originating from the south. Vehicles will travel northwards along Grattan Crescent before making a left-turn onto Emmet Rd. They will then travel onto South Circular Rd and redistribute at the Chapelizod Bypass / South Circular Rd Junction. The routing is represented by Cyan in **Figure 7-35**.

It should however be noted that, based on the existing configuration of the Chapelizod Bypass (Con Colbert Road) / South Circular Rd Junction, eastbound vehicles will be required to travel into the city via Conyngham

Road. This is a relatively large detour for eastbound traffic and therefore not the preferred solution for motorists. As a result, it is recommended that a short-term right turn movement be added to the northbound direction on the South Circular Road Bridge. This adjustment is consistent with the proposed configuration of the junction following the implementation of BusConnects. The preferred and alternative eastbound traffic diversions are shown in **Figure 7-35 and Figure 7-36** while the proposed BusConnects layout is shown in **Figure 7-36.**

Owing to the lengthy anticipated duration of the closure of the Memorial Road Bridge (OBC3) crossing; vehicular users will undoubtedly find further alternatives to reach their destinations; some of which may well be longer in length but possibly with shorter journey times.

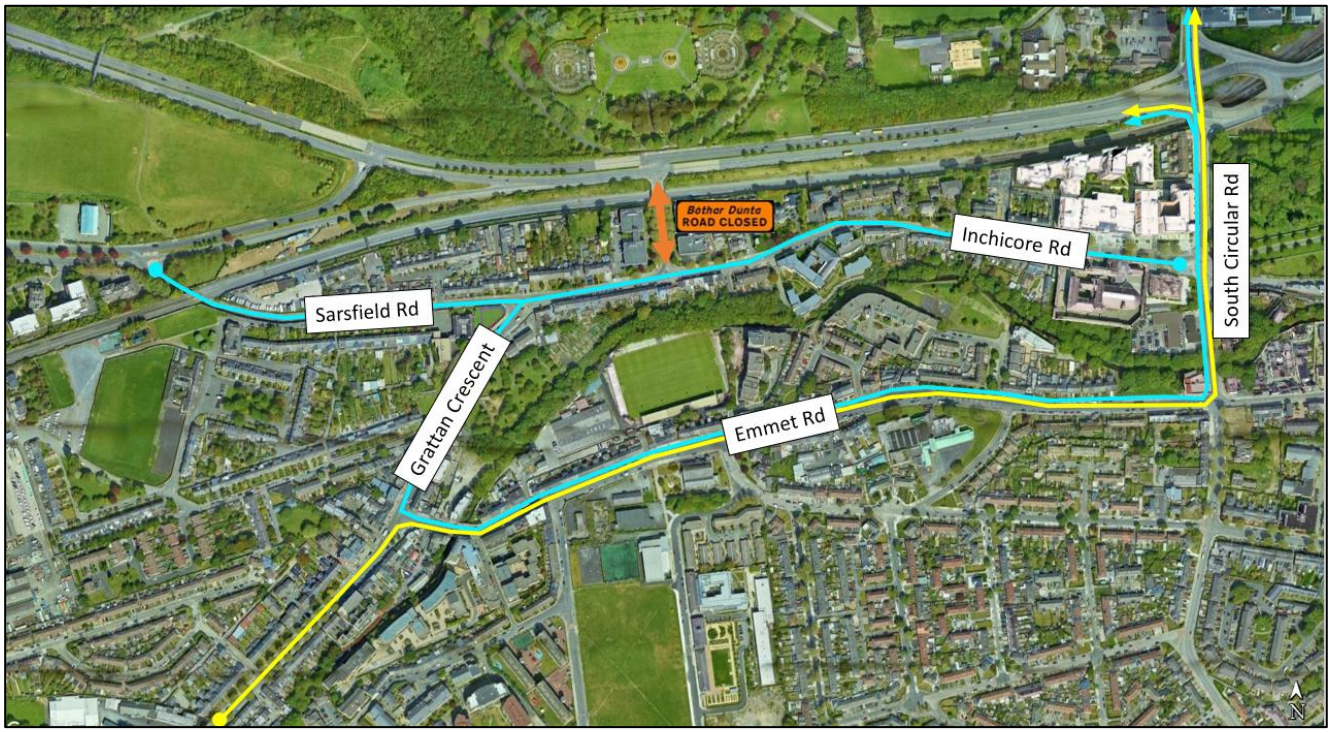

Figure 7-35 Proposed vehicular diversion routes and/or indicative dispersion patterns

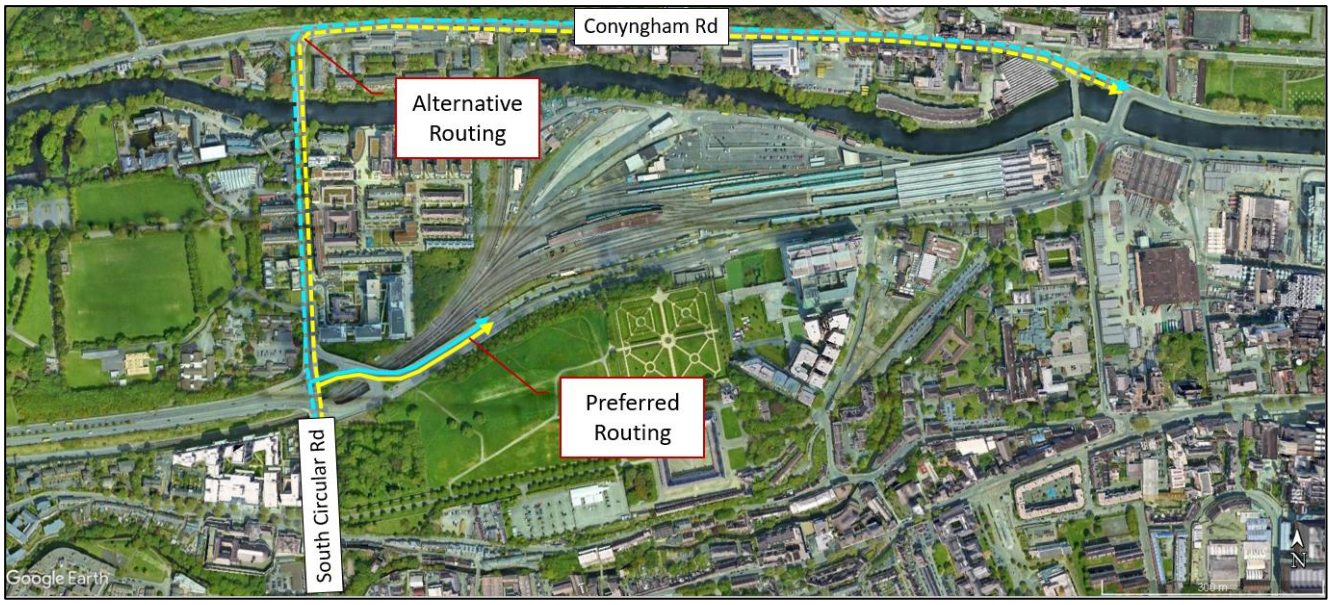

Figure 7-36 Eastbound Traffic Routing

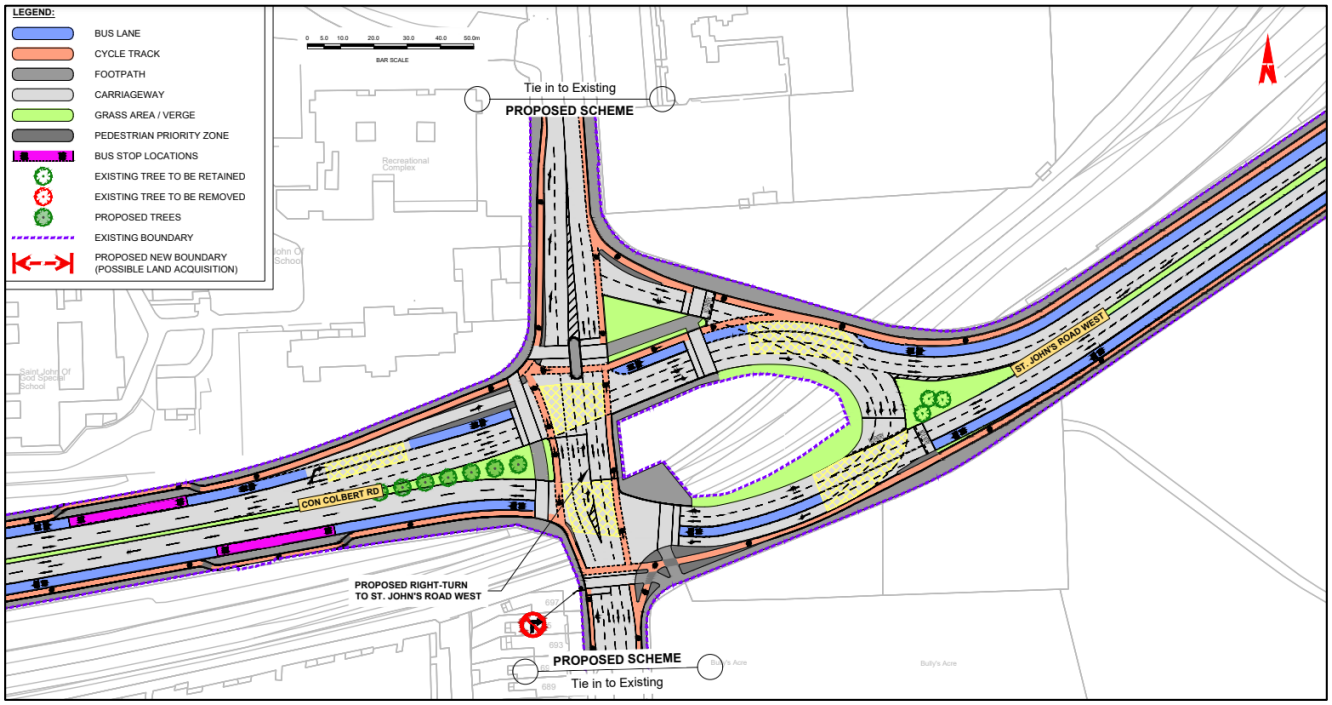

Figure 7-37 - Proposed Junction Layout - BusConnects

The right turn proposed in the temporary diversion proposal **It** would not be different to the latest published Bus Connects proposal for a permanent right turn, as evident in **Figure 7-37.**

Vulnerable Users (Pedestrians, Wheelchair users and Cyclists)

Memorial Road is also a well-used pedestrian route providing connectivity between Memorial Park (north of Chapelizod Bypass / Con Colbert Road) for those residing working or visiting Kilmainham and Inchicore areas. In addition, it provides a safer and shorter route for vulnerable children attending the St John of God's special needs school (as opposed to crossing at South Circular Road junction).

It is proposed to provide a 3.15m wide temporary bridge for continuous vulnerable user access to their original route. This would facilitate passing movements between wheelchair user (or cyclist walking a bicycle) and a pedestrian.

The eastern footpath of Memorial Road will be closed for the duration of the works as well as the southern footpath of Chapelizod Bypass (Con Colbert Road). The footpath to the west of the temporary bridge (up to the slip road leading towards Sarsfield Road) will also be closed while the retaining wall adjacent is constructed and the railway/road corridor boundary wall is reinstated onto the new piled retaining wall. Those that would normally use this section of footpath to access Memorial Park will need to walk via Sarsfield Road and cross the temporary bridge referred to above (see in **Figure 7-39**).

While currently there are some that would walk the length of Chapelizod Bypass (Con Colbert Road) using the southern footpath; during the construction of this section of track and the structure, the southern footpath will be closed and they will need to choose one of the two alternatives proposed below, in **Figure 7-38**.

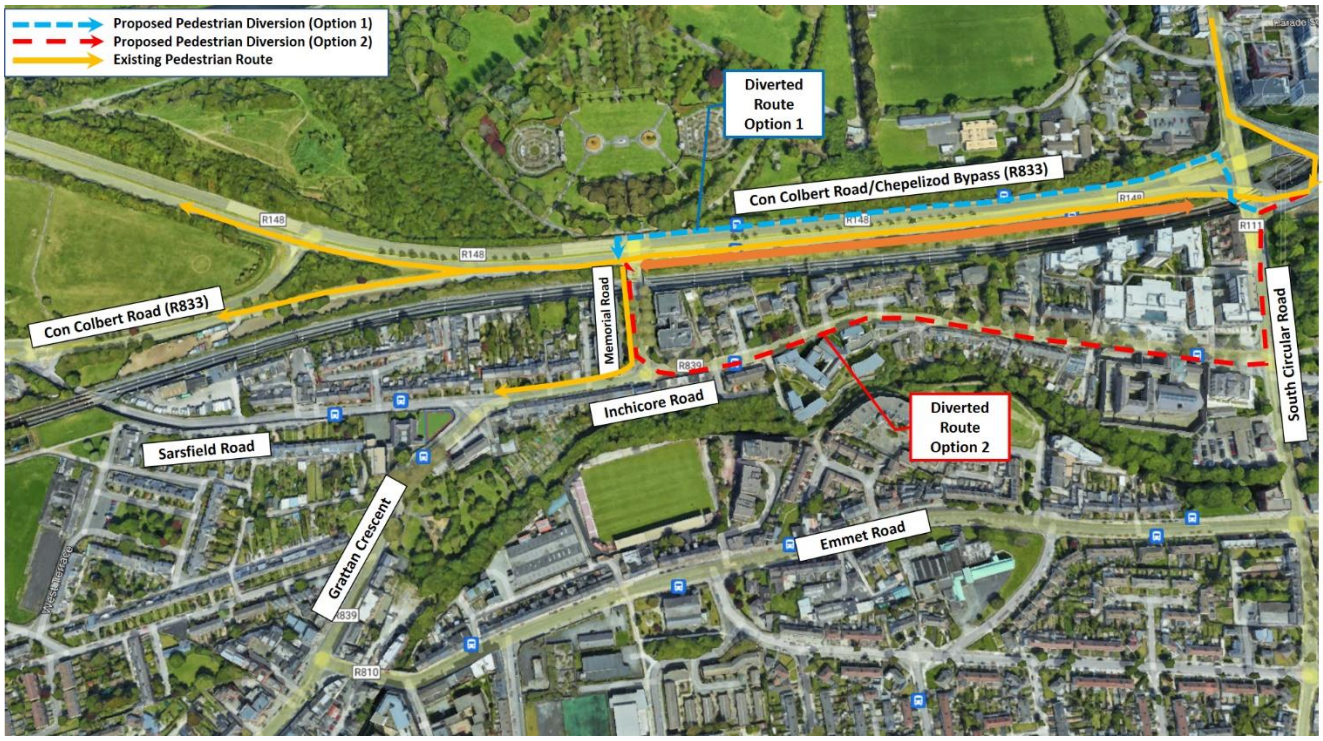

Figure 7-38 Proposed Pedestrian Diversion Routes (Westbound)

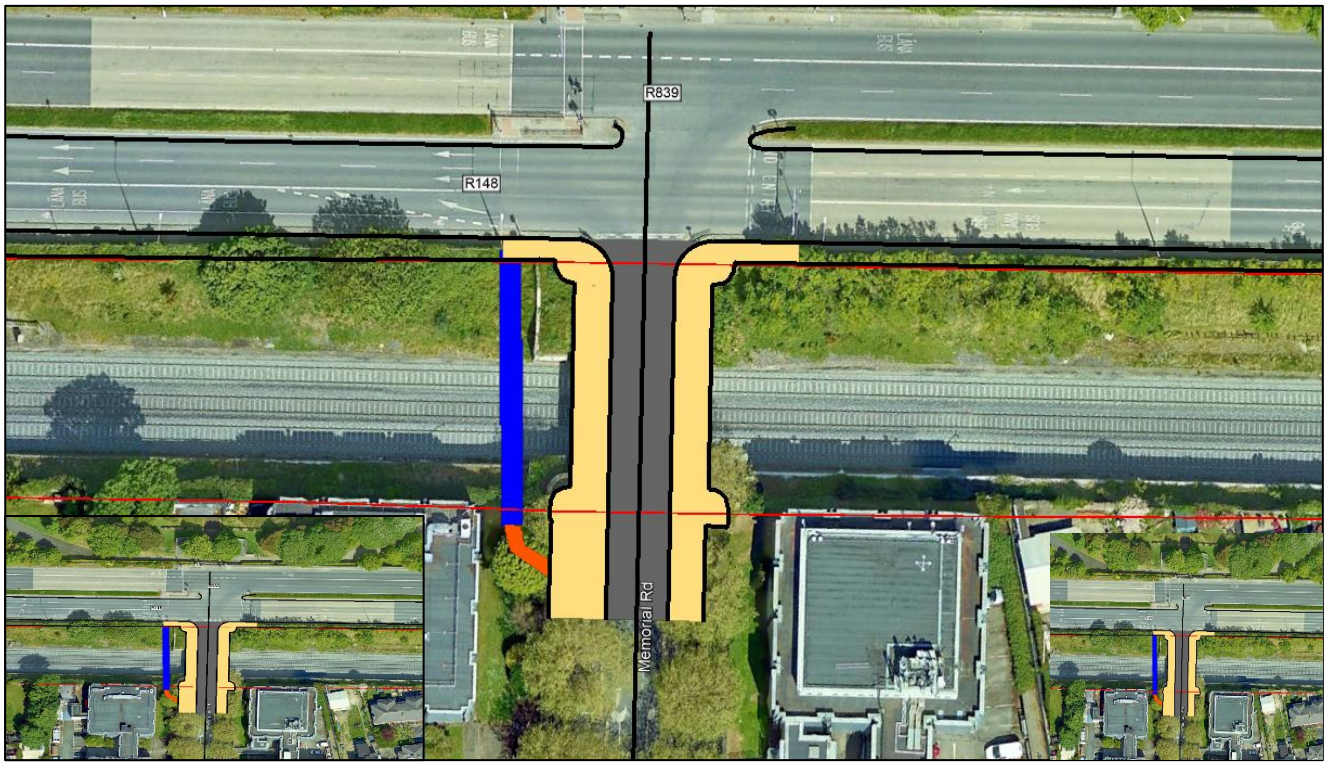

Figure 7-39 Proposed temporary vulnerable user diversion (incl. bridge)

Public Transport

The only bus route currently utilising Memorial Rd is Dublin Bus Route 69. The full closure of Memorial Rd is expected to require a diversion of Route 69 via Emmet Rd & South Circular Rd. The proposed diversion is shown in **Figure 7-40**.

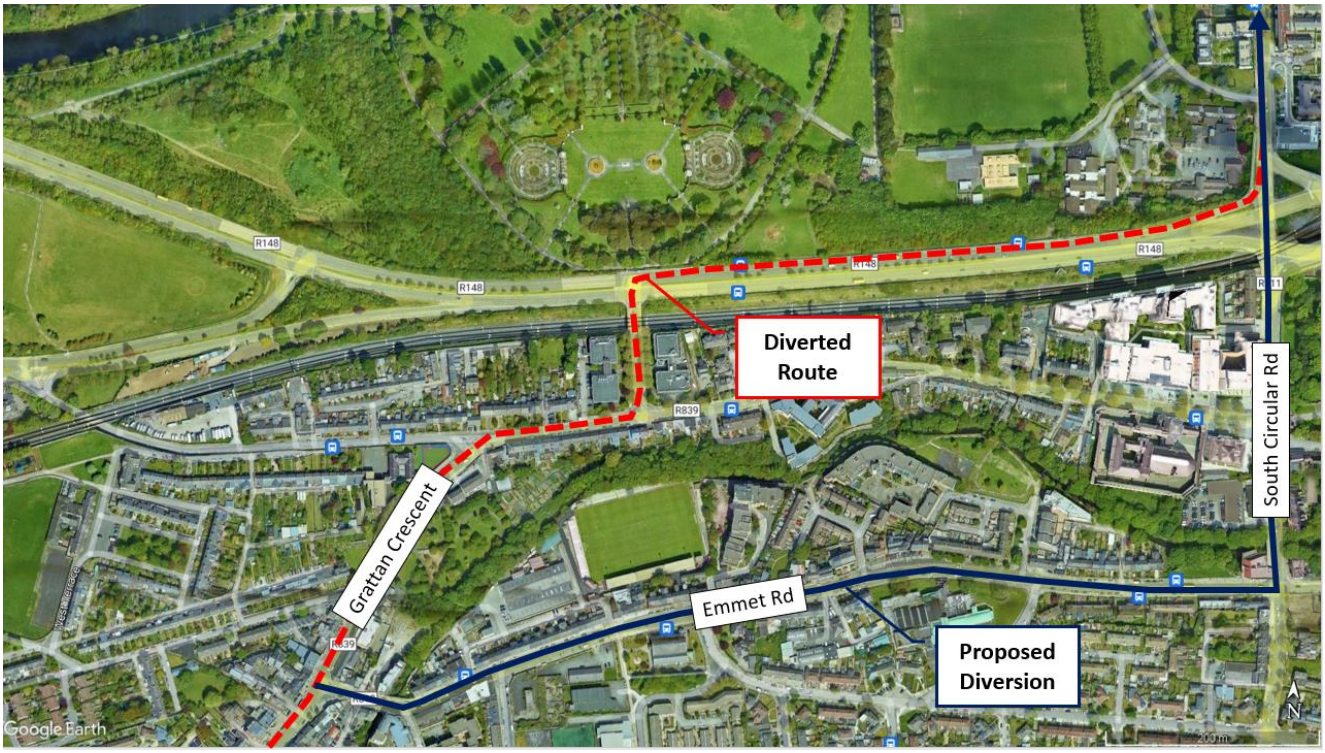

Figure 7-40 Proposed Bus Route Diversion - Dublin Bus Route 69

7.7.4 Permanent and Temporary Land Requirements

Permanent land acquisition is not envisaged along this section.

The preferred location of the construction compound and temporary vulnerable user bridge will require temporary land acquisition for the duration of the works.

The retaining wall solution along to the north of the rail corridor may require the temporary acquisition of lands to facilitate the construction of retaining structures.

The strengthening of the masonry wall on the southern side may be required.

7.8 South Circular Road Junction to East of St John's Road (Islandbridge)

This area extends from the east side of Memorial Road Bridge (OBC3) to where the railway mainline enters Heuston Station and Yard (known as Islandbridge Junction). Refer to **Figure 7-41**. The railway corridor currently consists of three tracks between Memorial Road Bridge and South Circular Road Bridge. This number of tracks then increases to the east side of South Circular Road Bridge at Islandbridge Junction.

The rail corridor along this section is primarily in cutting (i.e. the rail level is below the surrounding ground level) with retaining walls along the south side and earthwork slopes along the north side.

There are two major road overbridges along this section - the South Circular Road Bridge (OBC1) and St. John's Road Bridge (OBC0A). Together these structures carry road traffic, pedestrians and cyclists across the rail line and facilitate traffic movements at the junction of South Circular Road (R111), the Chapelizod Bypass (R148) and St. Johns Road West (also R148).

For more details on this section of the route refer to Volume 1 (Schematic Layout (Sheet 13)) and Volume 3G.

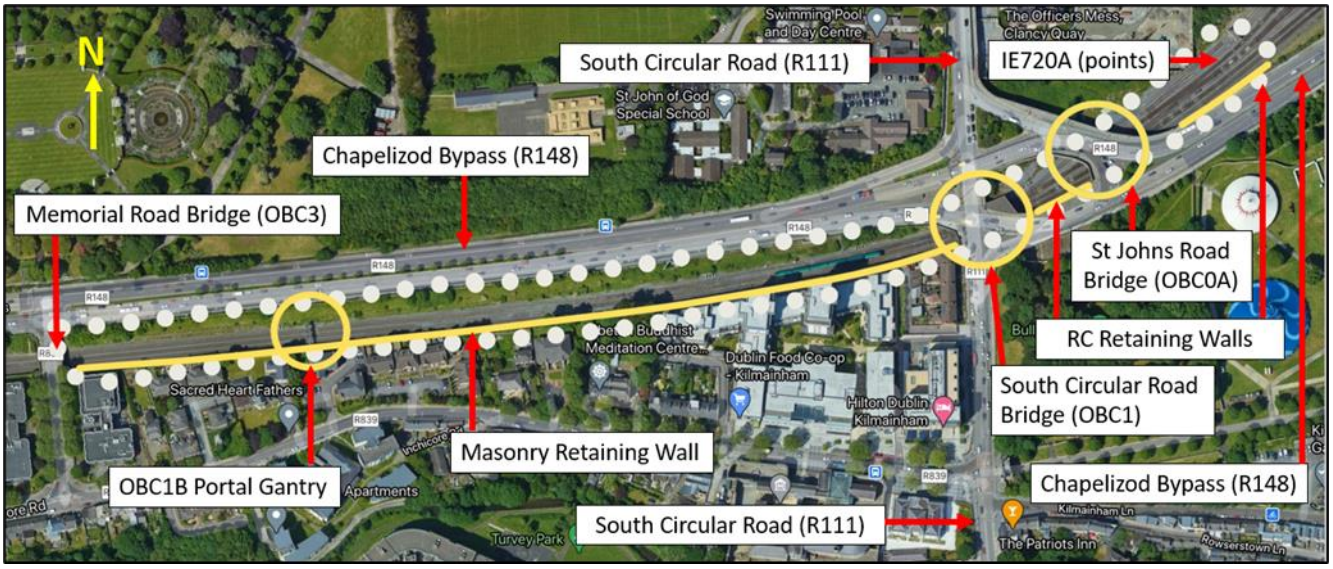

Figure 7-41 Aerial View (White Dotted Outline)

7.8.1 Review of Public Consultation No. 1 Feedback, Design Development and the Preferred Option

The Project Team has analysed the submissions and considered all relevant information in the re-evaluation and further development of the design options leading to the selection of the Preferred Option.

This area extends from Memorial Road Bridge to the South Circular Road Junction. There are two major bridge structures in this area which are part of the junction, namely South Circular Road and St. John's Road Bridge. St. John's Road Bridge has an adequate span length to enable a layout with the minimum four tracks requirement and is high enough for the electrification infrastructure required for DART. South Circular Road Bridge does not have an adequate span length to accommodate four tracks underneath and it is not high enough for the electrification infrastructure to pass under.

The Preferred Option leaves South Circular Road Bridge in place and includes the construction of a new structure to the north of the existing bridge. The new structure would be for the new DART tracks and the existing InterCity service would continue under the existing South Circular Road Bridge. The new structure requires retaining walls to be constructed on both sides beyond the junction area to the west.

The South Circular Road Junction is extremely busy and frequently has traffic queues, so any works in this area are likely to impact traffic. In order to minimise the impact on traffic during the works, the construction will be carried out in phases, utilising all available road space to safely divert all road users around the affected area.

The new structure will accommodate DART trains. This means that the existing South Circular Road Bridge would not need to be electrified and the track levels can remain as they are currently.

The proposed intervention is presented below in sectional elevation looking east towards Heuston Station.

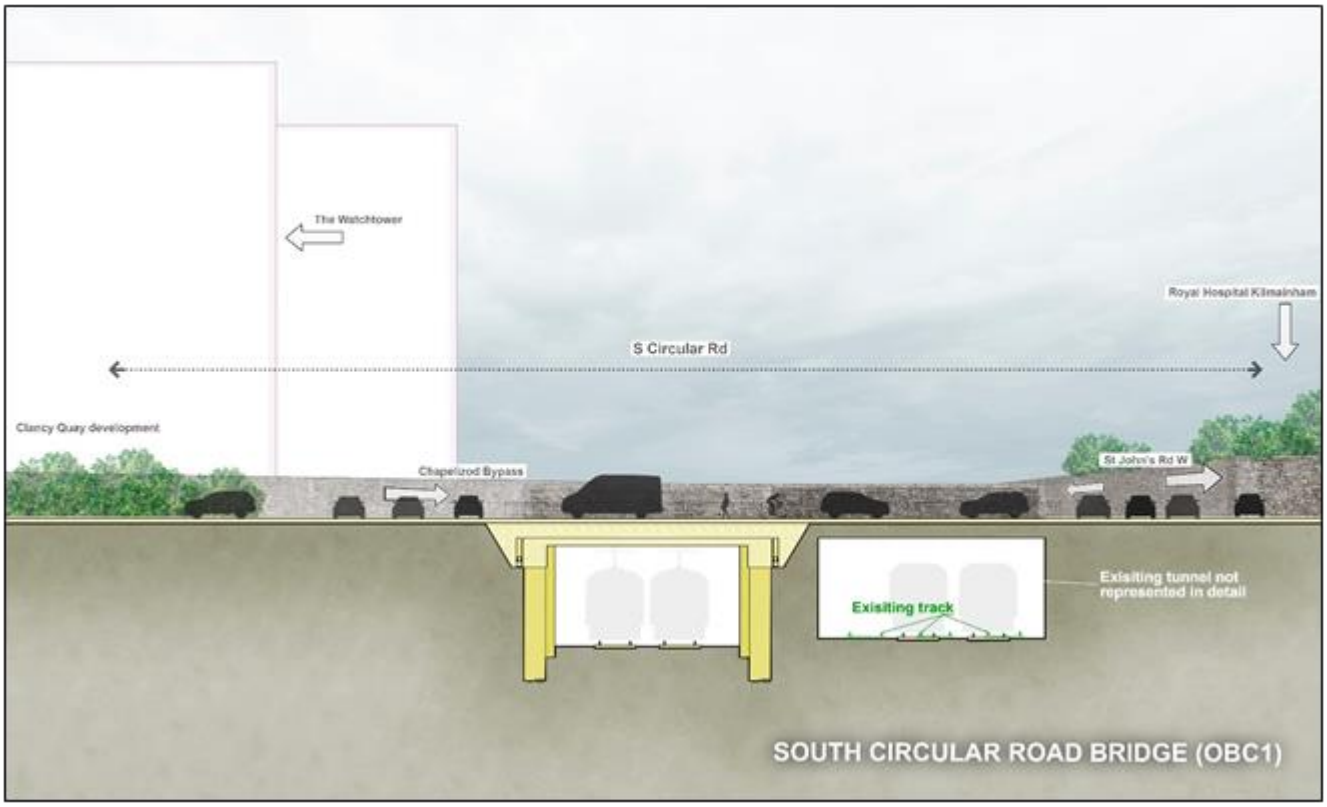

Figure 7-42 Preferred Option for South Circular Road Bridge (OBC1)

Figure 7-43 Aerial View of Emerging Preferred Option for South Circular Road Junction

It is proposed to increase the number of tracks from three to four tracks and electrify the two tracks on the northern side of the corridor.

It is not practically feasible to add an additional track on the south side of the rail corridor due to the density and proximity of commercial and residential properties between Memorial Road Bridge (OBC3) and South Circular Road Bridge. As such, all options include widening the corridor to the north to avoid the impact of the reconstruction of the existing retaining wall on the southern properties. The existing tracks will also be realigned to meet design standards.

The additional track will be placed on the north side by installing a retaining structure along the cutting slope between South Circular Road Bridge and Memorial Road Bridge. The track will be placed between the existing rail line and the Chapelizod Bypass (Con Colbert Road), which runs parallel.

Figure 7-44 St. John's Road Bridge (OBC0A) in foreground and South Circular Road Bridge (OBC1) in background

7.8.2 Memorial Road and South Circular Road Construction Compound

As noted in Section 7.7.2, a compound is required to facilitate the reconstruction of Memorial Road Bridge and localised works in the rail corridor. A second construction compound is required in the section between Memorial Road and South Circular Road. This section is very constrained, with the rail line located in a deep cutting, with Chapelizod Bypass (Con Colbert Road) to the north and residential properties to the south.

Large sections of the westbound bus lane will require closure to facilitate access and egress to the compounds as well as the works itself. Shorter sections have the potential to pose a greater hazard.

The preferred location for the construction compound is close to the works, between the South Circular Road Junction and Memorial Road Bridge. It will be used to service the South Circular Road Junction works and the widening of the rail corridor along this section. It is envisaged that this will be accommodated within the CIÉ property boundary. There will be a requirement to extend compound onto the adjacent road, agreement with Dublin City Council will be needed.

The compound will also act as the facility for moving materials from roadside to trackside by means of steep ramps.

The proposed works at the South Circular Road will require significant space for either in situ or precast concrete works, excavations and walling operations.

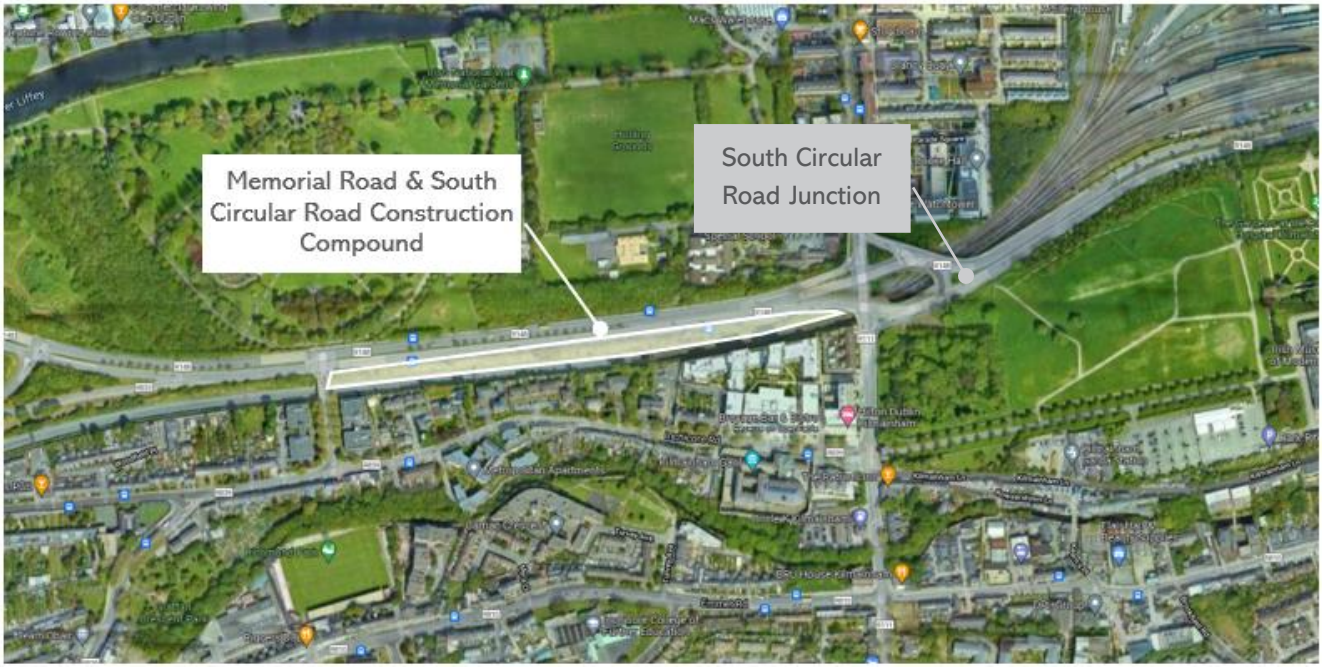

Figure 7-45 South Circular Road Preferred Construction Compound Location

7.8.3 Construction

This section sets out the approach in relation to the construction technologies and methodology for the works in the area along this section of the railway so that the public may understand the approach being considered. It is acknowledged that this information is based on information and the level of design available at this time and it will continue to be developed as part of the Railway Order package and supporting documentation.

The proposed works at this location includes the construction of a portal box structure to the south of the existing South Circular Road Bridge. This structure will facilitate tracks at a lower level to that of the existing tracks to enable the OHLE to pass under the existing road with greater clearance.

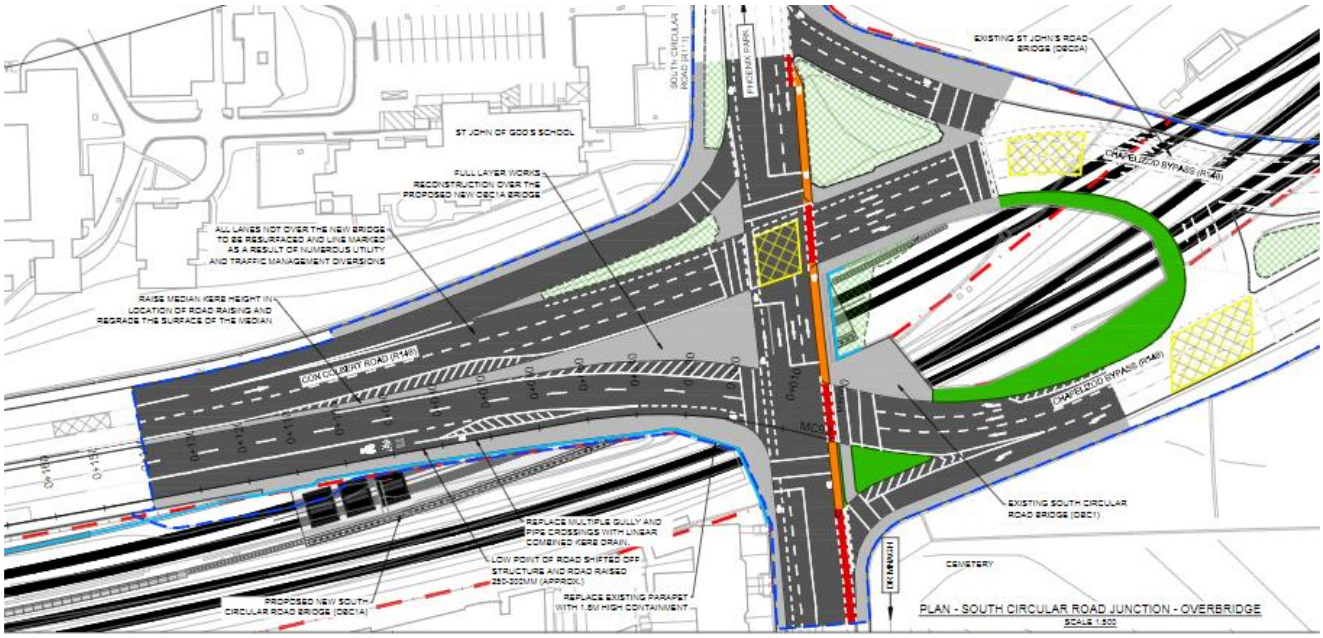

Figure 7-46 South Circular Road Junction Layout

7.8.3.1 Retaining Structures

To achieve the widened cross section, and limit the impact of the construction works on Chapelizod Bypass (Con Colbert Road) , it is proposed to construct retaining walls along the northern corridor boundary where there will be a level difference between the proposed tracks and the adjacent land (Chapelizod Bypass / Con Colbert Road corridor).

Several different wall types and /or earth retaining methodologies are proposed across the project depending on the height of the retained soil, the soil conditions and the proximity of buildings to the corridor. Refer to **Section 5.2.7** for a description of the different retaining walls under consideration.

It is proposed that a bored secant pile wall solution will be adopted for the section of retaining wall along the northern perimeter to form the northern (slow) tracks cess edge. The retaining wall will be approximately 4.5m to 7m in height and will be constructed utilising access from the trackside within Irish Rail lands.

The over steepened nature of the existing cutting slopes, proximity of the adjacent Chapelizod Bypass (Con Colbert Road) and height of the cutting slope to be retained, necessitates a piled wall solution with the inclusion of soil nails or ground anchors.

To minimise the pile size and associated lateral movement of the upper portion of the walls and to maintain the integrity of the infrastructure beyond the crest of the retained slope along Chapelizod Bypass (Con Colbert Road), the retaining wall along this section shall be anchored using soil nails extending into the existing slope substratum beneath Chapelizod Bypass (Con Colbert Road). The length of the soil nails/ground anchors will vary based on the height of the cutting slope to be retained and are anticipated to be approximately 15m to 20m in length.

The soil nails/ground anchors will be installed utilising access from the trackside within Irish Rail lands.

Example of a typical section of the wall along this section is shown in **Figure 7-47**.

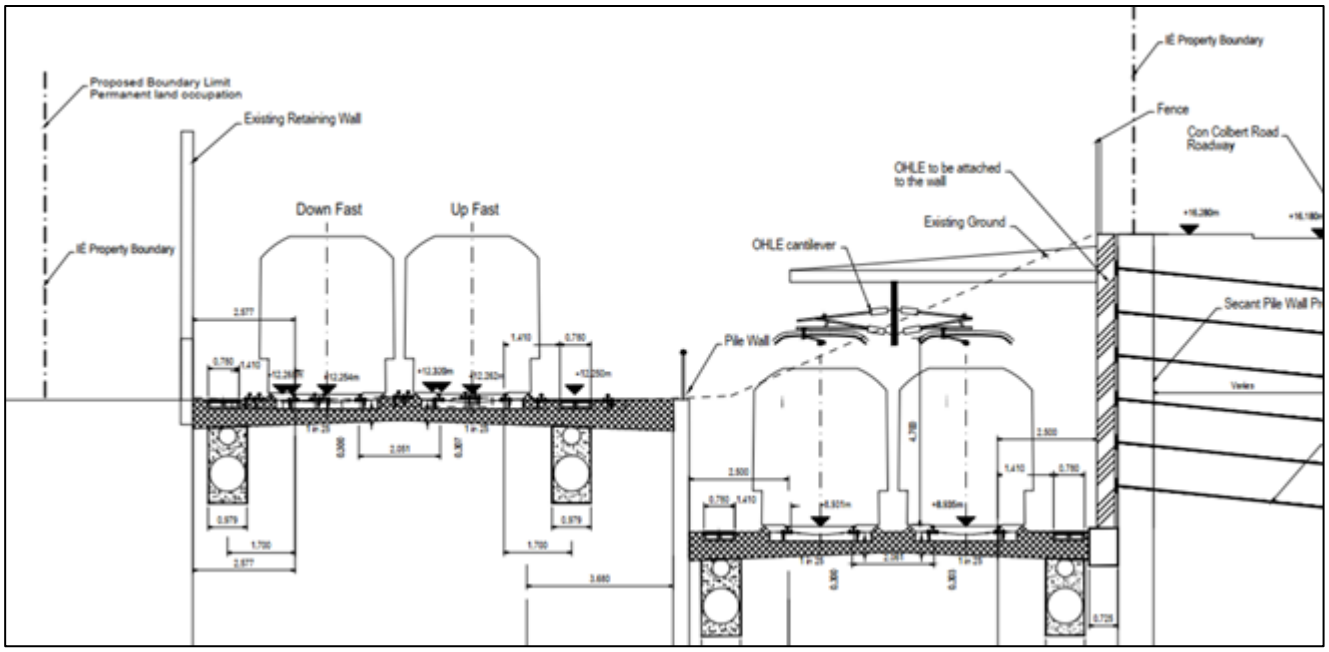

Figure 7-47 Con Colbert Road Retaining Wall & Ground Anchors

7.8.3.2 Structures

The proposed concrete portal structure which passes under the South Circular Road would be constructed using cut and cover method. This means placing piled walls on either side working from the top of the structure and then excavating between and placing a reinforced or prestressed concrete roof across from one wall to the other. The soil between the walls would then be excavated to formation level and the track placed. The major constraint to the cut and cover method is the large piling equipment and support vehicles required to place the piles and remove the soil in such a tight working space. In this regard, it may be required to undertake piling works at non-peak traffic times when additional lanes could be used for site vehicles and plant. As the track levels will be different between the old and the new tracks, a retaining wall will be required between each set of tracks. This work would need to be done under possession. Most other tasks are offline from the railway so could be undertaken in a safe zone during railway operational times, which means less impact to local residents in terms of noise.

7.8.3.3 Permanent Way

Track lowering will be required through this area to facilitate the provision of four-tracking and electrification. Works will comprise:

- Diversion or closure of the operational track, utilities, and ancillary infrastructure
- Where excavations are significant, support of adjacent operational track
- Excavation of trackbed
- Excavation of sub strata
- Replacement of utilities and ancillary infrastructure
- Construction of new trackbed

Between Memorial Road Bridge and the proposed South Circular Road Buried Portal, a retaining wall separating the existing tracks and the new DART tracks will be required. Due to the proximity of this wall to the existing track, it is probable that a few staging phases may be required to facilitate construction. Alternatively, the supporting wall will need to be constructed during night-time possession

7.8.3.4 OHLE Infrastructure

Structures will be required at a maximum spacing of 60m along the track to support the catenary cables. The support structures are generally supported from one side of the track (cantilever) or from both sides (portal) depending on the permanent way layout. Where there are adjacent walls the support structure can be fixed to the walls negating the need for vertical supports (stanchions).

Support structures will be founded by means of either piles or spread foundations, depending on soil conditions or the contractor's preferred methodology.

It is envisaged that the OHLE will be constructed in safe zones adjacent to the live railway or in night-time possessions.

7.8.3.5 Temporary Traffic Management

The South Circular Road Junction is one of the busiest road junctions in Dublin. The junction occurs between the Chapelizod Bypass (Con Colbert Road) inbound from the M50 and the South Circular Road. The junction operates over capacity and long queues occur at peak times in all directions. While there is some useable spare space in the vicinity of the junction, the site is highly spatially constrained.

The road operates on a one-way gyratory basis, controlled by traffic signals. Generally, there are 2-3 circulatory lanes and full pedestrian movement is catered for. To minimise disruption, the works to this junction will be completed on a phase basis.

7.8.4 Permanent and Temporary Land Take

Based on the level of information and design at present, the extent of permanent works is not envisaged to interfere with third party residential or commercial property rights, although widening of the rail corridor is required. Temporary interference of property rights during construction along the rail corridor and works around the junction have been identified as possible, however technical and construction related solutions will seek to minimise these impacts.

If an extension of the preferred location for the construction compound between the South Circular Road Junction and Memorial Road Bridge is required, agreement with Dublin City Council will be needed.

7.9 Heuston Station and Yard

The area around Heuston Station encompass the existing rail lines servicing platform nos. 1-8, signal structures, associated servicing and valet sidings, a carriage wash siding and a subway (UBC1A) providing access for IÉ personnel to the valeting plant at Heuston Yard; all within CIÉ's lands.

To the west, this area is bound by the Clancy Quay residential / mixed use development, with the River Liffey located to the north, St. John's Road and The Royal Hospital Kilmainham to the south and the main Heuston Station terminus to the east.

For more details on this section of the route refer to Volume 1 (Schematic Layout (Sheet 14)) and Volume 3H.

Figure 7-48 Aerial view of area

7.9.1 Review of Public Consultation No.1 Feedback and Design Development

The Project Team has analysed the submissions and considered all relevant information in re-evaluation and further development of design options leading to the selection of the Preferred Option.

Platforms 6, 7 and 8, as well as additional sidings to the north, are to be electrified to receive the new DART+ rolling stock, with one of the sidings requiring lengthening, whilst retaining the existing functionality of Heuston Yard. The track layout follows the existing station footprint as far as possible, remaining within the existing rail corridor and retaining the existing functionality of the station platforms and train servicing facilities.

The three tracks which run from St. John's Road Bridge to the Liffey Railway Bridge and then converge to two tracks which run through the Phoenix Park Tunnel are also to be electrified. These lines will pass through the proposed new Heuston West Station, which is located adjacent to the Clancy Quay Development and the existing platform 10.

The permanent way layout has not changed since PC1, except for the addition of a crossover between platforms 6 and 7 as part of the electrification requirements.

The proposed track drainage system will include filter drains to collect surface water runoff from the ballast and surrounding areas, and carrier pipes to convey collected runoffs to a proposed attenuation tank and discharge point. The attenuation tank will be located on CIÉ lands between the proposed Heuston West Station and the Islandbridge / Clancy Quay development.

7.9.2 Heuston / Islandbridge Substation

The DART+ Programme Power Study determined the requirement for an electrical substation in Islandbridge. The area is a densely populated urban environment, close to Dublin city centre; to the north is the River Liffey, to the south is the R148 and the Royal Hospital Kilmainham, to the east is Heuston Station and to the west is mix of residential and office space.

The site selection process followed the two-stage optioneering process outlined in **Chapter 4**. However, it is noted the study area in Islandbridge primarily focuses on the potential of utilising existing CIÉ owned land.

The final position of the substation will be subject to design development and confirmation from the ESB in relation to suitability for incoming power supply connection. The purpose of the OSR is to determine the optimal location for the traction power substations.

7.9.2.1 Stage 1: Preliminary Assessment

The Feasibility requirements for substations are electrification, constructability, and safety. The Project objectives and Requirements are Proximity to the Railway Line, Vehicular Access and Site Size.

Two Options, including the 'Do Nothing' option, have been identified for the area. Full details of the initial sifting assessment are included in Volume 3G. A summary of the findings of the sifting assessment is provided in **Table 7-4**.

Table 7-4 Preliminary Assessment (Sifting) Findings for Islandbridge Substation

Preliminary Assessment (Sifting) Findings for Islandbridge Substation		
Option	**Description**	**Findings**
Option 0: 'Do Nothing'	There is no substation.	Will not deliver project objectives or requirements.
Option 1	This site is located to the north of the Chapelizod Bypass / South Circular Road Junction and to the south of the existing Clancy Quay residential development	Feasible
Option 2	This site is located to the east of Clancy Quay development.	Feasible
Option 3	This site is located to the east of Clancy Quay development on the southern bank of the River Liffey.	Feasible
Option 4	This site is located within the Heuston Yard area along the R148 (St. John's Road).	Feasible
Option 5	This site is located within Heuston Yard	Feasible

Option 0 'Do Nothing' fails to meet the necessary Engineering Feasibility and Project Requirements for a substation location (highlighted in grey) .

Options 1 to 5 all meet the necessary Engineering Feasibility and Project Requirements for a substation location and are brought forward to Stage 2: MCA for detailed assessment (highlighted in green).

7.9.2.2 Stage 2: MCA Assessment

Options 1 to 5 were put forward for detailed assessment. Full details of the assessment matrix are available in Volume 3. **Table 7-5** provides a summary of the MCA findings.

- **Option 1:** This Option located to the north of the Chapelizod Bypass / South Circular Road Junction and to the south of the existing Clancy Quay residential development. It is a brownfield Option in the possession of CIÉ adjacent to the railway.
- **Option 2:** This Option is located to the east of the Clancy Quay development. It is a brownfield Option in the possession of CIÉ adjacent to the railway.

- **Option 3:** This Option is also located to the east of the Clancy Quay development on the southern bank of the River Liffey. It is a brownfield Option site in the possession of CIÉ adjacent to the railway bridge across the river.
- **Option 4:** This Option is located within the Heuston Yard area along the R148 (St John's Road). It is a brownfield Option in the possession of CIÉ on the southern side of the railway yard.
- **Option 5:** This Option is located within Heuston Yard, next to the old Guinness sidings and existing CCE Maintenance Depots. It is a brownfield Option in the possession of CIÉ.

Figure 7-49 - Islandbridge Proposed Substation Options

Full details of the assessment matrix are available in Volume 3G. **Table 7-5** provides a summary of the MCA findings:

Table 7-5 Islandbridge Substation MCA Summary Table

CAF Parameters	Option 1 Assessment	Option 2 Assessment	Option 3 Assessment	Option 4 Assessment	Option 5 Assessment
1. Economy	Significant Comparative Disadvantage over Other Options	Some Comparative Disadvantage over Other Options	Some Comparative Disadvantage over Other Options	Significant Comparative Advantage over Other Options	Some Comparable Advantage over Other Options
2. Integration	Some Comparative Disadvantage over Other Options	Some Comparative Disadvantage over Other Options	Some Comparative Disadvantage over Other Options	Some Comparative Advantage over Other Options	Some Comparative Disadvantage over Other Options
3. Environment	Some Comparative Disadvantage over Other Options	Some Comparative Disadvantage over Other Options	Some Comparative Disadvantage over Other Options	Some Comparative Advantage over Other Options	Some Comparative Disadvantage over Other Options
4. Accessibility and Social Inclusion	Some Comparative Disadvantage over Other Options	Some Comparative Disadvantage over Other Options	Some Comparative Disadvantage over Other Options	Some Comparative Advantage over Other Options	Some Comparative Advantage over Other Options
5. Safety	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral
6. Physical Activity	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral	Comparable to Other Options / Neutral
Conclusion				Preferred Option	

Option 4 is the preferred option for the proposed Islandbridge traction power substation. In terms of Economy, Option 4 performs favourably due to ease of access and constructability due to close proximity to the R148 St John's Road. It is assumed that any permanent access track would require work to effectively separate it from the permanent way and thus permit access by ESB Networks personnel (unaccompanied by IÉ TSCs). ESB grid connection is likely to be comparatively simple when compared to other options.

All Options are comparative in terms of integration, with Option 4 offering a some comparative advantage over other options due to the ease of access to the adjacent road network. With regard to environmental criteria, Option 4 performs marginally better due to an expected lesser noise impact as this Option is located further away from existing residential developments when compared to the other options.

Similarly, as distance to neighbouring residences is maximised, Option 4 offers a slight comparable advantage over other options regarding Integration and Social Inclusion. All Options are comparable in terms of Safety

7.9.2.3 The Preferred Option

Option 4 is the Preferred Option for the location of the Islandbridge / Heuston Substation is located within the Heuston Yard area along the R148 (St John's Road). It is a brownfield site on the southern side of the railway yard. The proposed location is within existing CIÉ's property boundaries, therefore no land acquisition is envisaged.

7.9.3 Construction Compounds

A Construction Compound is required to the west of Heuston Station, adjacent to the existing platform 10. The compound is required for works to the Phoenix Park Tunnel, the construction of the new Heuston West Station and the installation of an underground attenuation tank, which is to be located in this area. This is the only available site to support works to the Phoenix Park Tunnel, utilising the Liffey Railway Bridge for access to the tunnel.

Due to the proximity of the proposed new underground drainage attenuation tank on the western side of the tracks, the compound will need to be split and works phased to allow the construction of the new Heuston West station and the Phoenix Park Tunnel works.

Outbound access to the main road network would be via the Heuston Station access road to Parkgate Street, Conyngham Road, Islandbridge Road and on to Chapelizod Bypass (Con Colbert Road) to the M50. Inbound traffic could use the Chapelizod Bypass (Con Colbert Road) and access directly the Heuston Station Access Road.

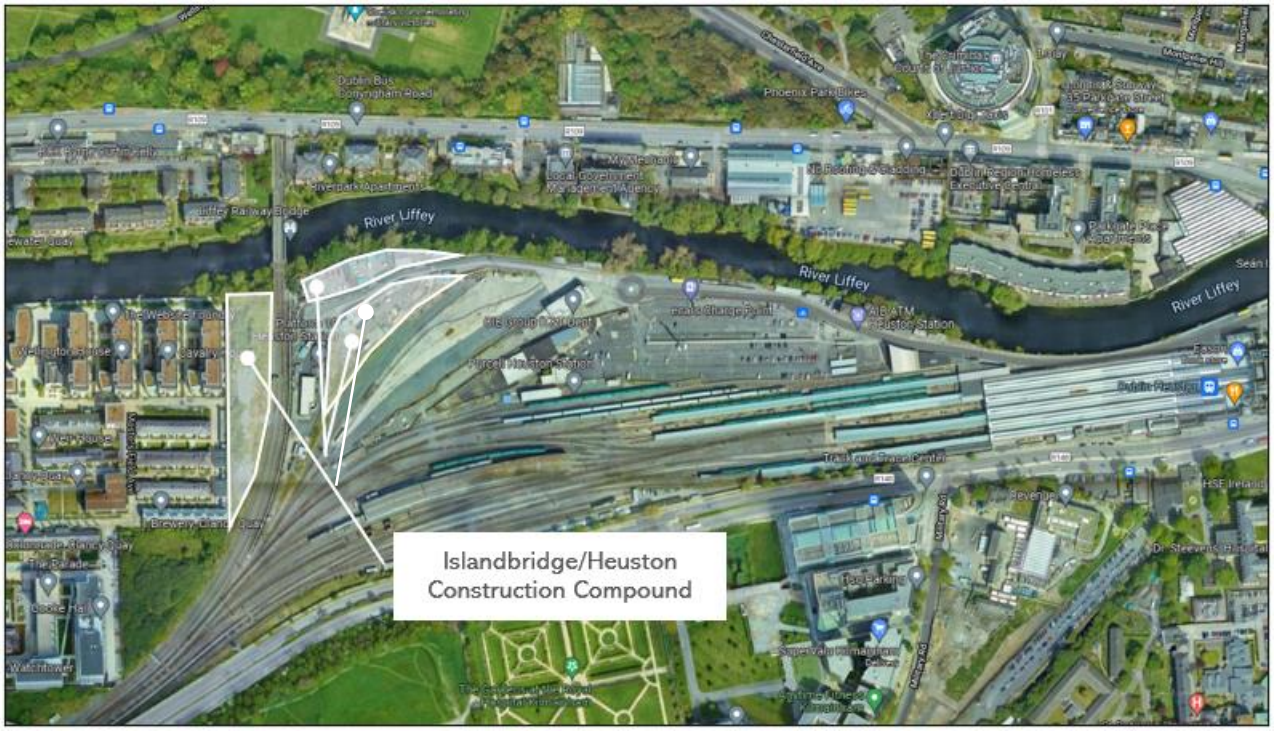

Figure 7-50 Heuston West Preferred Construction Compound Location

7.9.4 Permanent and Temporary Land Take

All permanent works (including the preferred substation location) and temporary construction compounds can take place within CIÉ owned land..

8 East of St John's Road Bridge (Islandbridge) to Glasnevin Junction

8.1 Introduction

The main Project requirement along the circa 4km between the east of St John's Road Bridge (Islandbridge) to Glasnevin Junction is electrification of the existing twin track. This section is referred to as the Phoenix Park Tunnel Branch Line.

This section of the line has been further broken down into the following areas:

- Heuston West Station
- East of St Johns Road Bridge (Islandbridge) to North of Phoenix Park Tunnel
- North of Phoenix Park Tunnel to Glasnevin Junction

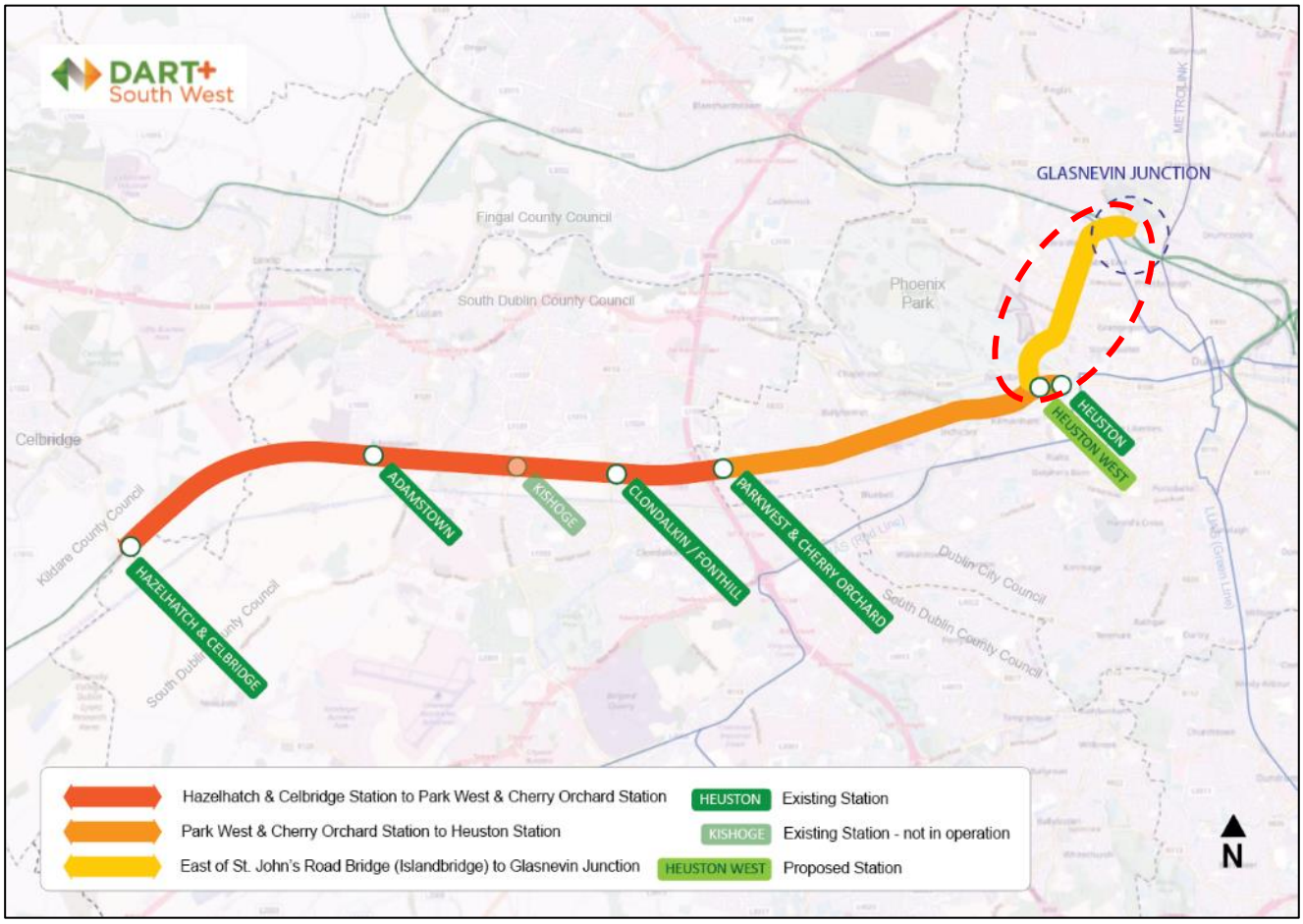

Figure 8-1 Overview of Section

8.2 Description of the Railway Corridor

From the east of St John's Road Bridge (Islandbridge) the line continues northwards over the River Liffey via the Liffey Railway Bridge and under Conyngham Road Overbridge (OBO2) where it enters the Phoenix Park Tunnel. The Phoenix Park Tunnel extends approximately 700m under the Phoenix Park and has historically been used for freight and maintenance; however, it reopened in 2016 for regular passenger traffic.

Figure 8-2 Phoenix Park Tunnel Entrance

The northern tunnel portal is close to the North Circular Road entrance to the Phoenix Park, in the environs of Garda Siochana HQ. The line then continues north under several road bridges. From here, the railway corridor is almost entirely located within steep cuttings (i.e. the rail level is below the surrounding ground level), with vegetation on the side slopes.

Bridges along this northern section of the line are McKee Barracks Bridge (OBO3), Blackhorse Avenue Bridge (OBO4), Old Cabra Road Bridge (OBO5), Cabra Road Bridge (OBO6), Faussagh Avenue Bridge (OBO7), Royal Canal & Luas Twin Arch (OBO8), the Maynooth Line Twin Arch (OBO9) and, heading east, under the Glasnevin Cemetery Road Bridge (OBO10).

Glasnevin Cemetery is located to the north of the rail corridor while Prospect Cemetery is located just on the inside bend of the existing line to the south. The line then continues east and interfaces with the proposed DART+ West line (Maynooth Line) at Glasnevin Junction. Refer to **Figure 8-3**.

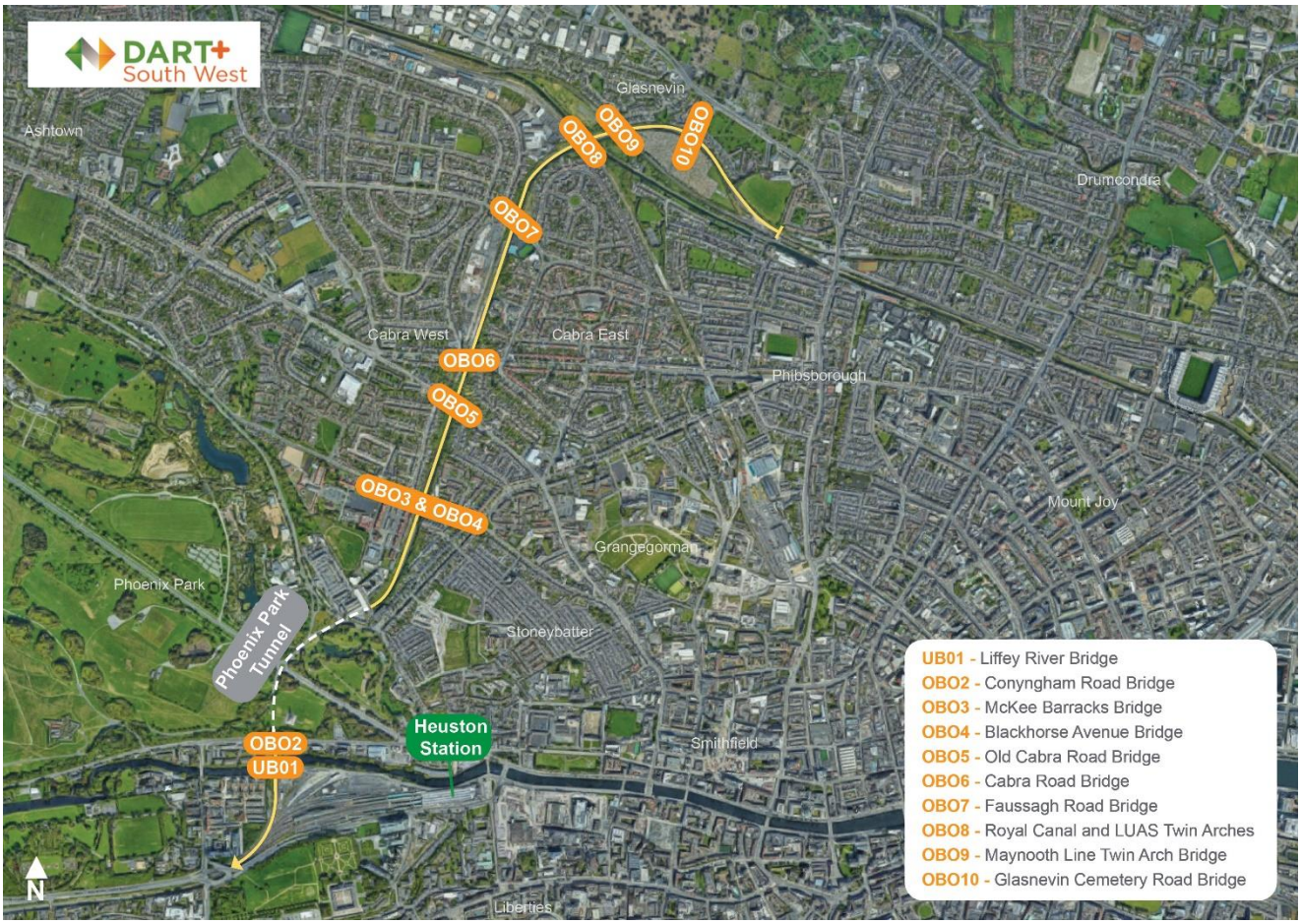

Figure 8-3 Aerial View of the Section of the Railway Corridor

Heuston Station environs includes the main Heuston Station building, ancillary buildings, platforms, track areas, car parks and maintenance facilities. There is existing pedestrian and vehicle access which extends from the proposed site, along the existing access road to the main Heuston Station and the Luas Red Line stop, which is located at the front entrance to Heuston Station.

The site for the proposed new station is located to the west of Heuston Station, adjacent to the Clancy Quay development and the new National Train Control Centre (NTCC) site. Refer to **Figure 8-4**.

1. Existing platform 10. Proposed location for Heuston West Station (with up line & down line platforms)
2. Heuston Station
3. Luas & Bus interchange
4. Existing route
5. Car park area
6. Clancy Quay development
7. Proposed Heuston West Station
8. Phoenix Park Tunnel portal

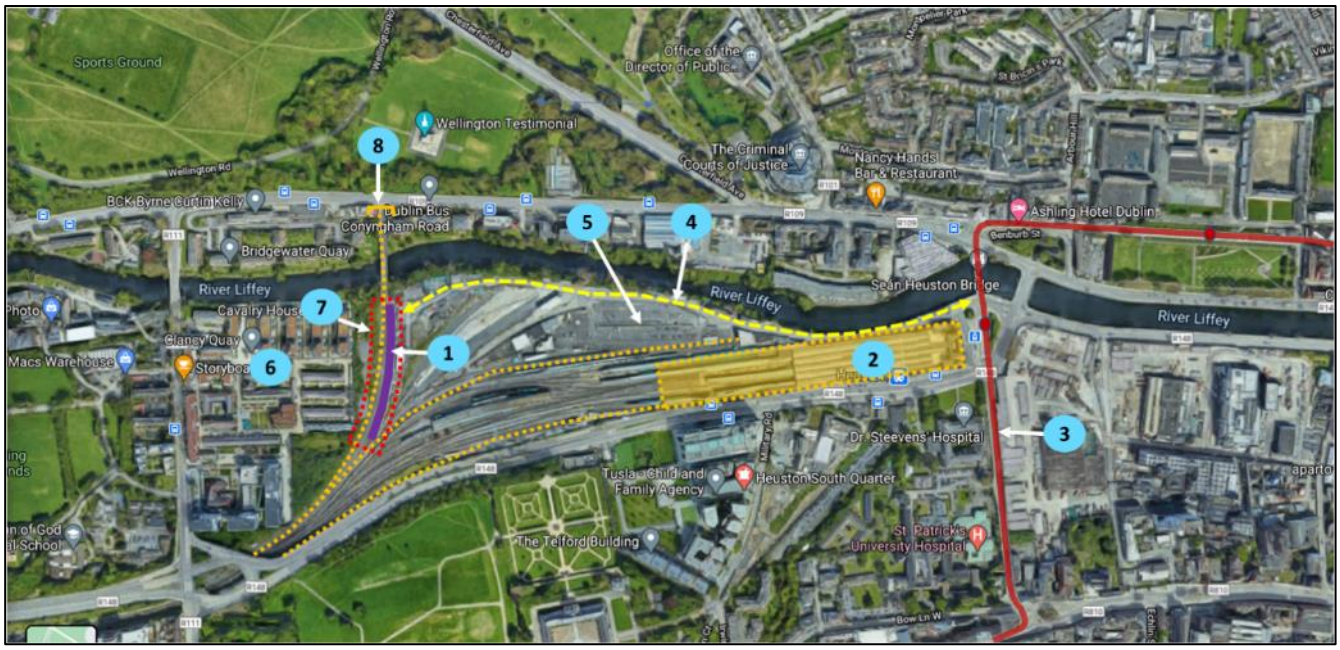

Figure 8-4 Heuston Station and Surrounding Area

8.3 Heuston West Station

Following feedback at PC1, the delivery of a new station is now included within the scope of the Project. This has been an area of design development focus for the Project Team.

The new Heuston West station will be the first station on the branch line from Glasnevin, which extends the route of the DART+ South West on to Connolly Station. Glasnevin Junction and Glasnevin Station will connect the south western and the western line routes both to Connolly and the new Spencer Dock station in the Docklands area.

For more details refer to Volume 1 (Schematic Layout (Sheet 14)) and Volume 3I.

8.3.1 Requirements

In addition to the general feasibility requirements of constructability, general fitness for intervention and safety, the specific design requirements for the new station are:

- Two open platforms, each 174 m long, finished with ramps for maintenance and emergency access to the tracks.
- Pedestrian access to be provided – connecting both station platforms.
- Platforms will have a minimum width of 3m. The arrangement will include two refuges per platform.
- Platform shelters to be provided for weather protection. Furniture including seats, bins and shelters will be provided and provision for advertising.
- The platform area and track area will be secured with a perimeter fence. Station access will be closed during non-operation hours.

- The station will be unstaffed, with full CCTV coverage. CCTV and platform help points are to be monitored from the customer communications centre within the NTCC.
- The external circulation area accessing both platforms will have ticket vending machines and a ticket validation system – tag on / off validation poles.
- Cycle park areas will be located at both station sides.
- The station to be accessible by road, including a set-down area for vehicles, access to be provided for emergency services vehicles.
- SET services will be allocated in a separate building, adjacent to the track.
- Access for the public to cross the rail line is to be provided by means of a footbridge or underpass.
- In accordance with accessibility requirements, access to the footbridge or underpass should be via stairs and ramp, or by stairs and lift.
- Lifts, if installed, should have suitable weather protection in the waiting area. Lifts will need to be monitored via lift passenger call in addition to CCTV coverage, monitored from the customer communications centre in the NTCC.
- A footbridge structure would require adequate clearance from the top of rail level to provide track electrification clearance.

8.3.2 Preliminary Assessment

As noted in **Section 4**, this station is located wholly in Iarnród Eireann's boundary (and more specifically at the location of the existing platform 10) and having regard to the specific requirements for the station (as set out above), the options for assessment are largely a technical and design matter relating to the station's configuration, including access arrangements (see **Table 8-1**).

The 'Do Nothing' Option was excluded as it will not deliver the Project objectives or meet the project requirements. All 'Do Something' Options were also 'Do Minimum Options' as the station will be located within Iarnród Eireann owned land.

Table 8-1 Preliminary Assessment (Sifting) Findings for Heuston Station West

Preliminary Assessment (Sifting) for Heuston West Station		
Option	**Description**	**Findings**
Option 0: Do Nothing	The existing infrastructure remains unchanged. There is no new station.	Will not deliver Project objectives or requirements.
Station Option A	Footbridge accessed by lifts and stairs.	Feasible.
Station Option B	Footbridge accessed by ramps and stairs.	Feasible.
Station Option C	Underpass via the Liffey Railway Bridge arches will be accessed by lift and stairs (the stairs follow the embankment profile).	Feasible.

Preliminary Assessment (Sifting) for Heuston West Station		
Option	**Description**	**Findings**
Station Option D	Underpass via the Liffey Railway Bridge arches will be accessed by stairs and ramps. Ramps run parallel to Liffey River.	Feasible.
Station option E	Underpass via the Liffey Railway Bridge arches will be accessed by lift and ramps. Ramps run parallel to platforms.	Feasible.

The summary of the findings of the Preliminary Assessment (Sifting) were that all five options met the necessary Engineering Feasibility and Project Requirements and were brought forward to Stage 2: MCA for detailed assessment.

8.3.3 Stage 2 MCA

All five options (A to E) were brought forward are considered feasible and were brought forward to Stage 2: MCA. **Table 8-2** shows the summary findings of the comparative assessment undertaken during Stage 2 MCA.

Table 8-2 Preliminary Assessment (Sifting) Findings for Heuston Station West

CAF Parameters	Option A	Option B	Option C	Option D	Option E
1. Economy	Some Comparative Disadvantage over the Other Options	Some Comparative Advantage over the Other Options	Some Comparative Disadvantage over the Other Options	Some Comparative Advantage over the Other Options	Some Comparative Advantage over the Other Options
2. Integration	Some Comparative Advantage over the Other Options	Some Comparative Advantage over the Other Options	Some Comparative Disadvantage over the Other Options	Some Comparative Disadvantage over the Other Options	Some Comparative Disadvantage over the Other Options
3. Environment	Some Comparative Advantage over the Other Options	Some Comparative Advantage over the Other Options	Some Comparative Disadvantage over the Other Options	Some Comparative Disadvantage over the Other Options	Some Comparative Disadvantage over the Other Options
4. Accessibility and Social Inclusion	Some Comparative Disadvantage over the Other Options	Some Comparative Advantage over the Other Options	Some Comparative Disadvantage over the Other Options	Some Comparative Disadvantage over the Other Options	Some Comparative Disadvantage over the Other Options
5. Safety	Comparable to the Other Options / Neutral	Comparable to the Other Options / Neutral	Comparable to the Other Options / Neutral	Comparable to the Other Options / Neutral	Comparable to the Other Options / Neutral
6. Physical Activity	Some Comparative Advantage over the Other Options	Some Comparative Advantage over the Other Options	Some Comparative Disadvantage over the Other Options	Some Comparative Disadvantage over the Other Options	Some Comparative Disadvantage over the Other Options
Conclusion	**Some Comparative Disadvantage over the Other Option**	**Some Comparative Advantage over the Other Option**	**Some Comparative Disadvantage over the Other Option**	**Some Comparative Disadvantage over the Other Option**	**Some Comparative Disadvantage over the Other Option**

Across the CAF, the following items are to be considered in the assessment of Heuston West Station design Options:

- Economy: Options with ramps are preferred under this parameter because of the maintenance / servicing requirements of lifts which have a significant operational cost. Other matters to consider are occupancy on land in the embankment, outside of the CIÉ property. In terms of potential for future urban regeneration, an underpass is considered less favourable as they are perceived to be less secure for users.

- Integration: All options are equally affected by current local and national government policies. North-west area of all station options is in contact of the Protection Area limit. However, the underpass options occupy the River Liffey embankment beyond the IÉ property boundary, with impact on Environmental and River Liffey policy matters within the Protection Area.
- Environment: In this case, the options with the bridge underpass have a higher impact in the Conservation Area than those with footbridges. There is considerable visual impact in the River Liffey embankment in Options C, D and E. On the other hand, these options also require major earthworks. Despite ramps and stairs being suited to the existing topography, these earthworks are anticipated for the construction of lifts (Option C); as well as to adapt the embankment to the required geometry of the station.
- Accessibility and social inclusion: All options provide PRM access. All options provide a connection between two parts of the city today disconnected. Ramp access to the footbridge or underpass is considered in this case preferable to lift access, as it does not depend on the station attendance and provides a higher capacity and flexibility for passengers, public and cyclists. Another issue to consider is the underpass options would be less accepted by users, as those options would be perceived less secure.
- Safety: From the perspective of Transport Safety there is no difference between the options.
- Physical activity: In this case, like the previous point, the options of the bridge underpass require longer travel routes. The urban connection of these options is less advantageous. Only if a riverside walk were to be developed, this situation would improve, but in the current state the urban connection of options C to E is more disadvantageous.

Option B which includes the provision of a footbridge accessed by ramps and stairs, it also provides the most direct connection between east and west areas and is the preferred option in respect of the majority of CAF Parameters, namely Economy, Environment, Accessibility and Social Inclusion and Physical Activity. Full details of the assessment including the station layout drawings are included in Volume 3I.

8.3.4 Preferred Option

The Preferred Option (in terms of station configuration and design) incorporates two open platforms, each 174 m long. The station will be accessible by road, including a set-down area for vehicles. Access is to be provided for emergency services vehicles. Access for the public to cross the rail line to be provided by means of a footbridge; in accordance with accessibility requirements; access to the footbridge will also incorporate a ramp.

A new pedestrian access route to the Clancy Quay development will also be provided on the western side of the station.

The design for the station takes into consideration the current development strategy and masterplan for the wider Heuston Station site and surrounding environs. The Masterplan area stretches some 500m along the south bank of the River Liffey and includes the CIÉ owned site on the north bank at Conyngham Road. The urban design proposals are to facilitate development of a new city quarter on the western edge of the city centre, incorporating an integrated inter-modal transport hub centred on the existing station, a new retail and commercial core, and a residential neighbourhood all with a high level of focus on open space provision and the public realm.

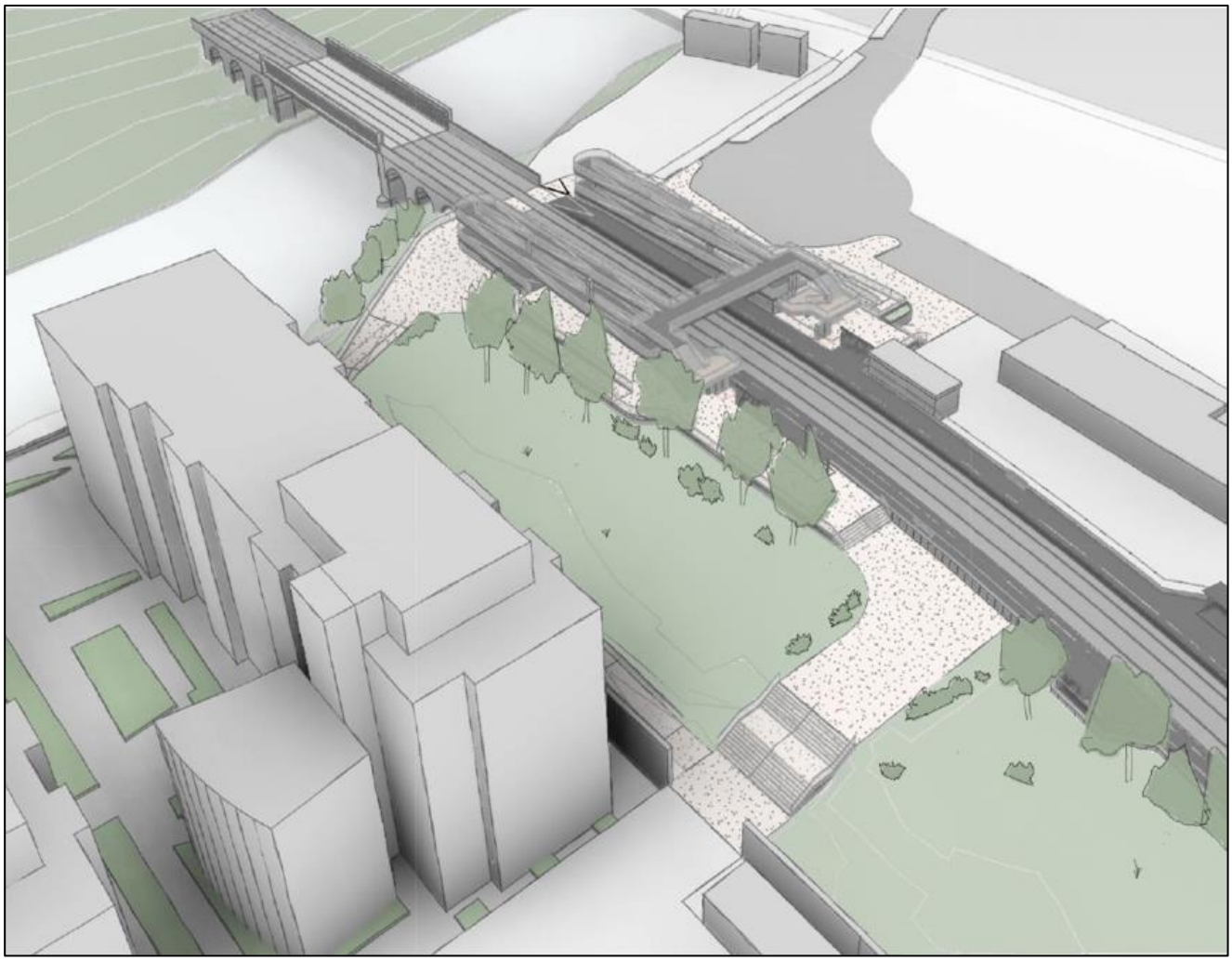

Figure 8-5 Image of Proposed Heuston West Station

8.4 East of St Johns Road Bridge (Islandbridge) to North of Phoenix Park Tunnel

8.4.1 Overview

This part of the scheme is approximately 1.1km long and extends from east of St John's Road Bridge (Islandbridge) to the north portal of the Phoenix Park Tunnel, encompassing platform 10 at Heuston Station, the Liffey Railway Bridge (UBO1) and Conyngham Road Bridge (UBO2). This part of the scheme does not currently have any provision for electrification.

The railway line in this area consists of three sets of tracks at grade until the branch lines cross the River Liffey over the Liffey Railway Bridge, from which the railway follows a twin-track alignment. The tracks pass beneath Conyngham Road Bridge before entering the Phoenix Park Tunnel. An existing arch viaduct supports the tracks between the Liffey Railway Bridge and the Conyngham Road Bridge.

There is a steel cantilever gantry located adjacent to Heuston Station platform 10.

The major infrastructure features are shown in **Figure 8-6**.

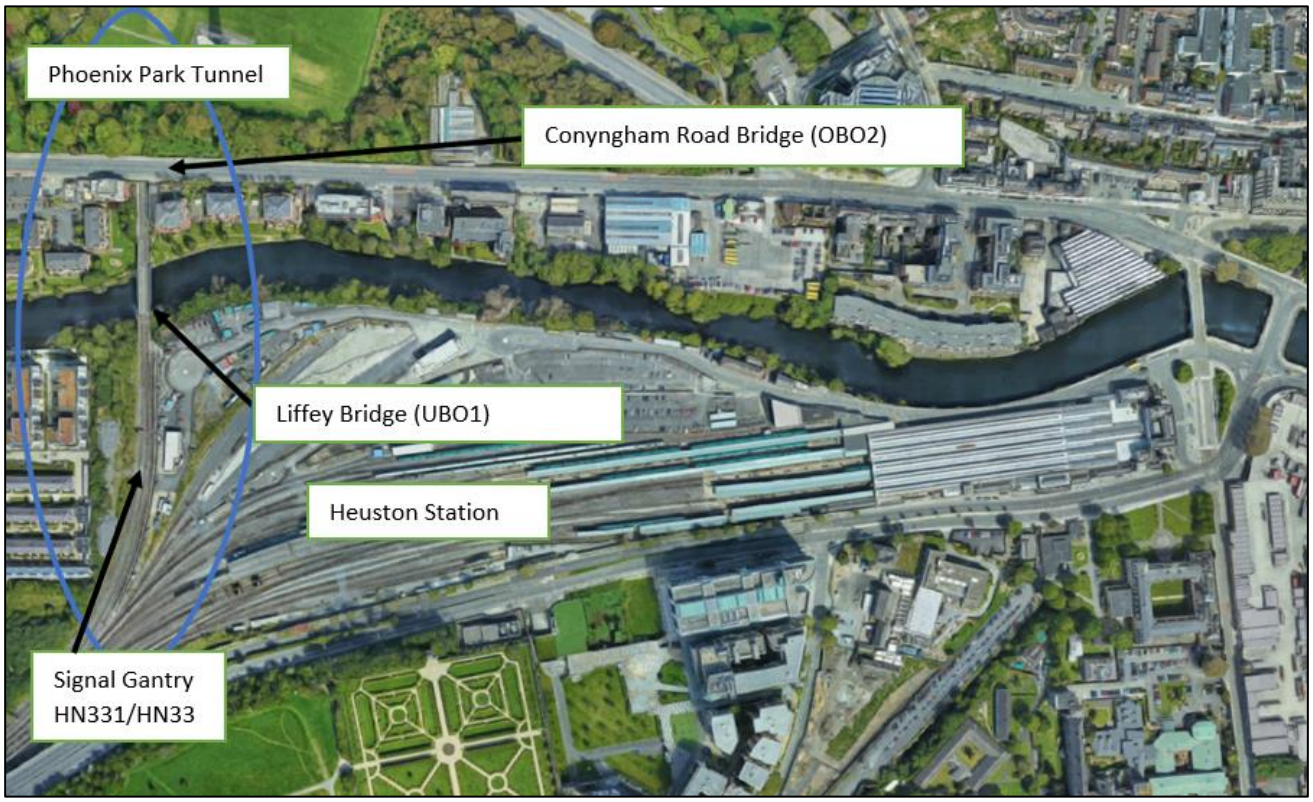

Figure 8-6 Aerial view of the approach to the Phoenix Park Tunnel

The main feature in this area is the Phoenix Park Tunnel, which begins at Conyngham Road Overbridge and runs underneath the Phoenix Park for approximately 700m before re-emerging close to the junction of Infirmary Road and North Circular Road. The railway line through the tunnel is comprised of ballasted track with a central channel.

For more details on this section of the route refer to Volume 1 (Schematic Layout (Sheet 15)) and Volume 3J.

Figure 8-7 View Inside the Phoenix Park Tunnel

8.4.2 Review of Public Consultation Feedback, Design Development and the Preferred Option

The Project Team has analysed the submissions and considered all relevant information in the re-evaluation and further development of design options for this section, leading to the selection of the Preferred Option.

The Preferred Option for the Liffey Railway Bridge features electrification and retention of the existing fixed track system. The OHLE solution will comprise structures supported from one side of the track (cantilever) or from both sides (portal) depending on the permanent way layout.

The Phoenix Park Tunnel is directly adjacent to the Conyngham Road Bridge and therefore, these two structures have been considered together when defining the OHLE solution for each option.

Phoenix Park Tunnel is sufficiently high that the OHLE can pass through the tunnel, but due to its length the OHLE will be connected to the tunnel at multiple regular locations. This option provides a continuation of the flexible OHLE through the tunnel. The support and registration arms through the tunnel for this option is likely to comprise a small system height cantilever supported from the centre of the tunnel crown.

The length of the tunnel is approximately 700m with the overlap at each end of the tunnel; the total tension length for this section will be more than 800m. Therefore, a mid-point anchor is required within the tunnel.

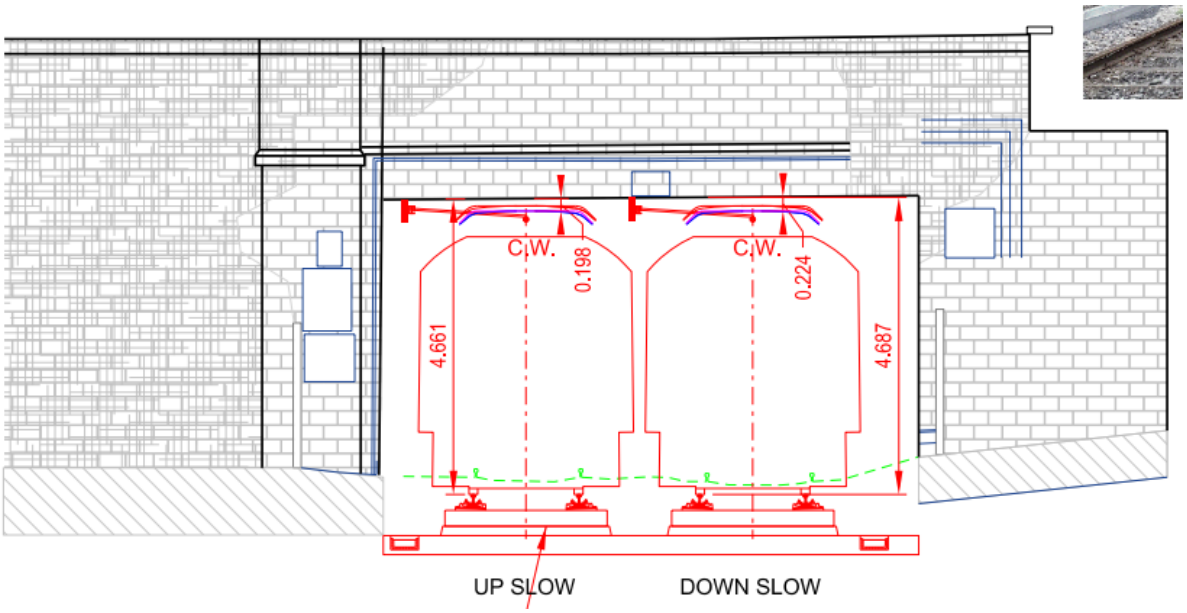

Figure 8-8 Example cross section for fitted OHLE system in twin track area

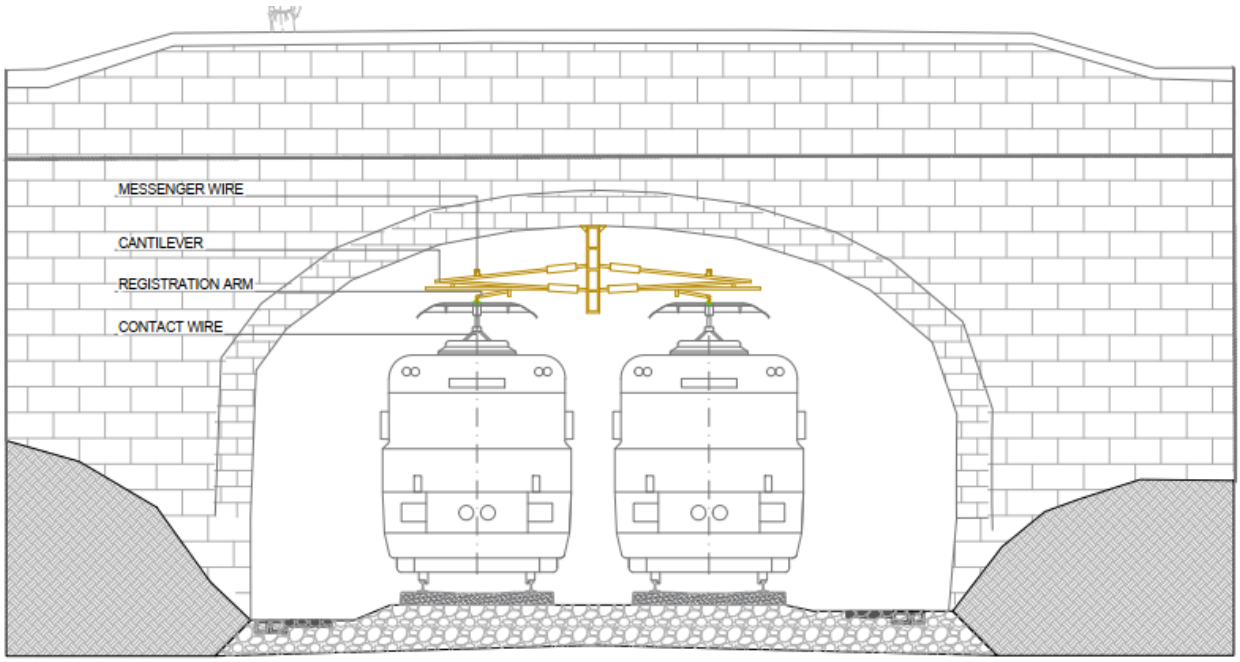

Figure 8-9 Typical OHLE Tunnel Cantilever arrangement

Figure 8-10 Northern and Southern Portals to the Phoenix Park Tunnel

The Permanent Way for this section of the railway corridor consists of two tracks from St. John's Road Bridge to the Liffey Railway Bridge, and then two tracks running through the Phoenix Park Tunnel and the remaining length of the scheme to connect with the DART+ West at Glasnevin Junction.

The track alignment through the Phoenix Park Tunnel has been realigned horizontally and vertically to ensure that structural and passing clearances are achieved, whilst providing the necessary headroom for the installation of new OHLE equipment required to electrify the lines. Due to the constrictive nature of the tunnel, a careful balance has been struck to optimise the outcome of fitting the track with the new OHLE equipment. It is proposed to install slab track from Conyngham Road Bridge and through Phoenix Park Tunnel, in order to provide improved restraint and positioning of the rails and maintain structure and passing clearances. There is an additional benefit in that slab track offers a shallower "trackform" compared to ballasted track that will aid the provision of drainage through the tunnel, whilst facilitating the track lowering required to install the OHLE system.

8.4.3 Construction

This section sets out the approach in relation to the construction technologies and methodology for the works in the area along this section of the railway so that the public may understand the approach being considered. It is acknowledged that this information is based on information and the level of design available at this time and it will continue to be developed as part of the Railway Order package and supporting documentation.

8.4.3.1.1 Bridges

No bridge reconstruction works are required but currently it is proposed that the River Liffey Bridge (UBO1) will be used to provide access to construct the P-Way and OHLE works from the River Liffey as well as to including the Phoenix Park Tunnel Works.

8.4.3.1.2 Signalling Cantilevers

Signalling infrastructure in this section will be located within IE existing land. Foundations for the signalling infrastructure will be either a shallow cast in-situ reinforced concrete footing or small diameter pile foundation.

Where space for foundations in the Cess is not available, consideration will be given to integrating the signalling cantilevers into the retaining wall structural design locally.

8.4.3.1.3 Permanent Way

Track lowering will be limited where possible and is currently only envisaged that minor lowering will occur between St John's Road Bridge (OBC0A) and the Phoenix Park Tunnel to facilitate the provision of four tracking and electrification. The majority of the track work south of the River Liffey will be at grade.

Works will comprise:

- Diversion or closure of the operational track, utilities and ancillary infrastructure.
- Where excavations are significant, support of adjacent operational track.
- Excavation of track bed.
- Excavation of sub strata.
- Replacement of utilities and ancillary infrastructure.
- Construction of new track bed.

It is probable that a number of staging phases may be required to facilitate construction due to the section being the junction the Greater Heuston Station Complex.

8.4.3.1.4 OHLE Infrastructure

Structures will be required at a maximum spacing of 60m along the track to support the catenary cables. The support structures are generally supported from one side of the track (cantilever) or from both sides (portal) depending on the permanent way layout. Where there are adjacent walls the support structure can be fixed to the walls negating the need for vertical supports (stanchions).

Support structures will be either founded by means of piles or spread foundations, depending on soil conditions or the contractor's preferred methodology.

It is envisaged that the OHLE will be constructed in safe zones adjacent to the live railway or in night-time possessions.

8.4.3.1.5 Temporary Traffic Management

There are no long duration public road closures currently proposed for this section of track construction. However, the section between Heuston Station and Conyngham Road Bridge (OBO2) as well as Phoenix Park tunnel are otherwise landlocked in terms of gaining access to support the construction works. It is proposed to either use the Liffey Bridge for access to the northern side of the River Liffey, assuming a complete closure of the Tunnel for a period of time or to construct a temporary bridge to the side of the Liffey bridge for use by construction vehicles. An appointed contractor may propose short duration off peak lane closures to too crane in materials occasionally from Conyngham Road Bridge (OBO2) down to the railway.

Access to the compounds will be via the existing Station Access Road used by current NTCC construction vehicles and IE operational HGV's.

8.4.4 Permanent and Temporary Land Take

All permanent works can generally take place within CIÉ owned land; however, some SET equipment may encroach on third party lands.

8.5 North of Phoenix Park Tunnel to Glasnevin Junction

8.5.1 Overview

This part of the scheme connects the Dublin-Cork Mainline with the Maynooth Line and extends from the Phoenix Park Tunnel, in the south, to Glasnevin Junction in the north. The rail corridor is primarily in a cutting (i.e. the rail level is below the surrounding ground level) formed mainly by earth embankments; the track passes under eight overbridges and over one culvert. The northern boundary of this section of the line is approx. 10m east of Glasnevin Cemetery Road Bridge (OBO10), after this point the line extends to join the Maynooth Line and interface with the DART+ West Project.

The general view of the area is shown in Figure 8-11.

For more details on this section of the route refer to Volume 1 (Schematic Layout (Sheets 15-17)) and Volume 3K.

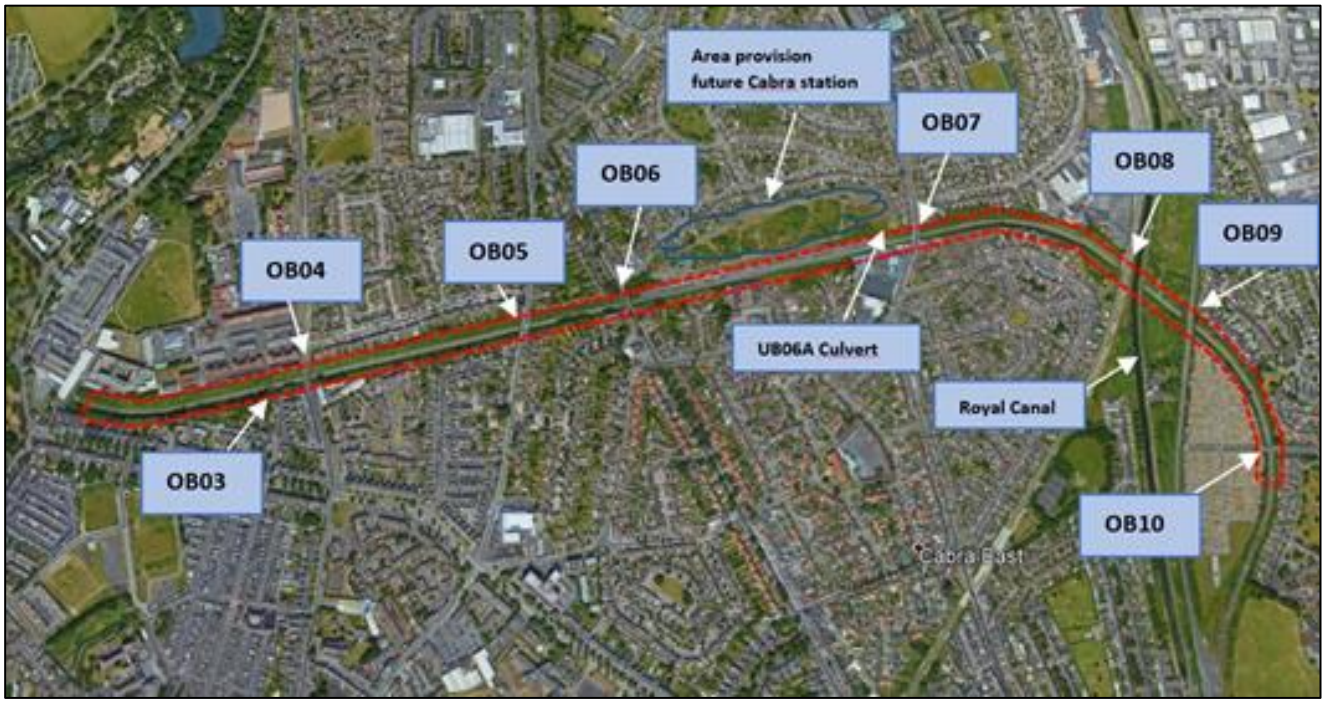

Figure 8-11 General View of Area North of Phoenix Park Tunnel to Glasnevin Junction

Along this section the main constraint to the electrification requirements of the Project is the low clearances of existing overbridges in the area (including service bridges), namely: McKee Barracks Bridge, Blackhorse Avenue Bridge, Old Cabra Road Bridge, Cabra Road Bridge, Fassaugh Road Bridge, Royal Canal & Luas Twin Arch, the Maynooth Line Twin Arch and Glasnevin Cemetery Road Bridge. See **Figure 8-12**.

Cabra Road Bridge (OBO6)

Faussagh Road Bridge (OBO7)

Royal Canal & Luas Twin Arch (OBO8)

Maynooth Line Twin Arch (OBO9)

Figure 8-12 Sample of Bridges with Low Clearances along this Section

8.5.2 Review of Public Consultation No. 1 Feedback, Design Development and the Preferred Option

The Project Team has analysed the submissions received and considered all relevant information in the re-evaluation and further development of the design options for this section, leading to the selection of the Preferred Option.

The Preferred Option for this section requires little or no intervention to the majority of bridges. In instances where the required electrical clearance beneath a bridge is sub-standard, the required clearance will be achieved by a standard OHLE solution, track lowering, fitted OHLE and / or derogation from standard. This is not the case for Glasnevin Cemetery Bridge, and the Preferred Option is the replacement of the bridge deck. Refer to **Table 8-3**.

Table 8-3 Bridge OHLE Proposals

Bridge ID	Bridge Name	OHLE Proposed Solution
OBO2	Conyngham Road Bridge	Track Lowering (Slab Track)

Bridge ID	Bridge Name	OHLE Proposed Solution
OBO3	McKee Barracks Bridge	OHLE Solution
OBO4	Blackhorse Avenue Bridge	OHLE Solution
OBO5	Old Cabra Road Bridge	OHLE Solution
OBO6	Cabra Road Bridge	Track Lowering (Ballast)
OBO7	Fassaugh Avenue Bridge	Track Lowering (Ballast)
OBO8	Royal Canal & Luas Twin Arch	Track Lowering (Ballast)
OBO9	Maynooth Line Twin Arch	Track Lowering (Ballast)
OBO10	Glasnevin Cemetery Road Bridge	Bridge Deck Replacement

There are four existing structures on this section of the line where the existing clearance beneath the bridge is insufficient to allow the installation of a standard OHLE solution. At these locations, track lowering, the installation of a reduced height OHLE solution, or a combination of both, shall be employed to allow a suitable solution to be achieved. This work will have minimal effect on the existing bridges and the works will be undertaken predominantly within the existing rail corridor. The exact technical design solution for each bridge is the subject of ongoing detailed design work and will be presented as part of the Railway Order.

The bridges in question are:

- Cabra Road Bridge (OBO6)
- Faussagh Avenue Bridge (OBO7)
- Royal Canal & Luas Twin Arch (OBO8)
- Maynooth Line Twin Arch (OBO9)

Proposals regarding the diversion of the existing sewer pipe bridge located south of Blackhorse Avenue Bridge (OBO4) are under development and subject to ongoing consultation with Irish Water. As the sewer serves McKee Barracks, the Department of Defence (DoD) have also been contacted. The likely diversion of this sewer comprises a pumping station on the west side of the rail corridor connected to a pipe crossing through OBO4 from west to east, and a connection point east of the bridge to the sewer network. Proposals in relation to the diversion of combined sewers north and south of OBO6 are also under development.

In terms of Permanent Way to the north of the Phoenix Park Tunnel, the Preferred Option involves track lowering at certain locations to achieve the height requirements for electrification. Horizontally, the track corridor will need to be widened in some areas to ensure passing clearance for the new DART+ rolling stock. Retaining structures are required at certain points to both the north and south sides of the rail corridor, which is in cutting along this section.

OHLE structures will be required at a maximum spacing of 60m along the track to support the catenary cables. The support structures will be generally supported from one side of the track or from both sides, depending on the permanent way layout.

The provision of a new station at Cabra does not form part of the scope of DART+ South West Project. However, passive provision for a potential station has been assessed. The proposed location for the future station is located adjacent to the track between Carnlough Road and Cabra Road. The proposed site is located beside a new residential development which is currently under construction.

The future Cabra Station is sited on a length of horizontal straight track, which is ideal for constructing the platform to standard offsets to facilitate passenger stepping to the train. The track alignment has been designed to take into account the future provision of a station at this location.

8.5.3 Revaluation of Interventions to Glasnevin Cemetery Bridge

Following additional surveys and analysis, the Do-minimum Option presented at PC1 (an OHLE solution and track lowering) is not feasible in the case of Glasnevin Cemetery Bridge (OBO10) and further intervention is required.

The three Options originally developed for Glasnevin Cemetery Bridge, as presented at PC1, as follows:

- Option 0: Do Nothing,
- Option 1: Do-Minimum (an OHLE solution by combination of track lowering and OHLE derogations from standards / fitted solution); and
- Option 2. Do-Something (partial bridge reconstruction, as well as track lowering and / or OHLE derogations from standards / fitted solution if required).

Both Option 1 and Option 2 were 'feasible'; however, Option 1 required more detailed analysis. This analysis revealed the existing bridge deck is in poor state of repair and will require replacement in the medium term; therefore, the Project is taking this forward to achieve required height and improvement of the deck.

On the basis that Option 1 is no longer feasible, design development focused on Option 2, which involved partial bridge reconstruction. As there were no other options, and as intervention can still be generally met within the existing railway corridor Stage 2: MCA is not necessary.

The Preferred Option requires the construction of a new deck with the same span and width as the existing. The parapet height will meet the minimum electrification protection requirement of 1.8m.The current design assumes a single slab atop a new raised seating beam, but a shallow beam and deck combination is also under consideration. This is subject to further design development.

No track lowering is envisaged under Glasnevin Cemetery Bridge.

Design development has focused on the provision of a bridge structure that minimises the impact to the cemetery car parking.

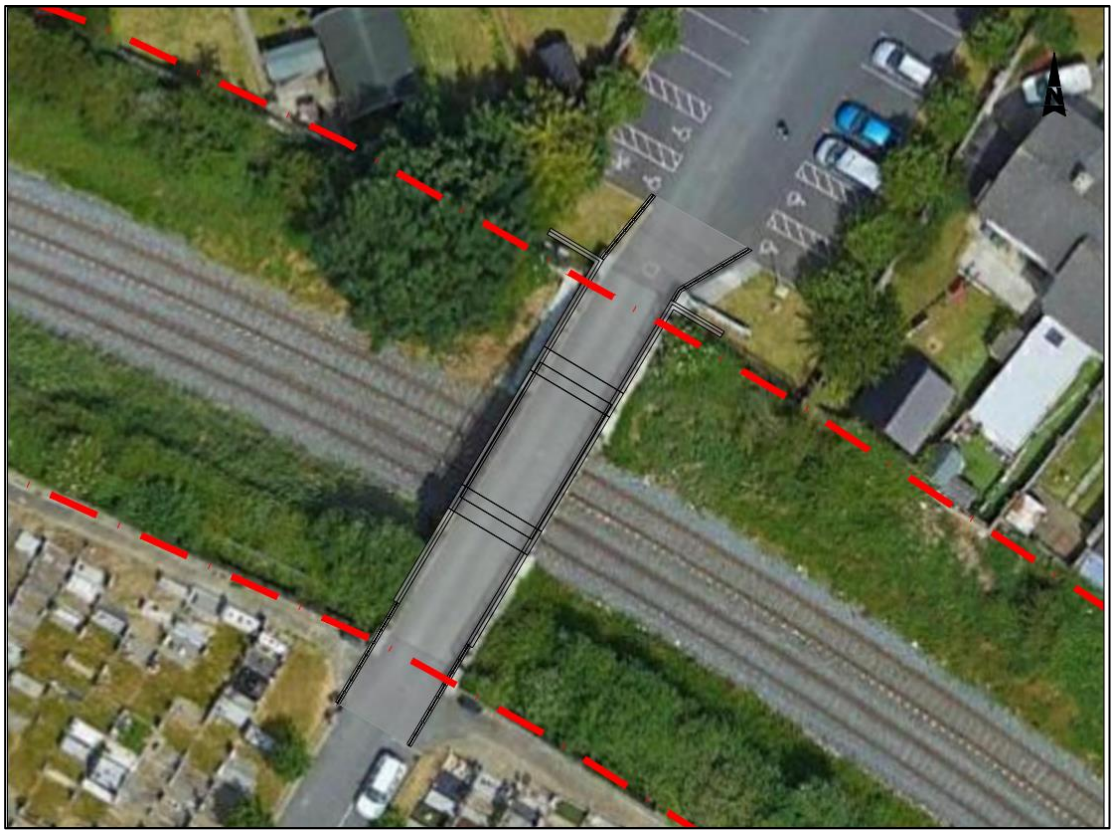

Figure 8-13 Existing layout of Glasnevin Cemetery Road Bridge

Figure 8-14 Cross Section of Proposed Glasnevin Cemetery Road Bridge

8.5.4 Construction

This section of the report sets out the approach in relation to the construction methodology for the works in the area from the northern end of the Phoenix Park Tunnel to just east of the Glasnevin Cemetery Road Bridge, so that the public may understand the approach being considered. It is acknowledged that this information is based on the information available, and level of design developed at this time, and it will continue to be refined as part of the Railway Order package and supporting documentation.

This section of the report sets out the approach in relation to the construction methodology for the works in the area from the northern end of the Phoenix Park Tunnel to just east of the Glasnevin Cemetery Road Bridge.).

8.5.4.1 Summary of the Proposed Construction Works

The section of the railway corridor between the northern end of the Phoenix Park Tunnel and Glasnevin Cemetery Road Bridge (OBO10) will need to be widened nominally to accommodate the OHLE infrastructure as well as preferred minimum track cess offsets from the running rail. The cross section varies through this area but is predominantly in cutting, with property boundaries close to the top of the cut slopes. The widening operation is further complicated by the need to lower the tracks along certain sections.

This section of the Project includes the electrification of the two existing tracks. These tracks, however, are not remaining in their same alignment, either in the Phoenix Park Tunnel, or the section between the tunnel and the Glasnevin tie-in point. Along with the reconstruction of the trackbed, associated with the improved realignment of the tracks, an improved drainage network will be installed. The works would include the widening of the cess with the provision of new earth retaining structures.

8.5.4.2 Retaining Structures

To achieve the widened cross section, and limit the impact of the construction works on adjacent properties and to reduce land acquisition, it is proposed to construct walls along sections of the railway corridor where there is a level difference between the tracks and the adjacent land.

A number of different wall types are proposed and depend on the height of the retained soil, the soil conditions and the proximity of buildings to the corridor. Refer to **Section 5.2.7** for a description of the different retaining walls under consideration.

It is proposed that a cantilever wall solution will be adopted for the section of retaining wall required along both cess edges of the rail corridor along this section of the railway line. The cantilever retaining walls will typically range from 0.5m to 1.5 m in height and will be constructed utilising access from the trackside within CIÉ lands.

To minimise the associated lateral movement of the walls and to maintain the integrity of the slopes beyond the top of the retained slope, the retaining walls along this section may be anchored using soil nails extending into the existing slope substratum on both sides of the rail corridor. The length of the soil nails/ground anchors will vary based on the height of the cutting slope to be retained. The soil nails/ground anchors will be installed from the trackside within CIÉ lands.

8.5.4.3 Bridges

Glasnevin Cemetery Road Bridge

The requirement for a new bridge deck would result in the temporary closure of the existing crossing. The resultant modifications would also require reworking of the existing access ramps to the bridge to allow for vulnerable user access. To minimise the potential for a permanent loss of car parking spaces within the main car park, localised regrading/profiling of the car park surface adjacent to the bridge may be required.

Glasnevin Cemetery Bridge reconstruction requires a full closure of the existing shared vehicular and vulnerable user crossing to the cemetery. Due to the space constraints and the sensitive nature of the site to the south of the rail corridor there is only sufficient space to accommodate a temporary bridge for vulnerable users.

The current proposal includes the pre-installation of a temporary pedestrian and wheelchair accessible bridge for the duration of the works with appropriate ramps, in a location 3m to 6m (approx.) south east of the existing structure. The existing deck would need to be demolished under night-time possession or during a temporary closure of the Phoenix Park Tunnel branch line.

This temporary bridge will be installed in advance of the works and will also include for temporary diversion of the existing water and electrical supply to the cemetery. (See **Figure 8-15**)

Once the original crossing is re-established, with the appropriate protection, the temporary pedestrian and wheelchair accessible bridge will be removed.

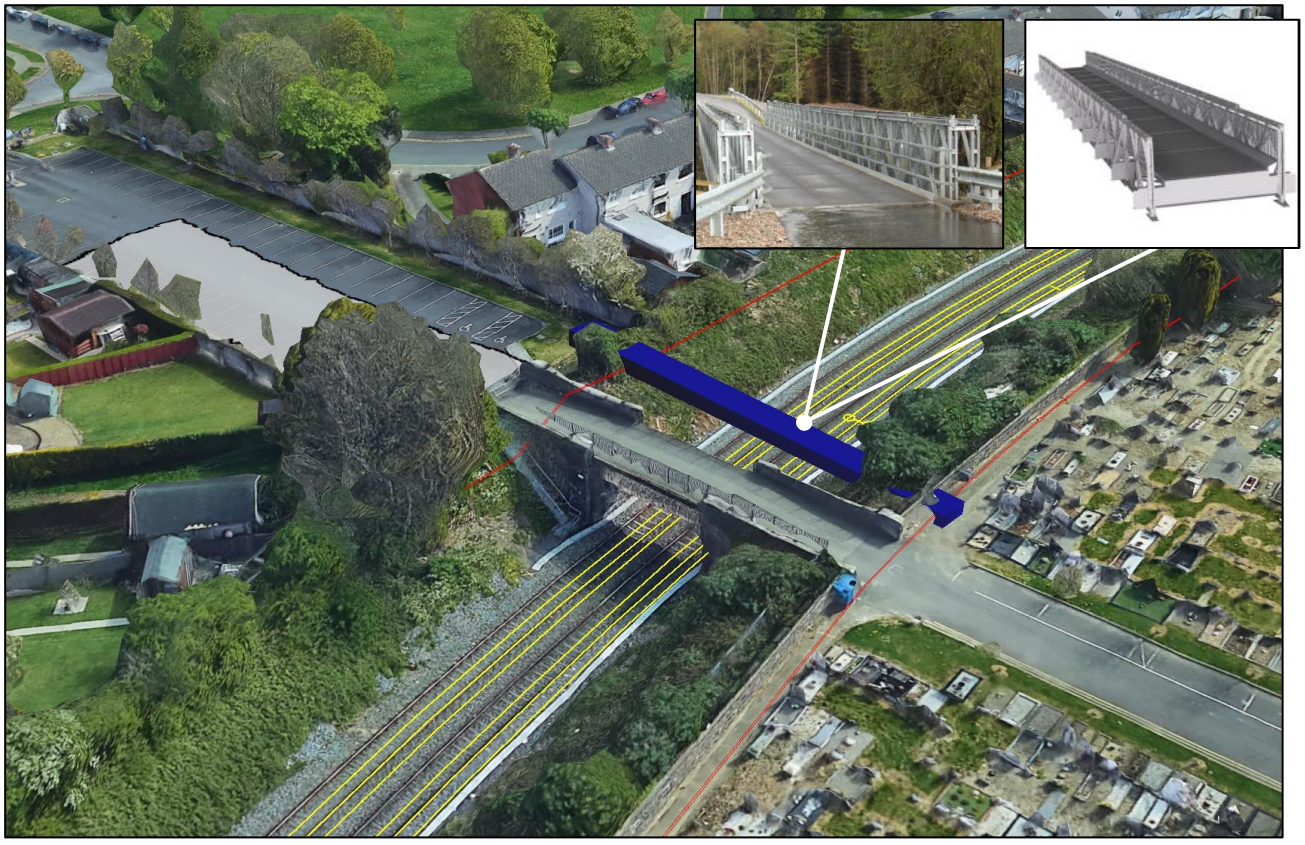

Figure 8-15 Proposed temporary vulnerable user diversion (incl. bridge)

8.5.4.4 Permanent Way

Track lowering and localised horizontal realignment will be required under a number of bridges to achieve electrification. Works will comprise:

- Diversion or closure of the operational track, utilities and ancillary infrastructure.
- Where excavations are significant, support of adjacent operational track.
- Excavation of trackbed.
- Excavation of sub strata.
- Replacement or relocation of any under track utilities and ancillary infrastructure where necessary.
- Construction of new trackbed.

8.5.4.5 OHLE Infrastructure

Structures will be required at a maximum spacing of 60m along the track to support the catenary cables. The support structures are generally supported from one side of the track (cantilever) or from both sides (portal), depending on the permanent way layout. Where there are adjacent walls, the support structure can be fixed to the walls negating the need for vertical supports (stanchions).

Support structures will be founded by means of either piles or spread foundations, depending on soil conditions or the contractor's preferred methodology.

As there are only two tracks along this section of the railway line, railway possession will be required to install all OHLE equipment.

8.5.5 Construction Compounds

As detailed in **Section 6.5**, Construction Compounds are required at specific construction sub-sites. Those required along this section are required for localised track lowering, drainage works, construction of retaining structures, electrification works and replacement of the deck at Glasnevin Cemetery Bridge.

8.5.6 Cabra Construction Compound

The Cabra Construction Compound is located adjacent to the Cabra Road / Carnlough Road Junction. The works in this area involve localised track lowering, comprising of ballast removal, lowering of substrata, reinstallation of ballast, drainage works and construction of retaining structures.

The rail line from the Phoenix Park Tunnel to Glasnevin Junction runs in a deep cutting with steep embankments on either side. The proposed construction compound is located in an area where the ground levels off and opens up, providing good access to the rail corridor.

Access is via Carnlough Road to Cabra Road, Navan Road to the M50. The preferred location for the compound is on CIÉ property with direct access to the rail line. The compound has also been identified by the DART+ West Project as a potential compound for that project.

A new residential development is currently under construction immediately adjacent to the site.

Figure 8-16 Proposed Construction Compound at Cabra

8.5.7 Faussagh Avenue Construction Compound

Faussagh Avenue Construction Compound is proposed to support the provision of electrification works and the localised track lowering works along this section of the railway line. The rail corridor on this section of the route passes through a built-up urban area, with the line being located in a deep cutting with steep embankments on either side.

A construction compound is proposed for Faussagh Avenue on the eastern side of the rail corridor to supplement the Cabra compound which is located approx. 500m to the south. Access to Faussagh Avenue construction compound would be via Faussagh Avenue, Quarry Road, Cabra Road, Navan Road to the M50.

This site is located on Faussagh Ave, it is currently occupied by a disused public house and is in private ownership. However, planning permission has been granted for the site's redevelopment and it may not be available as a construction compound.

Two additional sites were considered for construction compounds, one north of the railway and another to the south. However, the area is very constrained, the Maynooth Line runs along the northern boundary of the proposed sites, and the Royal Canal and Luas Green line run along the southern boundary.

The only access to the proposed sites is along the Royal Canal Greenway from Phibsborough Road. However, this greenway is a heavily used footway and cycleway, on further assessment both sites were ruled out due to access and environmental issues.

Figure 8-17 Proposed Construction Compound at Faussagh Avenue

8.5.8 Glasnevin Cemetery Construction Compound

A Construction Compound is required in this area to facilitate works to Glasnevin Cemetery Road Bridge. The proposed site will include a temporary office, welfare facility and minimal staff parking.

The site will need to facilitate ongoing access to the cemetery by the public and cemetery workers. A temporary pedestrian bridge will need to be installed alongside the existing bridge for this purpose.

Access to this site would be via Claremont Lawns and Finglas Road to the M50.

Figure 8-18 Proposed Construction Compound at Glasnevin Cemetery

9 Next Steps

This report presents the Preferred Route to the public as part of Public Consultation No. 2. It includes an enhanced level of detail to assist the public in appreciating the impacts and the benefits of the project. Once the public consultation process is complete, all feedback and submissions received will be reviewed and assessed as part of the finalisation of the design. Following a full appraisal of the feedback, a Public Consultation No. 2 Findings Report will be prepared and published.

All information gathered by the Project Team will be used to inform the design development of the project which will be the subject of the Environmental Impact Assessment (EIA) and Appropriate Assessment (AA) prepared as part of the Railway Order application that will be submitted to An Bord Pleanála.

The Railway Order application process is set out in the Transport (Railway Infrastructure) Act 2001 (as amended) and the application will be submitted to An Bord Pleanála for statutory approval. An Environmental Impact Assessment Report (EIAR) will accompany the Railway Order application, and this will detail the nature and extent of the proposed project, and identify and describe the impacts on the environment. It will also detail the measures that will be taken to avoid, reduce and/or monitor these impacts.

An Bord Pleanála may conduct an oral hearing, to allow the public to provide further participation in the decision-making process for this Project. At an oral hearing, the Iarnród Éireann Project Team will provide responses to submissions and will be available for questioning. Any person or body may make a submission or observation in writing to the Board in relation to the Railway Order application, including the EIAR and the Compulsory Purchase land requirements.