DART+ South West

Volume 3K – Technical Optioneering Report – North of the Phoenix Park Tunnel to Glasnevin Junction

Iarnród Éireann

November 2021

Contents

Tables

Figures

Glossary of Terms

Reference	Description
ABP	An Bord Pleanála
ACA	Architectural Conservation Area
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
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
CSS	Construction Support Site, Interchangeable with Construction Compound
CTC	Central Traffic Control

Reference	Description
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
GI	Ground Investigation
HAZID	Hazard Identification

Reference	Description
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.
P&C	Points and Crossings
Pantograph	The device on top of the train that collects electric current from the contact wire to power the train.
PC	Public Consultation

Reference	Description
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
SMR	Sites and Monuments Records
SMS	IÉ Safety Management System
TII	Transport Infrastructure Ireland
TMS	Train Management System

Reference	Description
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)
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

1.1. Purpose of the Report

The purpose of this report is to provide technical input to the Option Selection Report to inform Public Consultation no.2 (PC2). This report shows the options considered as part of the project development and why the preferred option for PC2 was chosen.

This report provides the technical assessment of the area between north of Phoenix Park Tunnel and Glasnevin Junction. This report presents the approach to option development, options assessment, and options selection. This optioneering process incorporates assessment by the following Design Workstreams and specialist Project Teams:

- Permanent Way
- Civils and Structures
- Signalling, Electrification and Telecommunications (SET) and Low Voltage Power
- Overhead Line Equipment (OHLE)
- Environment
- Highways
- Geotechnical
- Construction Compounds

The report provides:

- An area overview and a detailed description of the existing railway infrastructure and challenges.
- The Project Requirements for this area.
- The technical and environmental constraints, including the horizontal and vertical clearances at structures.
- The options considered for this area.
- The option selection process is leading to the identification of the Preferred Option, including the Sifting process and the Multi-Criteria Analysis process.
- A summary of the feedback received from the first public consultation which was held in May and June 2021.
- An update on the design development.
- An overview of the proposed construction methodology and requirements in terms of construction compounds.

1.2. DART+ Programme Overview

The DART+ Programme is a transformative railway investment programme that will modernise and improve the existing rail services in the Greater Dublin Area. It will provide a sustainable, electrified, reliable and more frequent rail service, improving capacity on rail corridors serving Dublin.

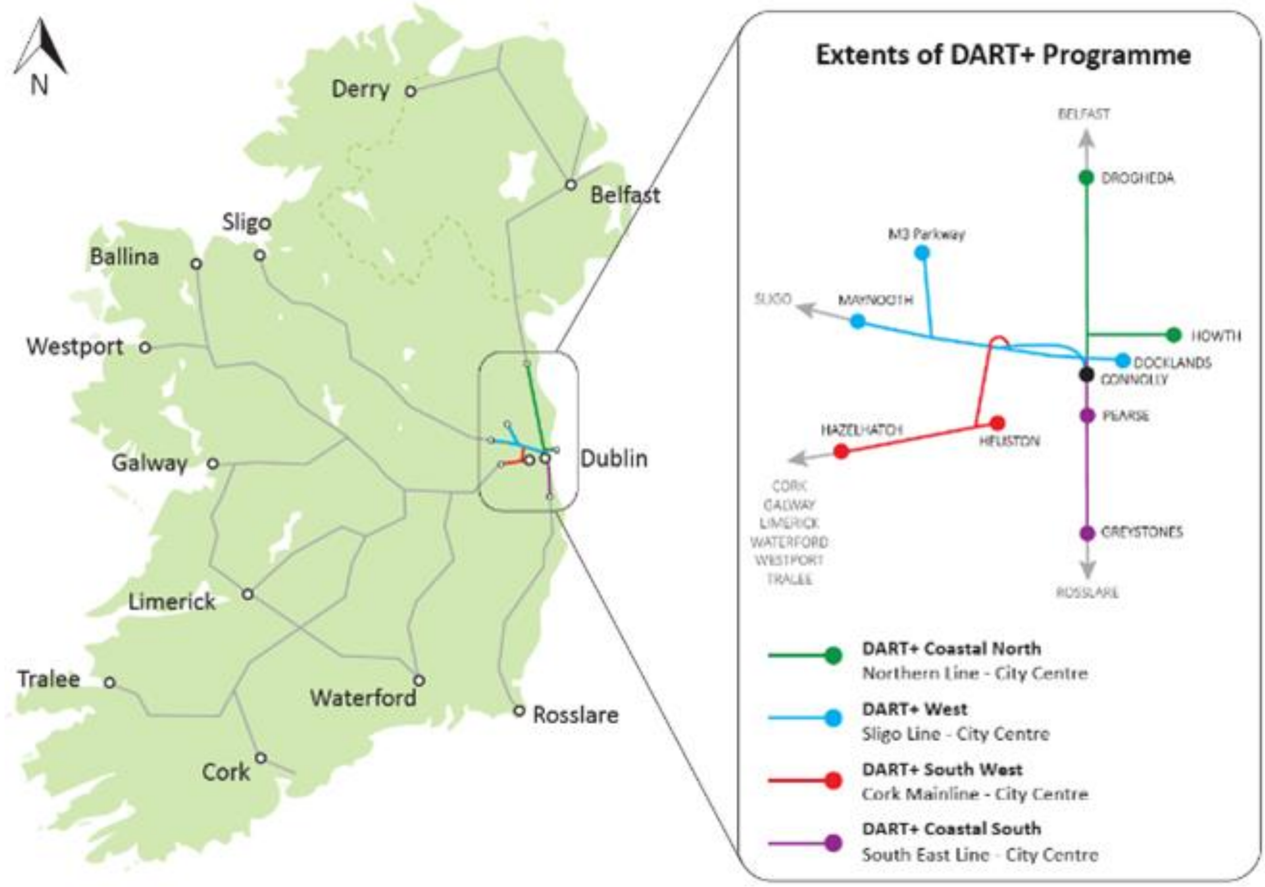


Figure 1-1 Dart+ Programme

The current electrified DART network is 50km long, extending from Malahide / Howth to Bray / Greystones. The DART+ Programme seeks to increase the 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 and Heuston Station and also circa 4km between Heuston Station and Glasnevin Junction, 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.

The Programme also has been prioritised as part of Project Ireland 2040 and the National Development Plan 2021-2030 as it is integral to the provision of an integrated, high-quality public transport system.

Delivery of the Programme will also 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.

Ultimately 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.

1.3. DART+ South West Overview

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

DART+ South West 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 (i.e., where four tracks reduce to two), 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 DART+ South West electrification, new DART trains will be used on this railway corridor, similar to those currently operating on the Malahide / Howth to Bray / Greystones Line.

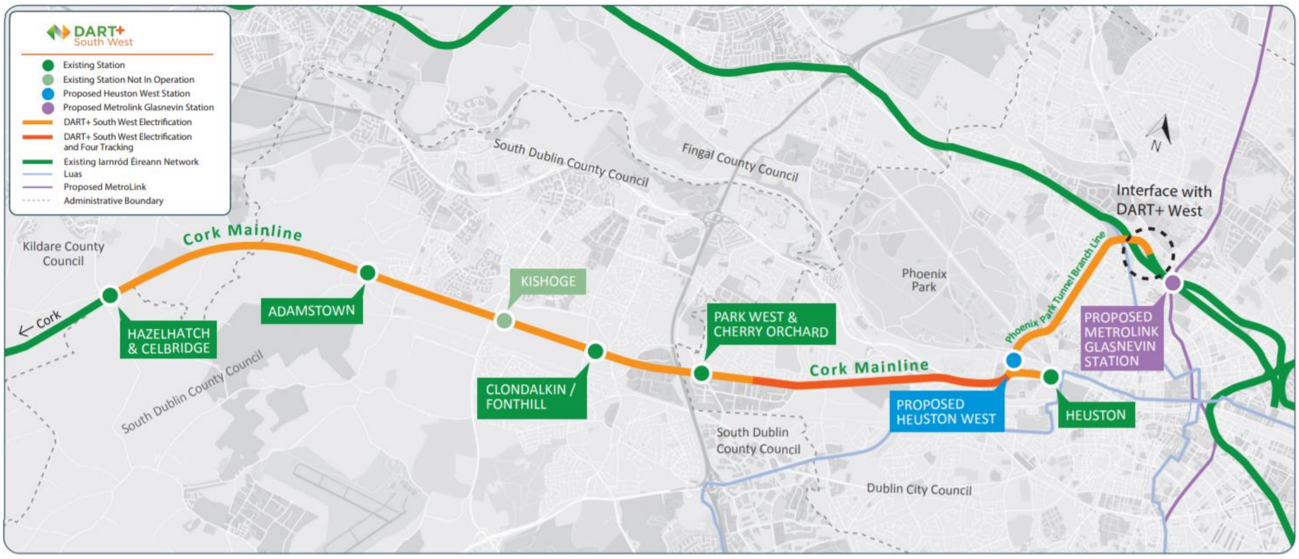


Figure 1-2 DART+ South West Route Map

1.4. Capacity Increase Delivered by DART+ South West

DART+ South West will improve performance 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. It 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. Upon completion of the DART+ South West Project, train services will be increased according to passenger demand.

1.5. Key Infrastructural Elements of DART+ South West Project

The key elements of DART+ South West are as follows:

- Completion of four-tracking from Park West & Cherry Orchard Station to Heuston Station, extending the 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, where it will link with the proposed DART+ West.
- Undertaking improvements / reconstructions of bridges to achieve vertical and horizontal clearances.
- Remove rail constraints along the Phoenix Park Tunnel Branch Line.
- The 'Preferred Option' will be compatible with the future stations at Kylemore and Cabra, although the construction of these stations is not part of the DART+ South West Project.

1.6. Route Description

The existing rail corridor extends from Heuston Station to Hazelhatch & Celbridge Station, the route also extends through the Phoenix Park Tunnel to Glasnevin. The area descriptions and extents are set out in Table 1-1 below.

Table 1-1 Route Breakdown

Area Name	Sub-area Description	Extents	Main Features
Hazelhatch to Park West	Area from Hazelhatch to Park West (Volume 3A)	West side of Hazelhatch & Celbridge Station to 50m to west of Cherry Orchard Footbridge (OBC8B)	Hazelhatch & Celbridge Station Adamstown Station Clondalkin/Fonthill Station Park West & Cherry Orchard Station
Park West to Heuston Station	Area from Park West to Le Fanu (Volume 3B)	West of Cherry Orchard Footbridge (OBC8B) to the East of the proposed Le Fanu Road Bridge (OBC7)	Cherry Orchard Footbridge (OBC8B) Le Fanu Road Bridge (OBC7)

Area Name	Sub-area Description	Extents	Main Features
	Area from Le Fanu to Kylemore (Volume 3C)	East of the proposed Le Fanu Road Bridge (OBC7) to the East of IE700B (i.e. the points for the Inchicore headshunt turnout)	Kylemore Road Bridge (OBC5A)
	Area from Kylemore to Sarsfield (Volume 3D)	East of IE700B (i.e. the points for the Inchicore headshunt turnout to the west of Sarsfield Road Bridge (UBC4)	Inchicore Works Depot Khyber Pass Footbridge (OBC5)
	Area from Sarsfield to Memorial (Volume 3E)	West of Sarsfield Road Bridge (UBC4) to the West of Memorial Road Bridge (OBC3)	Sarsfield Road Bridge (UBC4)
	Memorial Road (Volume 3F)	Area around Memorial Road Bridge	Memorial Road Bridge (OBC3)
	Area from Memorial Road to South Circular Road Junction (Volume 3G)	East of Memorial Road Bridge (OBC3) to East of St John's Road Bridge (OBC0A)	South Circular Road Junction South Circular Road Bridge (OBC1) St Johns Road Bridge (OBC0A)
	Area around Heuston Station and Yard (Volume 3H)	Area at the South side of the Heuston Station Yard (non-DART+ tracks)	Heuston Station Sidings around Heuston Station
Heuston West Station	New Heuston West Station (Volume 3I)	Area to the West of Heuston Station, adjacent to Liffey Bridge (UBO1)	Heuston West Station
St John's Road Bridge (Islandbridge) to Glasnevin Junction	East of St John's Road Bridge (OBC0A) (Islandbridge) to North of Phoenix Park Tunnel (Volume 3J)	East of St John's Road Bridge (OBC0A) (Islandbridge) to North of Phoenix Park Tunnel	Liffey Bridge (UBO1). Conyngham Road Bridge (OBO2) Phoenix Park Tunnel

Area Name	Sub-area Description	Extents	Main Features
St John's Road Bridge to Glasnevin Junction	North of the Phoenix Park Tunnel to Glasnevin Junction (Volume 3K)	North of Phoenix Park Tunnel to South of Glasnevin Junction	McKee Barracks Bridge (OBO3) Blackhorse Avenue Bridge (OBO4) Old Cabra Road Bridge (OBO5) Cabra Road Bridge (OBO6) Fassaugh Avenue Bridge (OBO7) Royal Canal and LUAS Twin Arches (OBO8) Maynooth Line Twin Arch (OBO9) Glasnevin Cemetery Road Bridge (OBO10)

1.7. Stakeholder Feedback

There was a large volume of stakeholder submissions during the 6-week public consultation period from 12 May 2021 to 23 June 2021, and the additional week until 30 June 2021. All submissions received either via email, post, telephone, or through the online feedback form, were analysed and recorded by the project team on a dedicated consultation database. Each individual submission was analysed to identify the themes that were raised by the respondent and each submission was classified according to the themes raised. All feedback provided was then anonymised before being analysed under each of the themes. In addition, further engagement with relevant local authorities and prescribed stakeholders has been ongoing. Engagement with potentially affected landowners has also taken place since the commencement of PC1.

All submissions received as part of the first round of public consultation have fed into the design process and the selection of 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.

Stakeholder feedback in general focused on potential increase construction, operational and maintenance noise; as well and construction traffic impact.

The area surrounding Glasnevin was highlighted for its cultural importance by stakeholders. They noted that area is of high cultural importance and assessments should be undertaken to ensure no structure or feature is unknowingly damaged as a result of the proposed works. Noting that an underground model impacts less on the historical sites in the area.

Further details of the Stakeholder Feedback are captured in the **Public Consultation No. 1: Findings Report, Volume 4**.

Similarly, all feedback received on the Preferred Option at Public Consultation No.2 will feed into the development of the preliminary design, Railway Order and Environmental Impact Assessment Report (EIAR).

2. Existing Situation

2.1. Overview

This part of the scheme connects the Dublin-Cork line 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 cutting (i.e. the rail level is below the surrounding ground level), the corridor is formed mainly by earth embankments, the track passes under 8 no. overbridges and over 1 no. 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 the interface with the DART+ West project.

The general view of the area is shown in **Figure 2-1**.

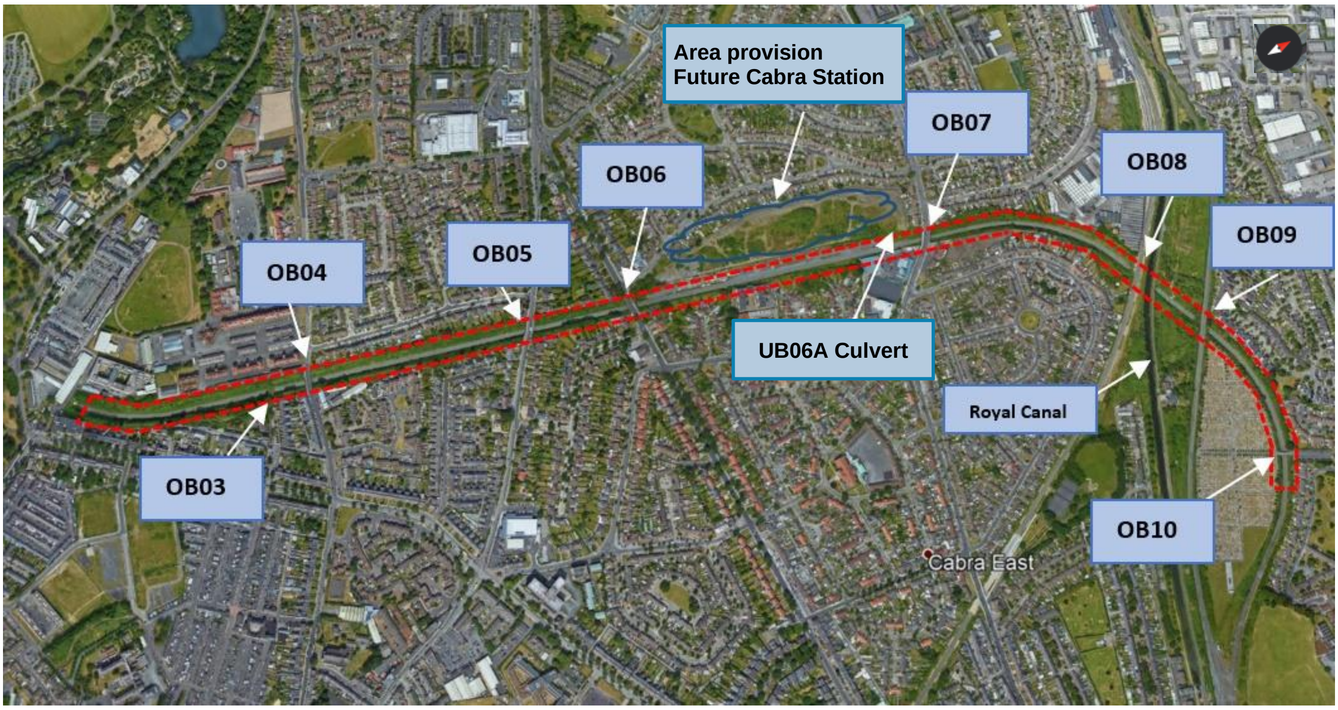


Figure 2-1 General View

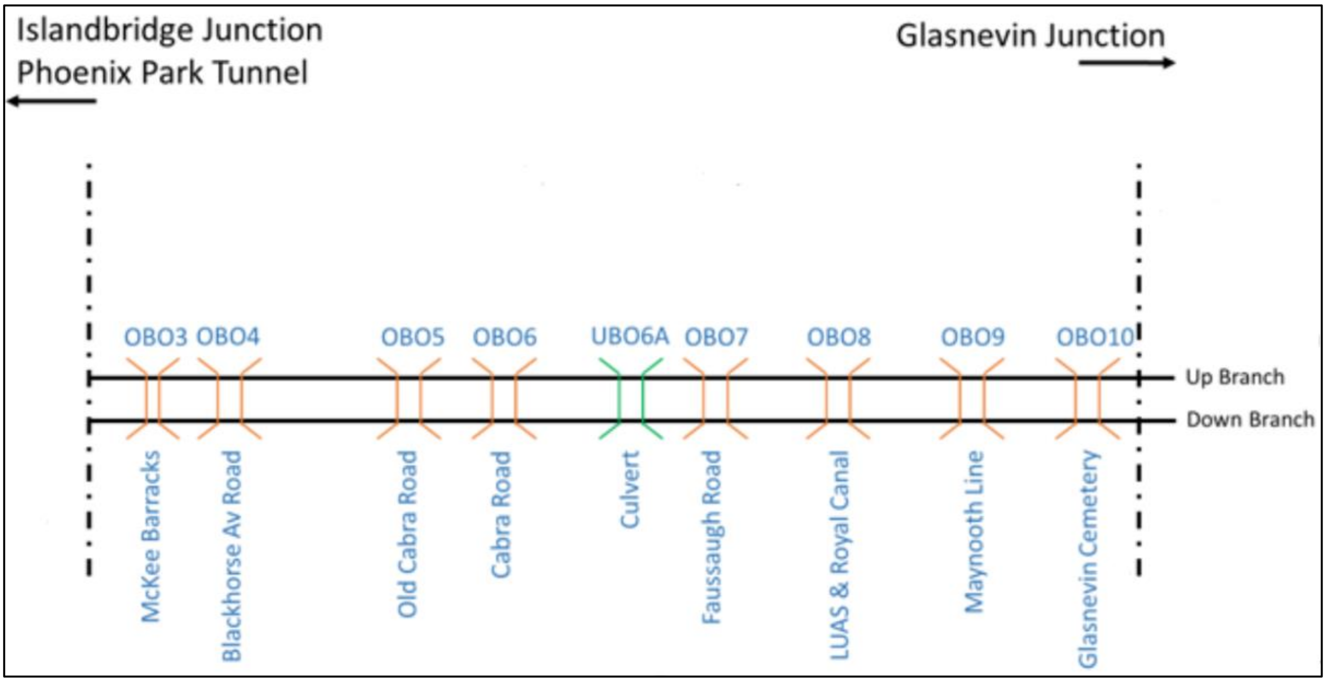


Figure 2-2 Existing Track Layout

2.2. Challenges

The main constraint to the electrification requirements of the Project is the low clearances of existing overbridges in the area, as some of the existing bridges do not have enough vertical clearance to install the new overhead electrification system.

In addition to the vertical clearance issue, the Royal Canal and LUAS Twin Arch Bridge (OBO8) and Maynooth Line Twin Arch Bridge (OBO9) structures are two masonry arch bridges and are known to have limited passing lateral clearance. There are known issues with lateral passing clearances and an area with limited clearance (restricted access for maintenance staff).

Figure 2-3 View from the east, of Royal Canal and LUAS Twin Arch Bridge (OBO8).

In terms of the vertical alignment in this section, there is a low point between Royal Canal and LUAS Twin Arch Bridge (OBO8) and the Maynooth Line Twin Arch Bridge (OBO9) (refer to **Figure 2-4**). This has caused some flooding issues in the past. In recent years, a pumping station and an infiltration tank has been installed as part of stabilisation works carried out in the cutting west of Royal Canal and LUAS Twin Arch Bridge (OBO8). The pumping station drains the excess water from the cutting located immediately to the west of Royal Canal and LUAS Twin Arch Bridge (OBO8), as per **Figure 2-4**). This facility directs the inflows to the attenuation tank located to the northwest.

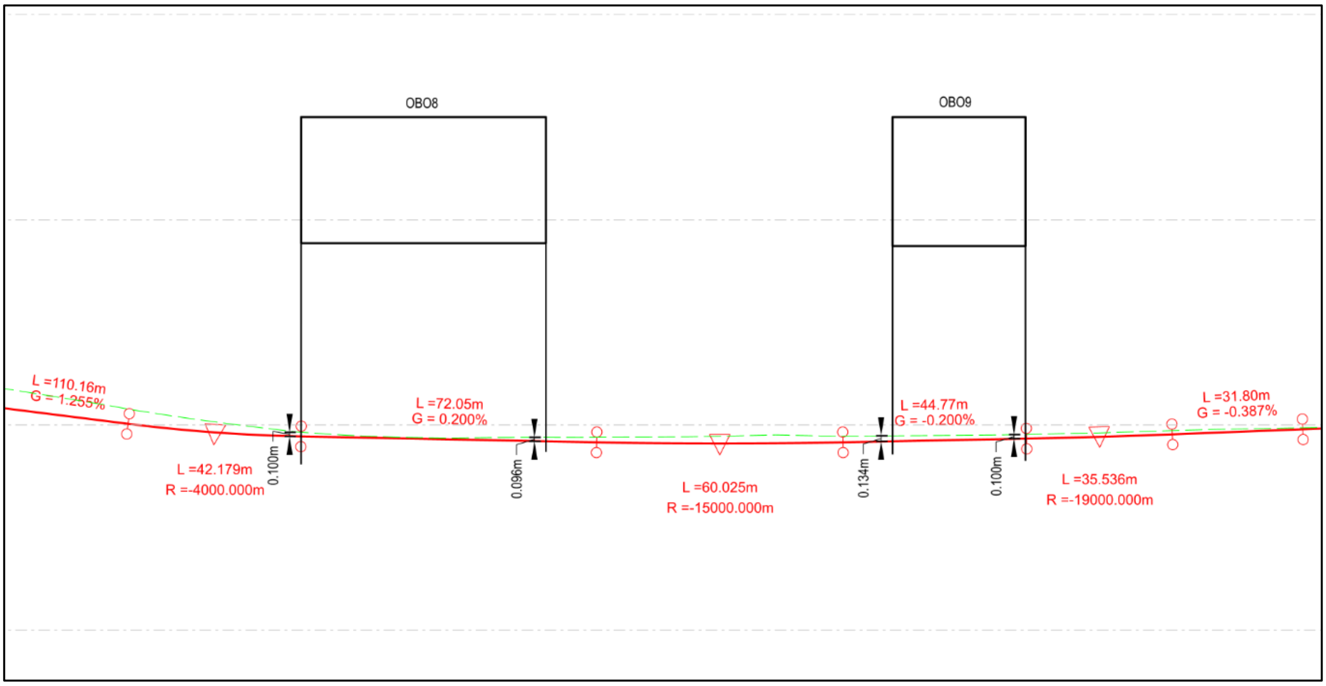


Figure 2-4 Longitudinal profile between Royal Canal and LUAS Twin Arch Bridge (OBO8) and Maynooth Line Twin Arch Bridge (OBO9).

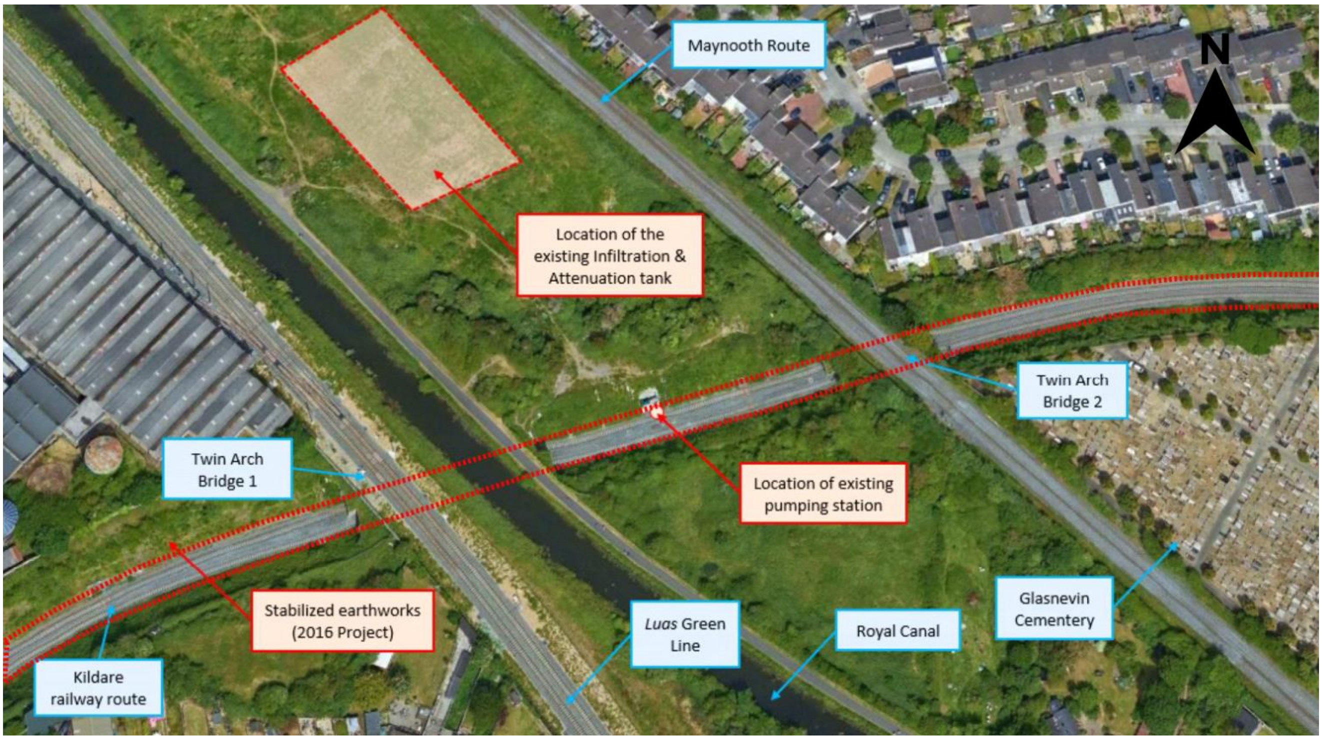


Figure 2-5 Location of drainage challenges.

2.3. Structures

2.3.1. McKee Barracks Bridge (OBO3)

The McKee Barracks Bridge (OBO3) is a single span masonry arch bridge, the bridge is not currently in use. Topographical surveys undertaken by the project indicate the bridge has a minimum soffit height over the cess rail of 7.23m.

The track through the McKee Barracks Bridge (OBO3) can be electrified with no structural or track intervention required.

The existing structure has stone masonery block parapets, approximately 1.4m in height. However it is sufficient as a safety barrier for infrequent access by inspection personnel, as there is no public access to the structure.

Figure 2-6 McKee Barracks Bridge (OBO3) south elevation

2.3.2. Blackhorse Avenue Bridge (OBO4)

The Blackhorse Avenue Bridge (OBO4) is a single span masonry arch bridge that carries the Blackhorse Avenue Road over two railway tracks. The bridge has a span of 8.5m approx. and a minimum soffit height over the cess rail of 5.16m.

On the south side, there is a utitilies bridge with a minimum height of 4.40m to the track.

As the height of the existing bridge parapet (being a composite of masonry block and fencing) is greater than required, no additional parapet raising is necessary. However the upper fenced portion of the parapet has an appperture size smaller than what is deemed acceptable for an electrified railway. A solid infill will need to be provided to bring the parapet into compliance for electrified railways.

The track through the Blackhorse Avenue Bridge can be electrified with no major track nor bridge structural intervention; however the utility bridge will need to be demolished and the utiliies diverted.

Figure 2-7 Blackhorse Avenue Bridge (OBO4) south elevation

2.3.3. Old Cabra Road Bridge (OBO5)

The Old Cabra Bridge (OBO5) is a single span masonry arch bridge that carries the Old Cabra Road over two railway tracks. On the north side, there is a pipe bridge that has a lower soffit level than Old Cabra Road Bridge (OBO5). The pipe bridge has a minimum soffit height over the cess rail of 6.08m.

As the height of the existing bridge parapet (being a composite of masonry block and fencing) is greater than required, no additional parapet raising is necessary. However the upper fenced portion of the parapet has an appperture size smaller than what is deemed acceptable for an electrified railway A solid infill will need to be provided to bring the parapet into compliance for electrified railways.

The track through Old Cabra Road Bridge (OBO5) can be electrified, and no structural or track intervention is required to the road bridge. In addition further design development has confirmed that modifications to the existing utility pipe or its support structures are also not required.

Figure 2-8 Old Cabra Road Bridge (OBO5) north elevation

2.3.4. Cabra Road Bridge (OBO6)

The Cabra Road Bridge (OBO6) is a single span bridge that carries the Cabra Road over two railway tracks. A structural drawing dated February 1946 indicates the bridge has a skew clear span of 8.70m and a soffit height of 4.36m above rail level. The bridge has a width of 13.92m, including a 9.30m carriageway, a southern footpath of 1.65m and a northern footpath of 2.97m. The drawing refers to “girders” and proposals for renewal including reinforced concrete slab, and reinforced concrete beams of H-section with slab on top. This suggest that the bridge deck may have been replaced. The superstructure is a reinforced concrete slab.

The track through Cabra Road Bridge (OBO6) cannot be electrified without structural or track intervention, or a combination of both.

As the height of the existing bridge parapet (being a composite of masonry block and fencing) is greater than required, no additional parapet raising is necessary. However the upper fenced portion of the parapet has an appperture size smaller than what is deemed acceptable for an electrified railway. A solid infill will need to be provided to bring the parapet into compliance for electrified railways.

Figure 2-9 Cabra Road Bridge (OBO6) north elevation

2.3.5. Fassaugh Avenue Bridge (OBO7)

Fassaugh Avenue Bridge (OBO7) is a single span masonry arch bridge with a clear span of 8.50m and a width of 6.86m. The original bridge has been widened either side with a concrete beam deck on concrete piers..

The route through the Fassaugh Avenue Bridge (OBO7) cannot be electrified without structural or track intervention, or a combination of both.

As the height of the existing bridge parapet (being a composite of masonry block and fencing) is greater than required, no additional parapet raising is necessary. However the upper fenced portion of the parapet has an appperture size smaller than what is deemed acceptable for an electrified railway. A solid infill will need to be provided to bring the parapet into compliance for electrified railways.

Figure 2-10 Fassaugh Avenue Bridge (OBO7) north elevation

Figure 2-11 Fassaugh Avenue Bridge (OBO7) south elevation

2.3.6. Royal Canal and LUAS Twin Arch Bridge (OBO8)

The Royal Canal and LUAS Twin Arch Bridge (OBO8) is a 55m long twin arch bridge that carries the Royal Canal and two LUAS tracks over the railway corridor. As-built drawings for the bridge are not available. The minimum soffit height is 4.54m.

The route through the Royal Canal and LUAS Twin Arch Bridge (OBO8) cannot be electrified without structural or track intervention, or a combination of both.

Palisade fencing runs the length of the crossing infrastructure forming a corridor boundary that for the purposes of this report will be referred to as the bridges' parapets. There is currently no fencing or typical edge parapets in close proximity to the bridge face however there is also no public access to the structure. The palisade fence aperture spacing while being lower than a typical parapet requirement for an electrified track; its distance from the track is considered sufficient to be compliant.

Figure 2-12 The Royal Canal and LUAS Twin Arch Bridge (OBO8) north elevation

2.3.7. Maynooth Line Twin Arch Bridge (OBO9)

The Maynooth Line Twin Arch Bridge (OBO9) is a 35m long twin arch bridge that carries two railway tracks for the Maynooth Line over the railway corridor. As-built drawings for the bridge are not available. The twin arch has a soffit height of 4.57m at the low point.

The track through the Maynooth Line Twin Arch Bridge (OBO9) cannot be electrified without structural or track intervention, or a combination of both.

Palisade fencing runs the length of the crossing infrastructure forming a corridor boundary that for the purposes of this report will be referred to as the bridges' parapets. There is currently no fencing or typical edge parapets in close proximity the bridge face however there is also no public access to the structure. The palisade fence aperture spacing while being lower than a typical parapet requirement for an electruified track; its distance from the track is considered sufficient to be compliant.

Figure 2-13 Maynooth Line Twin Arch Bridge (OBO9) north elevation

2.3.8. Glasnevin Cemetery Road Bridge (OBO10)

The Glasnevin Cemetery Road Bridge (OBO10) is a single span reinforced concrete slab bridge that provides vehicle access to the Glasnevin Cemetery from the cemetery carpark. The bridge has a minimum soffit height of 4.58m.

The track through the Glasnevin Cemetery Road Bridge (OBO10) cannot be electrified without structural and/or track intervention. In addition, the existing bridge deck is nearing the end of its design life.

The parapets over the deck are currently only fencing, while on the approach ramps they are a composite of stone masonry block and fencing. The fencing aperture width is lower than that for a compliant parapet for an electrified railway. A solid or IPX2 rated infill to provide a minimum 1.8m total parapet height or a new stone parapet in the case of the bridge deck replacement.

Figure 2-14 Glasnevin Cemetery Road Bridge (OBO10) east Elevation

2.3.9. Retaining walls and minor structures

The table below provides details of existing retaining walls on this section of the line:

Table 2-1 Existing Retaining Wall Assets (Source IE Database Records)

Track Section	Asset ID	Start Mileage	End Mileage	Side	Wall Type	Wall Height	Description
Connolly - Heuston	RWO001U	2m 1250yrds	2m 1320yrds	Up	Mass Concrete	1.7m	N/A
Connolly - Heuston	RWO001D	2m 1200yrds	2m 1350yrds	Down	Mass Concrete	4.3m	N/A
Connolly - Heuston	RWO000DC	2m 1170yrds	2m 1180yrds	Down	Block Wall	1.5m	LOCATION CASE
Connolly - Heuston	RWO000UO	2m 0885yrds	2m 0890yrds	Up	Precast Concrete	1.8m	LOCATION CASES
Connolly - Heuston	RWO000UG	2m 0286yrds	2m 0289yrds	Up	Block Wall	2.1m	LOCATION CASES
Connolly - Heuston	RWO000UF	2m 0113yrds	2m 0143yrds	Up	Gabions	1.2m	N/A
Connolly - Heuston	RWO000UE	2m 0084yrds	2m 0113yrds	Up	Mass Concrete	1.2m	N/A
Connolly - Heuston	RWO000UD	1m 1704yrds	1m 1715yrds	Up	Gabions	1.6m	N/A
Connolly - Heuston	RWO000UH	1m 1505yrds	1m 1508yrds	Up	Precast Concrete	1.8m	LOCATION CASES
Connolly - Heuston	RWO000DB	1m 1339yrds	1m 1457yrds	Down	Masonry	2.5m	N/A
Connolly - Heuston	RWO000UC	1m 0835yrds	1m 0838yrds	Up	Block Wall	1.6m	LOCATION CASES
Connolly - Heuston	RWO000UB	1m 0242yrds	1m 0248yrds	Up	Block Wall	1.6m	LOCATION CASES

2.4. Permanent Way and Tracks

This section starts to the east of Phoenix Park Tunnel, and the railway features a double track section. The horizontal alignment is straight from the tunnel up to Fassaugh Avenue Bridge (OBO7) before the track alignment crosses under the LUAS Green Line and Royal Canal Twin Arch Bridge (OBO8) and Maynooth Line Twin Arch

Bridge (OBO9) to connect with the Maynooth Line at Glasnevin Junction. The vertical alignment features a high point between Cabra Road Bridge (OBO6) and Fassaugh Avenue Bridge (OBO7). The gradient falls towards the Phoenix Park Tunnel in this section and is up to 1.15% between the tunnel and Cabra Road Bridge (OBO6). The gradient reduces from Cabra Road Bridge (OBO6) to Glasnevin featuring a low point between OBO8 and Maynooth Line Twin Arch Bridge (OBO9). Between Cabra Road Bridge (OBO6) and Fassaugh Avenue Bridge (OBO7) the area levels off near where Cabra Sidings were located (**Figure 2-15**).

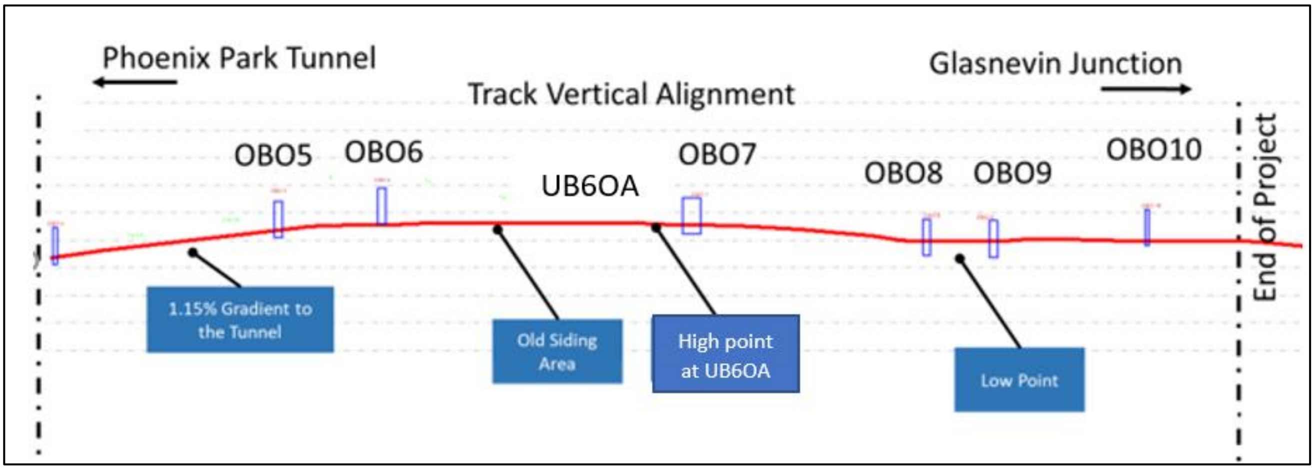


Figure 2-15 Track vertical alignment

2.5. Roads

There are several roads crossing over the railway in this area.

With the exception of Glasnevin Cemetery Bridge, it is anticipated that the works to the existing bridges on the branch line can be accommodated within the existing rail corridor, minimising disruption to the existing roads infrastructure.

2.6. Ground Conditions

The topography of the area is typically flat, sloping gently towards the east. The railway is almost entirely located within steep cuttings covered by vegetation. A short section west of the railway between Cabra Road Bridge (OBO6) and Fassaugh Avenue Bridge (OBO7) is locally at grade.

Geological mapping indicates the superficial deposits comprise till underlain by bedrock (limestone and shale).

To the south, close to the Phoenix Park Tunnel, ground investigations show the ground conditions to comprise gravel stone fill (likely ballast associated with the railway) underlain by stiff to very stiff black gravelly clay. Bedrock consisting of a medium strong to strong limestone was encountered at 7.20m bgl (17.90m AOD). Groundwater strikes are shown to be recorded between existing ground level and 4.70m bgl.

Towards Cabra, made ground described as sandy gravelly clay with glass, red brick and organic fragments has been recorded up to 3.10m thick. The made ground is underlain by firm to stiff gravelly clay with unproven thickness. The recorded groundwater levels towards Cabra range from 2.85m bgl to 3.45m bgl.

Further north, to the east of the railway at Quarry Road, ground investigation shows the ground conditions comprise made ground or fill underlain by stiff to very stiff black gravelly clay. The till is overlain by pockets of sand or firm brown gravelly clay in places. Groundwater at Quarry Road was recorded between 2.10m bgl to 6.20m bgl.

An Electrical Resistivity Tomography (ERT) geophysical survey was completed along the Phoenix Park Tunnel cutting. The survey shows that bedrock levels appear to undulate across the length of the rail corridor, however in general rock is shallower to the south.

Sections of cutting along this area have exhibited instability and are now soil nailed. I. Anecdotal evidence also suggests significant cutting failures have occurred due to construction of buildings close to the top of the existing earthworks.

A Ground Investigation is currently ongoing and preliminary results indicate the ground conditions verify the assumptions made to date.

2.7. Environment

Starting at McKee Barracks Bridge (OBO3) the McKee Military Barracks and the Garda Headquarters are adjacent to the existing line on the west side. The McKee Barracks Bridge is listed on the National Inventory of Architectural Heritage (NIAH). The track then passes through the Blackhorse Avenue Road Bridge (OBO4) and the Old Cabra Road Bridge (OBO5), both of which are listed on the NIAH. Approx. 100m to the west of the existing rail centreline is a post-box on the Old Cabra Road which is also an NIAH. Just south of the Old Cabra Road and adjacent to the rail corridor is Ryan's B&B. A house approx. 100m to the east of the rail centreline at the corner of Ellesmere Avenue is an NIAH (1920-40, of regional importance).

The track then passes through the Cabra Road Bridge (OBO6) which is on the Dublin City Council Record of Protected Structures (RPS). There is extensive residential development either side of the railway corridor from McKee Barracks Bridge to Cabra Road Bridge.

Between Cabra Road Bridge and Fassaugh Road Bridge (OBO7) which is not listed as an NIAH or RPS, is a building on Quarry Road approx. 100m to the east of rail centreline, Jack Pott's Bingo (1945-50). This building is listed on the NIAH and the building complex is also on the RPS. The Hill of Tara House B&B is located to the west of the rail corridor on Carnlough Road. Just south of Fassaugh Avenue and adjacent to the rail corridor is Gaelscoil Bharra National Primary School, Saint Finbar's GAA Club and HSE Health Centre Cabra. There is a former cement storage site located adjacent the existing rail line on the west side between Fassaugh Avenue and the Cabra Road. In this area, some small ephemeral ponds of standing water were noted in the 2020 ecology survey, with alkaline plants; and it was noted that these have potential to host amphibians.

The existing railway line then crosses under the Royal Canal and Luas Twin Arch (OBO8). Around St Attracta Road and Bannow Road, there is residential development either side of the rail corridor, as well as some commercial development near the Luas line/ canal comprising Valeo Foods and Batchelor's, and two national schools, Christ the Kind Boys National School and Girls National School. The tunnel itself under the Royal Canal is on the Dublin City Industrial Heritage Record, but is not listed as an NIAH or RPS. The Royal Canal Way is an amenity walking trail. Dublin City Council (DCC) also has a landscape protection objective (Z11) to "protect and improve canal, river and coastal amenities." The Royal Canal is also a Designated Conservation Area. South of the Royal Canal are Mount Bernard Park and a Pitch & Putt course.

The railway line then crosses the Maynooth Line Twin Arch (OBO9) and Glasnevin Cemetery Road Bridge (OBO10). There is existing residential development on the northern side of the existing line at Glasnevin (Claremont and Dalcassian), backing onto the R135 (Finglas Road). To the north-east of the existing line there are community features which include a national school (Saint Vincent's Christian Brothers National School) and secondary school (Saint Vincent's Secondary School).

Glasnevin Cemetery is located further north, the southern part of it just within the 250m buffer band of the existing rail centreline. The Glasnevin Museum is also located here and is a Fáilte Ireland visitor attraction. The cemetery is also a Geological Heritage Area/ County Geological Site. Prospect Cemetery is located just on the inside bend of the existing line; this cemetery also hosts a number of pauper's graves. Both cemeteries are sites of historical, archaeological and cultural heritage value. The Prospect Cemetery is also a Designated Conservation Area. .

The presence of the existing rail line has reduced biodiversity potential along the route to a large degree, however, there remain hotspots of interest in relation to hedgerows and treelines for bats, in particular the Royal Canal and LUAS Twin Arch Bridge (OBO8) has bat roost potential, and there is potential for spreading invasive species as the scheme progresses. The invasive Himalayan balsam was noted near the Royal Canal and LUAS Twin Arch Bridge (OBO8), with other invasive species noted at the Old Cabra Road Bridge (OB05) and the Cabra Road Bridge (OBO6).

Much of the subsoils traversing the zone are comprised of till derived from limestones. Groundwater vulnerability is rated as low to moderate.

2.8. Utilities

There are a considerable number of utilities typical of an urban environment. Service providers with network assets in this area include the following:

- Aurora
- British Telecoms (BT)
- Eir
- ESB Networks
- Dublin City Council Road Drainage (Storm Water Sewers)
- Dublin City Council / Irish Water (Foul Water Sewers)
- Dublin City Council / Irish Water (Water Supply)
- Dublin City Council Public Lighting
- Gas Networks Ireland (GNI)
- Virgin Media

Data in the form of utility service records have been gathered from all providers in the area. Most services are located within existing streets and rail line bridge crossings. Hence, where modifications are required to existing bridges and/or to the road network in the immediate vicinity of existing structures, impacts on utilities will be inevitable.

A number of services are also present at track level, crossing the railway corridor below the tracks. Where track lowering is proposed, consideration of the impacts on these services will be necessary. ESB cables identified in the cess below the Maynooth Line Twin Arch (OBO9) have been discussed with ESB and will be lowered with the tracks. Other services present in areas with proposed track lowering comprise foul / combined sewers and stormwater sewers. Where service records lack level data, discussions are ongoing to complete slit trenches and/or GPR surveys to confirm the depths of these utilities.

Significant utilities are also located in parallel to the railway along both the northern and southern boundaries. In terms of proposals to widen the railway corridor, an examination of the impacts on these services will be required.

.There is an existing combined sewer pipe bridge that runs adjacent to Blackhorse Avenue Road Bridge (OBO4). This pipe is located within the vertical clearance for the proposed OHLE; thus, a diversion will be required. There are also high voltage ESB cables that are strapped to the parapet of Cabra Road Bridge (OBO6). They have sufficient clearance to the proposed OHLE but require additional investigation regarding potential electrical interference with the OHLE.

2.9. Drainage

There is some track drainage installed in this area, from PPT up to the Royal Canal and LUAS Twin Arch Bridge (OBO8). However, along most of this corridor, storm water is thought to run following the track gradient, percolating into the terrain. Between the Royal Canal and LUAS Twin Arch Bridge (OBO8) and the Maynooth Line Twin Arch Bridge (OBO9) there is a low point and a pumping station was installed as part of the cutting stabilisation works between Cabra Sidings and Royal Canal and LUAS Twin Arch Bridge (OBO8). The pumping station drains into an attenuation / infiltration tank located to the northwest.

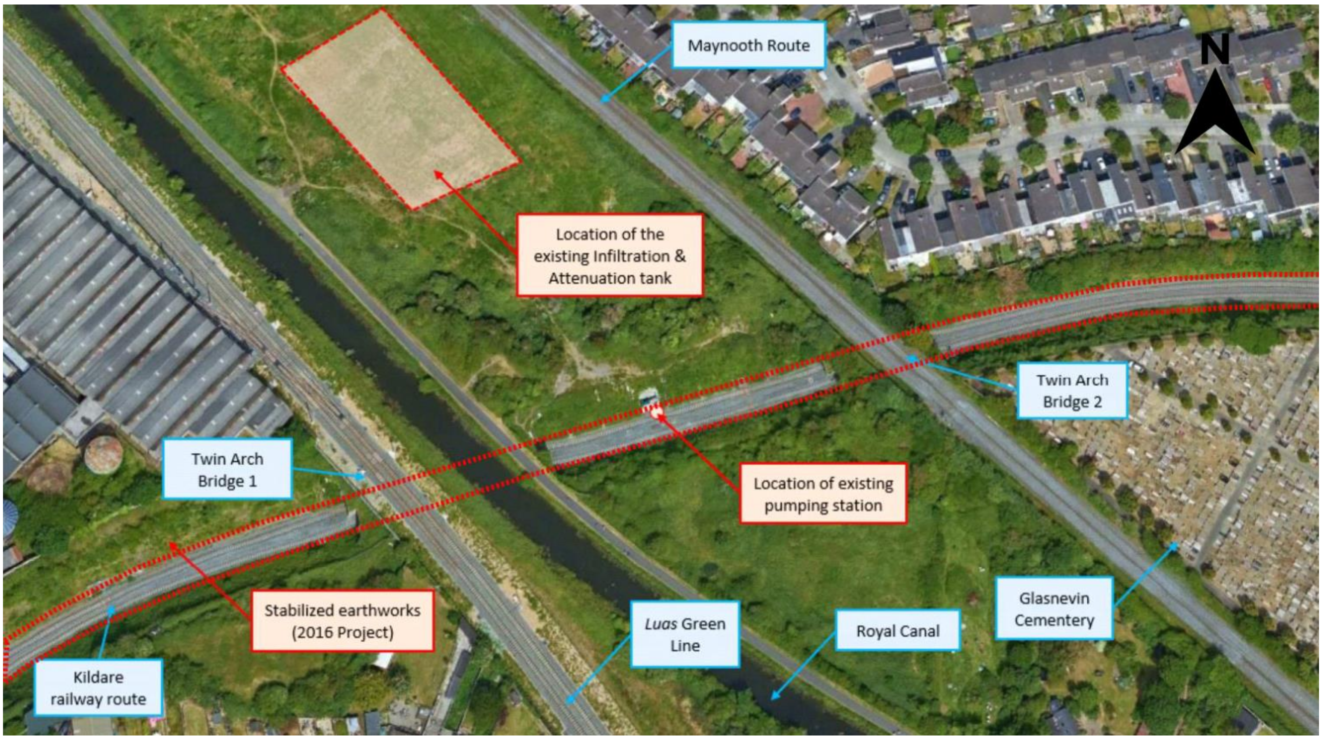


Figure 2-16 Location of drainage features and stabilization works.

3. Project Requirements

3.1. Area-Specific Requirements

In addition to the general feasibility requirements of constructability, general fitness for intervention and safety, the specific requirements for this area are:

- Electrification of 2 no. tracks for DART+.
- Provide sufficient vertical clearance for OHLE at structures through track lowering and /or structural interventions.
- Track alignment and drainage requirements (in accordance with their respective standards).
- Passive provision made in the track layout for a future Cabra Station between Cabra Road Bridge (OBO6) and Fassaugh Avenue Bridge (OBO7) – this requires compliant track gradients of 1:400 (0.25%) or less through the proposed platform extents on both the Down Branch and Up Branch lines.

3.2. Systems Infrastructure and Integration

In addition to the track and civil infrastructure modifications relating to them DART+ South West Project, there is a requirement to provide Overhead Line Electrification Equipment (OHLE) signalling and telecoms infrastructure.

The electrification system will be similar in style to that currently used on the existing DART network and integrated and compatible across the DART+ Programme. It is envisaged that a standardised approach to electrification will be adopted, but area or asset-specific interventions will also be required.

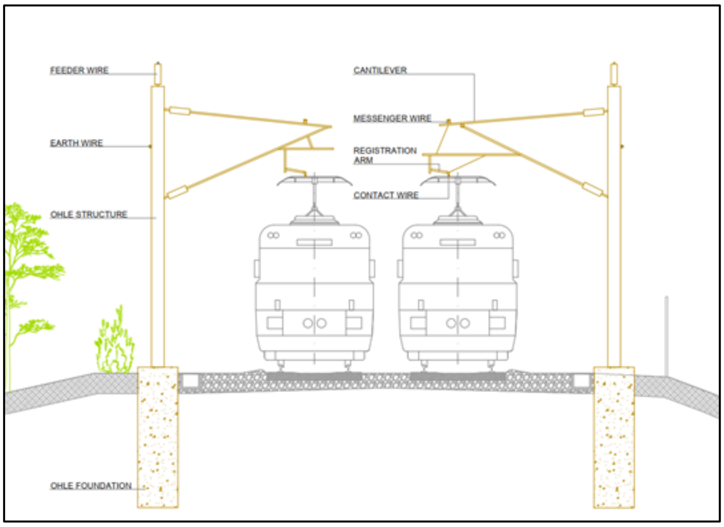
The Low Voltage and Telecommunications networks required for Signalling will be 'global systems' and are unlikely to vary significantly between or within the various areas. In order to achieve the necessary capacity enhancements and performance required for the introduction of the new electric multiple unit (EMU) fleet, it will be necessary to upgrade the existing signalling system as well as replacing some of the legacy signalling system. This will include provision of equipment rooms, including Relocatable Equipment Buildings (REB), to accommodate signalling equipment and associated power supplies and backup. Upgrades to the existing telecommunications infrastructure will be required to facilitate improvements to the radio-based technologies used on the network and for signalling and communication with the existing and future network control centres.

3.2.1. Electrification System

The OHLE system architecture is currently being developed. The Dart wide programme will adopt a 1500V Direct Current (DC) OHLE system to provide electrical power to the network's new electric train fleet.

It should be noted that all OHLE diagrams in this report are for visual information only. Construction details will be determined during Detail Design, which will be developed at later stages of the project.

The OHLE concept comprises a simple (2-wire) auto-tensioned system, supported on galvanised steel support structures. See **Figure 3-1** for a typical OHLE arrangement in a two-track open route.



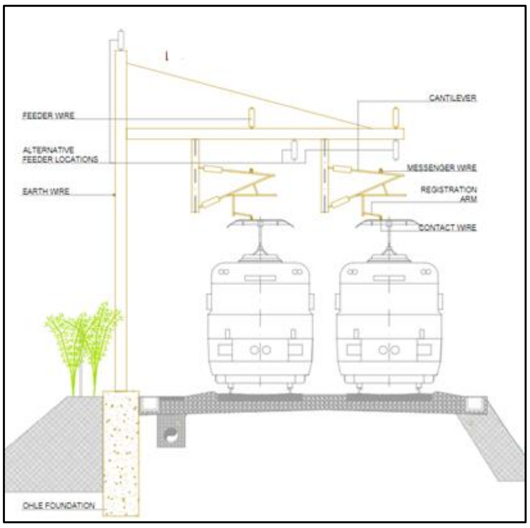


Figure 3-1 Typical OHLE arrangement in two track open route

In 2 No. track areas, a combination of Two Track Cantilevers (TTCs) and Single Track Cantilevers (STCs) will generally be placed on the side of the line, to support the OHLE. The project aims to achieve a minimum contact wire height of 4.4m throughout to ensure compliance with the relevant design standards, localised special conditions may be required.

Additional feeder cables will be supported from the masts at heights between 6.5m and 8m on each side of the track. An earth wire will also be suspended from the masts.

Maximum tension length is 1600m. Overlaps will comprise three spans, with spring tensioners used throughout. Midpoint Anchors (MPAs) will generally be of the tie-wire type, although the portal type may be needed in some locations.

At intervals of up to 1500m the OHLE wires will be anchored at an arrangement known as an overlap, and a new set of wires will take over. The anchors provide the mechanical tension that the wires need to perform reliably and safely. In areas of crossovers and junctions, additional wiring will be provided for the extra tracks, and these will also be provided with anchors. See **Figure 3-2** for a typical anchor structure.

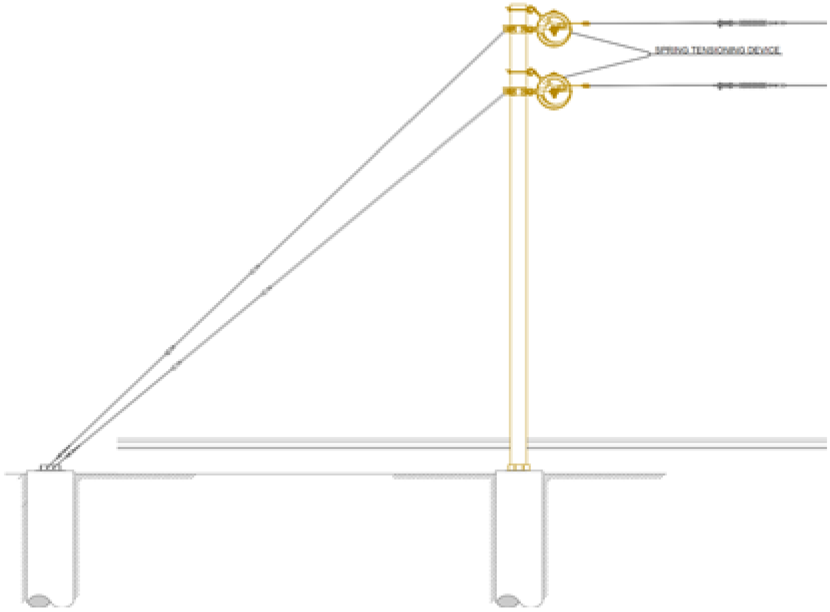


Figure 3-2 Typical anchor structure

The OHLE configuration through the overbridges for each track or civils option is being assessed using a clearance assessment tool derived from the System Wide Functional Requirement Specification (FRS) relating to Overhead Line Equipment (OHLE) and a set of configurations agreed with Irish Rail Signalling and Electrification Department through the Interface Coordination Document (ICD) process. This includes level and graded free running options, as well as level and graded options with elastic bridge arms fitted to the bridge. See **Figure 3-3** for a typical arrangement on approach to a low bridge.

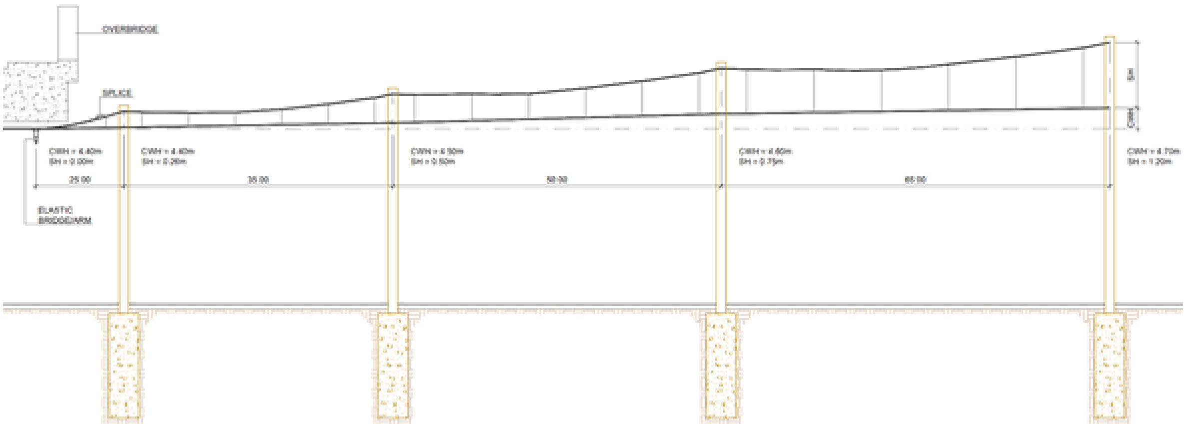


Figure 3-3 Typical arrangement on approach to a low bridge

The OHLE configuration through the tunnels is dependent on the shape, size and construction of the tunnel. Options available include continuation of the flexible OHLE system through the tunnel with a small system height with more frequent supports from the tunnel roof. This arrangement will be hidden within the tunnel.

Occasionally, the size, shape or construction of a tunnel may be restrictive enough that a rigid bar system needs to be used instead of flexible wires. This arrangement will also be hidden within the tunnel but may extend for a short distance outside the tunnel before reverting to the flexible wire system.

3.2.2. Substations

In order to facilitate the introduction of the new OHLE scheme across the DART+ network a power supply study has been carried out. There is a requirement to provide 6 new substations on the DART+ South West project, but none of them fall within this area.

3.2.3. Design Standards

The project design is governed by various technical and safety guidelines, which include European, National and Iarnród Éireann internal standards and specifications.

Compliance with these standards will be ensured via internal and external technical and safety assurance processes throughout the delivery and commission stages of the project.

4. Constraints

4.1. Environment

The key environmental constraints relate to the proximity of residential properties to the north and south of the corridor, the rich cultural heritage features and designated conservation areas. Further desk and field survey work has been undertaken to inform the environmental constraints identified in Section 2.8 and the feedback from PC1 has been reviewed. Together that information has improved the understanding of the environmental constraints in the study area. Details of the further desk and field survey work and stakeholder feedback from PC1 is outlined below.

Ecological field surveys of the route have been carried out to establish the baseline ecological conditions. Surveys for mammals (badger, bats), amphibians, invasive alien species, birds and freshwater and aquatic habitats have been carried out to date. Bat dusk emergence and dawn re-entry surveys have been carried out to characterise and identify bat roosting at the Royal Canal and Luas Twin Arch Bridge (OB08). Bat activity monitoring using a static bat detector has been carried out at a location South of Cabra Road bridge (OB06).

In relation to Built Heritage, a comprehensive desktop assessment of built heritage assets within 50m either side of the railway centreline has been undertaken by a Heritage Specialist. This assessment confirmed the designated status of the features of heritage interest i.e. Protected Structure status and/or inclusion in the NIAH record, and/or inclusion in the Industrial Heritage Record. A meeting with Dublin City Council noted that a new City Development Plan for 2022-2028 is being prepared. The new City Development Plan for 2022-2028 may contain modifications (additions/deletions) to the Record of Protected Structures (RPS). A structure must be listed on the planning authority's RPS to qualify for protected status under the Planning and Development Act 2000 (as amended). The RPS will be monitored on an on-going basis by the Heritage Specialist. A pre-application meeting with An Bord Pleanála noted the need to include social history of structures noting that the Cabra Road Bridge was a site of engagement during the 1916 Rising.

The Royal Canal crosses the railway line. This is a man-made/artificial channel. No information regarding the Royal Canal was provided in the ECFRAM Study. A flood Risk Assessment (FRA) is currently under preparation. The FRA will be completed in accordance with "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DOEHLG, 2009). Detailed mitigation measures will be specified in the final FRA and will inform the EIAR which will be submitted to An Bord Pleanála for Railway Order approval.

Stakeholder feedback from PC1 noted the area surrounding Glasnevin was highlighted by respondents for its cultural importance. Mc Kee barracks was also noted as architecturally and historically unique and interesting pocket of the city. Further issues or concerns raised during PC1 are described in the **Public Consultation No. 1 Findings Report, Volume 4.1**.

4.2. Roads

The immediate proximity of road junctions and plot accesses to the bridges pose significant challenges to road raising as an option to achieve the project requirements of providing an additional 2 No. tracks and electrifying these 2 No. tracks.

Several key criteria listed below are deemed to govern the road level changes required in support of providing OHLE clearances at bridges. In almost all cases and raising of road levels at railway road crossings would impact on 3rd Party landowners and require substantial road works even through junctions and into adjacent roads.

A single bridge however was identified as potentially requiring replacement primarily due to its remaining design life; namely, the Glasnevin Cemetery Road Bridge (OBO10).

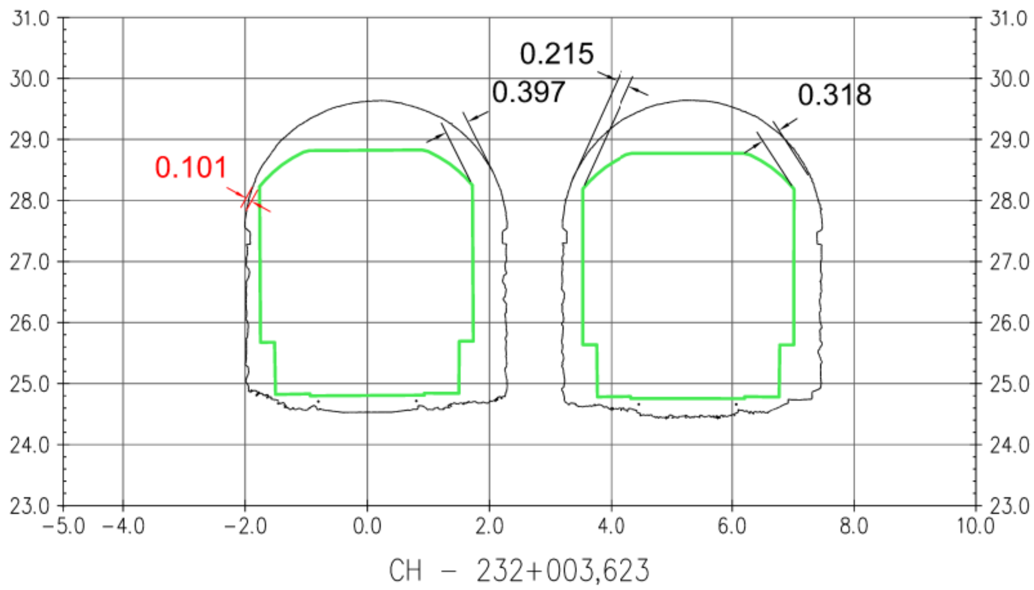
The following are the noted constraints on the extent to which the bridge and associated road could be raised.

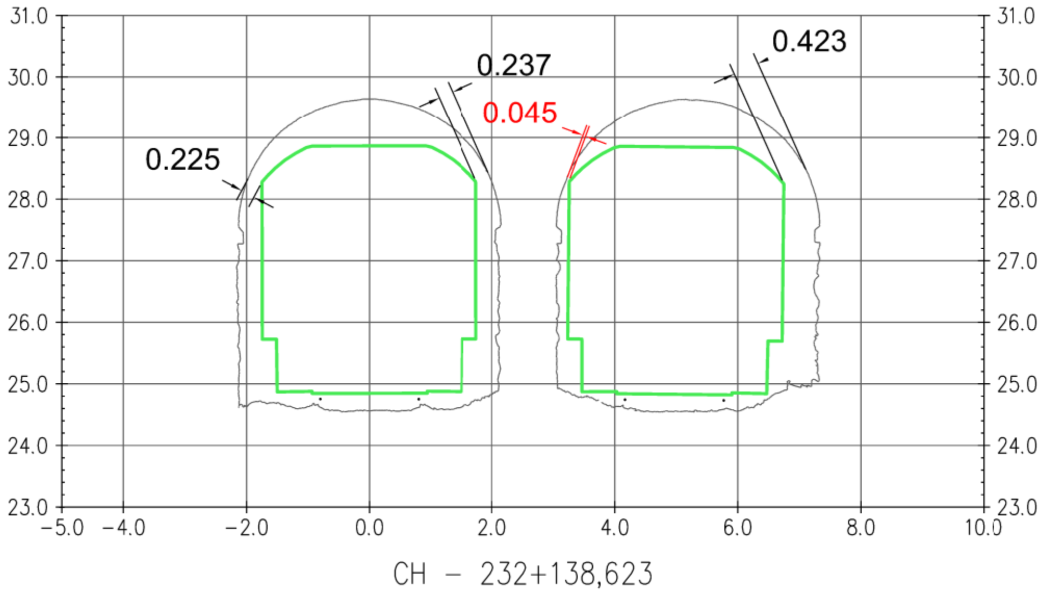
- The proximity to existing graves and maintaining access to graves particularly at construction stage.
- The requirement to limit impact on the permanent number of carpark spaces.
- An 8.3% (max.) for ramps in order to maintain wheelchair access acceptable (but only for short lengths), therefore approach and departure slopes on Glasnevin Cemetery Road Bridge (OBO10) access ramps may not exceed this, hence the proposed regrading of carpark (**Section 7.3.4**) at 5%.

4.3. Permanent Way

The details of each of the features that would constrain the Per Way solutions in the Zone 3 are demonstrated in **Table 4-1.**

Table 4-1 Details of the Per Way constraints

Name	Description of Constraints
Royal Canal and LUAS Twin Arch Bridge (OBO8)	The horizontal clearances at Royal Canal and LUAS Twin Arch Bridge (OBO8) are tight. The existing lateral passing clearances in Royal Canal and LUAS Twin Arch Bridge (OBO8) has been assessed (refer to **Figure 4-1**). It has a minimum lateral clearance of 101mm to the IRL2 reference profile in the existing situation.  **Figure 4-1 The left track (Up Branch)**

Name	Description of Constraints
Maynooth Line Twin Arch Bridge (OBO9)	The horizontal clearances at Maynooth Line Twin Arch Bridge (OBO9) are tight. The existing lateral passing clearances in Maynooth Line Twin Arch Bridge (OBO9) have been assessed and it becomes apparent substandard lateral clearances in the Down Branch Line exist (refer to **Figure 4-2**). It has a minimum lateral clearance of 45mm to the IRL2 reference profile in the existing situation.  **Figure 4-2 The right track (Down Branch)**
Existing Culvert UBO6A	The existing Culvert UBO6A crosses the tracks close to Fassaugh Avenue Bridge (OBO7). And constrains downward realignment of the tracks (**Figure 4-3**).  **Figure 4-3 Location of Culvert UBO6A, south of Fassaugh Avenue Bridge (OBO7)**

4.4. Existing Structures

Following an assessment of the eight overbridge structures, it has been found that:

- At McKee Barracks Bridge (OBO3), Blackhorse Avenue Bridge (OBO4) and Old Cabra Road Bridge (OBO5), an OHLE solution can be achieved without structural or track intervention.
- The service bridge located at Blackhorse Avenue Bridge (OBO4), Cabra Road Bridge (OBO6), Fassaugh Avenue Bridge (OBO7), Royal Canal and LUAS Twin Arch Bridge (OBO8) and Maynooth Line Twin Arch Bridge (OBO9), an OHLE solution cannot be achieved without structural or track interventions.
- Glasnevin Cemetery Road Bridge (OBO10) is located 5m from the nearest grave. The proximity of the existing graves and carpark will pose a significant constraint during the construction phase of the project. An OHLE solution cannot be achieved without structural or track interventions.

4.5. Geotechnical

Based on the existing information, groundwater conditions could be challenging in this area, which has been known to flood in the past. Where track lowering is required at or close to existing structures or earthworks, an assessment of the stability of existing structures will be required. A compressive assessment of the stability of the existing earthworks may be required due to the history of instability of the cuttings within this area. Where earthworks are subjected to track lowering, this may negatively impact the existing stability of the earthworks and further interventions such as soil nailing and/or earthworks retention may be required.

In addition to this, a suitable track drainage solution will be required, incorporating the pumped systems that are already in place between Royal Canal and LUAS Twin Arch Bridge (OBO8) and Maynooth Line Twin Arch Bridge (OBO9).

For existing retaining walls, the horizontal alignment of the railway is remaining largely unchanged therefore it is not anticipated that major interventions will be required to existing retaining walls for horizontal clearance purposes. However, the stability of the existing retaining walls should be checked against any proposed nearby track lowering. New retention or minor retaining walls may be required within existing earthwork cuttings at the location to proposed OHLE foundations and trackside equipment.

4.6. Existing Utilities

The majority of utilities that cross the rail corridor are concentrated in Blackhorse Avenue Bridge (OBO4), Old Cabra Road Bridge (OBO5), Cabra Road Bridge (OBO6) and Fassaugh Avenue Bridge (OBO7). Any option that requires minor / major bridge reconstruction works will cause major disruption to the associated services and will require diversion.

There are 6 no. utilities that cross the rail corridor elsewhere along the GSWR Branch Line. Shown below in **Figure 4-4** are the sewer crossings that pose constraints for works both beneath and above the tracks.

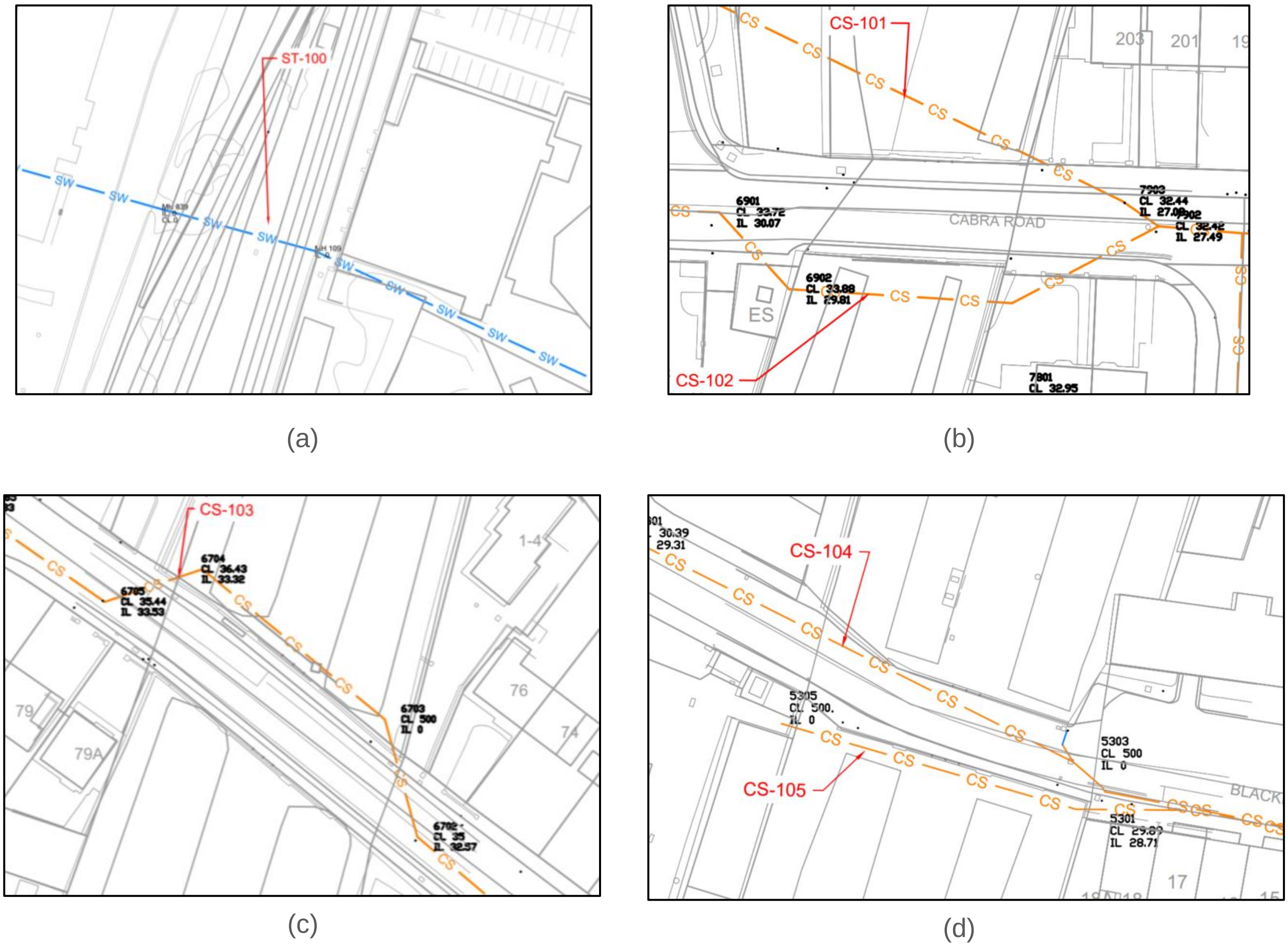


Figure 4-4 Utility Crossings

Note:

(a) 1 no. Underground Stormwater Sewer 120m south of Fassaugh Avenue Bridge (OBO7),

(b) 2 no. Underground Combined Sewers at Cabra Road Bridge (OBO6),

(c) 1 no. Combined Sewer Pipe Bridge north of Old Cabra Road Bridge (OBO5),

(d) 1 no. Combined Sewer Pipe Bridge south of Blackhorse Avenue Road Bridge (OBO4)

The existing pipe bridge located at Blackhorse Avenue Bridge (OBO4) (Reference ID CS-105) is shown in more detail in **Figure 4-5**; this pipe bridge spans the rail corridor along the southern side of Blackhorse Avenue Bridge (OBO4), crossing the tracks at a lower elevation. This conflicts with the required clearance for rail electrification and must be diverted.

Figure 4-5 Pipe Bridge at Blackhorse Avenue Bridge (OBO4) south elevation

Discussions regarding the diversion of the existing combined sewer pipe bridge are ongoing with Irish Water. As the sewer serves McKee Barracks, the Department of Defence (DoD) have also been contacted. The likely diversion route for this utility comprises a new pumping station arrangement on the west side of the rail corridor with a foul rising main provided to cross through Blackhorse Ave Bridge (OBO4) from west to east. It is proposed to discharge to the original gravity sewer located on the eastern side of the railway. The approximate specifications of the pumping station have been based on preliminary calculations for foul and storm discharge from the barracks site. Consultations with relevant stakeholders remain ongoing.

Consultation with Irish Water regarding the combined sewers north and south of Cabra Road Bridge (OBO6) is ongoing at time of print. Track lowering is confirmed in the immediate area of OBO6 thus creating the potential for a diversion of these under-track utility crossings. On examination, it appears current records are unreliable in terms of missing level data for local manholes, requiring ground investigative works to confirm levels. According to our current estimates, CS-101 may require a diversion, while CS-102, south of OBO6, has a siphon arrangement and so is unlikely to require a diversion. Future discussions regarding connecting CS-101 to CS-102 west of the rail corridor and thus avoiding a track level diversion to follow, if a diversion is required.

A minor diversion will be required for the ESB MV cable located at Maynooth Line Twin Arch (OBO9). The cable sits shallow in the cess and its warning tape can be seen in the ballast. As track lowering is required in this area, the cable will be lowered to an appropriate level.

There are potential constraints to services in the proximity of Glasnevin Cemetery Bridge (OBO10) depending on the works required for the bridge. If track lowering is sufficient to provide adequate room for OHLE equipment, the BT telecom duct that runs parallel to the tracks will pose a constraint as it is present in the cess. The duct will be lowered in tandem if possible or a temporary diversion will be implemented if required. No other constraints are envisaged for track lowering as there are no other services at track level or below the tracks.

If bridge reconstruction is required, there are 4 no. known services that pose constraints (as shown in **Figure 4-6**).

A combined sewer, according to the records, terminates south of the bridge. There is a manhole present both north and south of the bridge, however, there seems to be inadequate room for a sewer pipe within the deck, and there is no evidence of a pipe when viewing the bridge from below.

The BT duct running parallel to the tracks at track level may need to be diverted depending on the works required for reconstruction of the bridge.

There is an ESB LV cable connected to ESB pillars north west of the bridge. It is suspected that this provides power to the electric gate on the north entrance to the bridge. An ESB MV cable bypasses this arrangement around the bridge on the north side. Both will likely require minor diversion works locally if Glasnevin Cemetery Bridge (OBO10) is reconstructed.

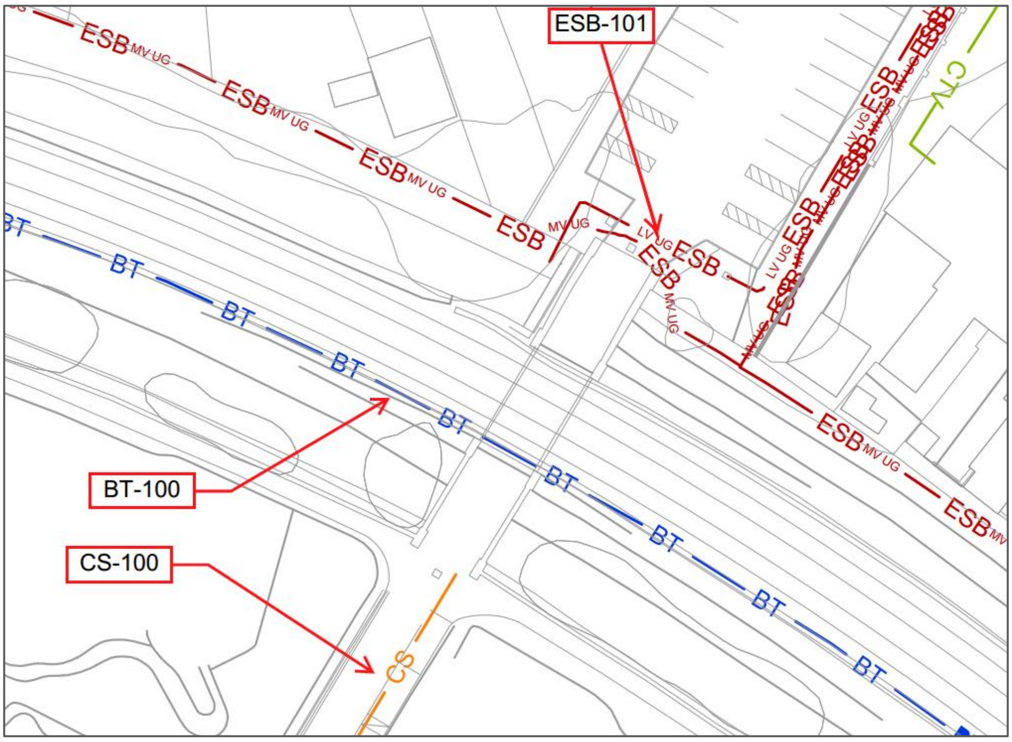


Figure 4-6 Glasnevin Cemetery Bridge (OBO10) Utilities Options

4.7. Drainage

The railway through this section is in a cutting, meaning that it is generally below surrounding ground levels. This means that the main constraint for the track drainage system is the location of a suitable outfall in the area and the existing track gradient. Current proposal is to utilise the existing drainage arrangement as the proposed track modifications are localised and relatively minor.

Particular attention is required in the area between Royal Canal and LUAS Twin Arch Bridge (OBO8) and Maynooth Line Twin Arch Bridge (OBO9). There is a low point between these overbridges and there are recurring flooding events.

5. Options

This section presents the options associated with the following elements between north of the Phoenix Park to Glasnevin Junction:

- Civil and OHLE infrastructure solutions
- Construction Compounds locations

5.1. Civil and OHLE Options

5.1.1. Bridge Option Descriptions

This section describes the Main Options that have been considered for the corridor bridges; the options relate predominantly to structures along the rail corridor which may be impacted by the proposed works.

The main constraints for fitting the OHLE equipment are the existing overbridges in the area. An assessment has been carried out for the area and details were presented at PC1, in relation to the clearances at each overbridge and potential options to address any clearance related issues.

The Main Options include a 'Do-Nothing' Option and a 'Do-Minimum' Option.

- A Do-Nothing option means that the design endeavours to achieve the project requirements without any intervention to the existing infrastructure.
- A Do-Minimum option means that the design endeavours to achieve the project requirements with only minor intervention to the existing infrastructure.

A summary of Options presented at PC1 as part of the Emerging Preferred Option Selection process for the bridges in the corridor area between East of Phoenix Park Tunnel to Glasnevin Junction is presented in the **Table 5-1**.

Table 5-1 Corridor Bridges Main Options Summary

Bridge	Design Options		
	Option 0: Do Nothing	Option 1: Do Minimum	Option 2
McKee Barracks Bridge (OBO3)	The existing infrastructure remains unchanged, the bridge is currently not in use. Parapets may need to be raised to 1.8m		
Blackhorse Avenue Bridge (OBO4)	The existing infrastructure remains unchanged.	Diversion of the existing service bridge. Install solid or IPX2 parapet infil.	The existing services bridge cannot be diverted. Combination of track lowering and OHLE system solution.
Old Cabra Bridge (OBO5)	The existing infrastructure remains unchanged.	Install solid or IPX2 parapet infil.	Install solid or IPX2 parapet infil.
Cabra Road Bridge (OBO6)	The existing infrastructure remains unchanged.	Combination of track lowering and OHLE system solution. No bridge reconstruction. Install solid or IPX2 parapet infil.	Partial bridge reconstruction. Track lowering and OHLE system solution if required.
Fassaugh Avenue Bridge (OBO7).	The existing infrastructure remains unchanged.	Combination of track lowering and OHLE system solution. No bridge reconstruction. Install solid or IPX2 parapet infil.	Partial bridge reconstruction. Track lowering and OHLE system solution if required.
Royal Canal and Luas Twin Arch Bridge (OBO8)	The existing infrastructure remains unchanged.	Combination of track lowering (or slab track) and OHLE system solution. No bridge reconstruction.	Bridge reconstruction. Track lowering and OHLE system solution if required.
Maynooth Line Twin Arch Bridge (OBO9)	The existing infrastructure remains unchanged.	Combination of track lowering (or slab track) and OHLE system solution. No bridge reconstruction.	Bridge reconstruction. Track lowering and OHLE system solution if required.
Glasnevin Cemetery Road Bridge (OBO10)	The existing infrastructure remains unchanged.	Combination of track lowering and OHLE system solution. No bridge reconstruction.	Partial bridge reconstruction. Track lowering and OHLE system solution if required.

5.1.1.1. McKee Barracks Bridge (OBO3)

5.1.1.1.1 Option 0: Do-Nothing

The Do-Nothing Option proposes no changes to the existing rail infrastructure. The only potential change to the existing McKee Barracks Bridge (OBO3) structure would be the raising of the parapets to 1.8m height for pedestrian protection, if required (bridge currently not in use).

5.1.1.2. Blackhorse Avenue Bridge (OBO4)

5.1.1.2.1 Option 0: Do-Nothing

The Do-Nothing Option proposes no changes to the existing rail infrastructure. There are also no changes proposed to the existing Blackhorse Avenue Bridge (OBO4) structure.

5.1.1.2.2. Option 1: Do-Minimum

Option 1 proposes no changes to the existing rail infrastructure. The existing services bridge south of Blackhorse Avenue Bridge (OBO4) would be demolished to allow for installation of the electrification system. There are no changes proposed to the existing Blackhorse Avenue Bridge (OBO4) structure.

5.1.1.2.3. Option 2: Do-Something

Option 2 is based on a situation where the existing service bridge cannot be diverted. The service bridge is the one constraining the installation of the electrification system because the Blackhorse Avenue Bridge (OBO4) bridge soffit is higher, therefore track lowering would be required to achieve the compliant clearances required for electrification. This option would only apply should Option 1 be deemed unfeasible.

5.1.1.3. Old Cabra Road Bridge (OBO5)

5.1.1.3.1. Option 0: Do-Nothing

The Do-Nothing Option proposes no changes to the existing rail infrastructure. There are also no changes proposed to the existing Old Cabra Road Bridge (OBO5) structure.

5.1.1.4. Cabra Road Bridge (OBO6)

5.1.1.4.1. Option 0: Do-Nothing

The Do-Nothing Option proposes no changes to the existing rail infrastructure. There are also no changes proposed to the existing Cabra Road Bridge (OBO6) structure.

5.1.1.4.2. Option 1: Do-Minimum

Option 1 proposes track lowering to achieve the compliant clearances required for electrification. No reconstruction of the bridge is proposed.

5.1.1.4.3. Option 2

Option 2 proposes to achieve an OHLE solution by partial bridge reconstruction, as well as track lowering to achieve the compliant clearances required for electrification.

This option proposes to replace the bridge deck at a higher soffit level. The existing abutments would be retained, and the abutment seats would be raised as required to accommodate the new deck.

Realignment of Cabra Road would be needed, but due to the proximity of residential properties and road junctions, the extent of road level raising would be limited within the bridge and up to adjacent side roads. Traffic would be accommodated via a temporary traffic management diversion over Old Cabra Bridge (OBO5) and Fassaugh Avenue Bridge (OBO7). Anticipated vehicle journeys increasing by 2 to 3 mins and pedestrians by 10 to 20mins, depending on destination. Option 2 would only apply should Option 1 be deemed unfeasible.

Figure 5-1 Extent of Potential Road Works considering Access and Junction Constraints

Figure 5-2 Potential Impact on Vehicular and Vulnerable Road Users during Construction

5.1.1.5. Fassaugh Avenue Bridge (OBO7)

5.1.1.5.1. Option 0: Do-Nothing

The Do-Nothing Option proposes no changes to the existing rail infrastructure. There are also no changes proposed to the existing Fassaugh Avenue Bridge (OBO7) structure.

5.1.1.5.2. Option 1: Do-Minimum

Option 1 proposes track lowering to achieve the compliant clearances required for electrification. No reconstruction of the bridge is proposed.

5.1.1.5.3. Option 2

Option 2 proposes to achieve an OHLE solution by partial bridge reconstruction, as well as track lowering to achieve the compliant clearances required for electrification.

This option proposes to replace the original bridge arch structure with new portal units installed on the existing abutments, while retaining the newer beam and slab bridge extensions if possible. Details of the connection between the flat deck bridge widenings and the original arch bridge need to be considered to determine whether partial reconstruction of the bridge widenings will also be required.

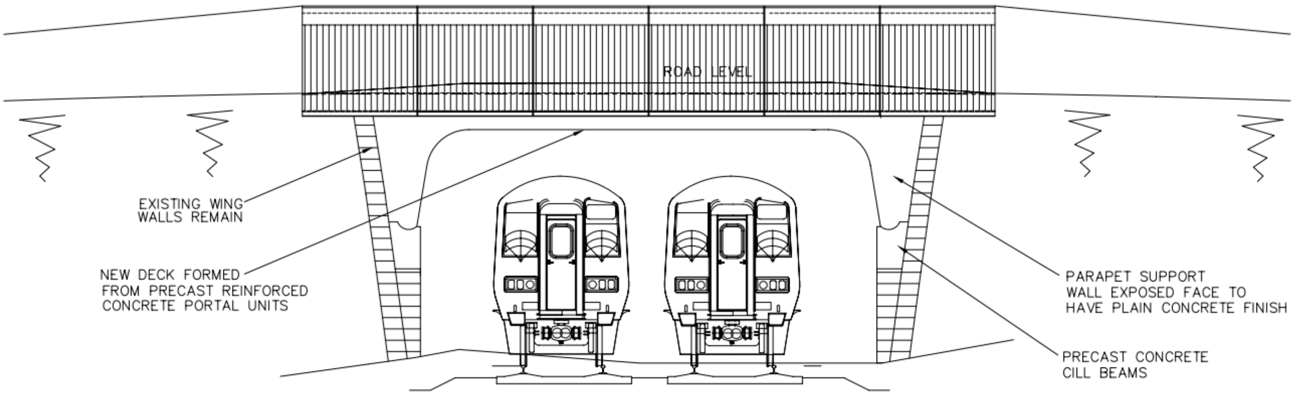


Figure 5-3 Indicative Arch Bridge Intervention

Realignment of Fassaugh Avenue may be required, but due to the proximity of residential properties and road junctions, the extent of road level raising would be limited within the bridge and up to adjacent side roads. General traffic would be accommodated via a temporary traffic management diversion over Cabra Road Bridge (OBO6) and/or Old Cabra Road Bridge (OBO5).

Track lowering is proposed to achieve the compliant clearances required for electrification and to minimize impact to the existing road levels.

Option 2 would only apply should Option 1 be deemed unfeasible.

Figure 5-4 Extent of Potential Road Works considering Access and Junction Constraints

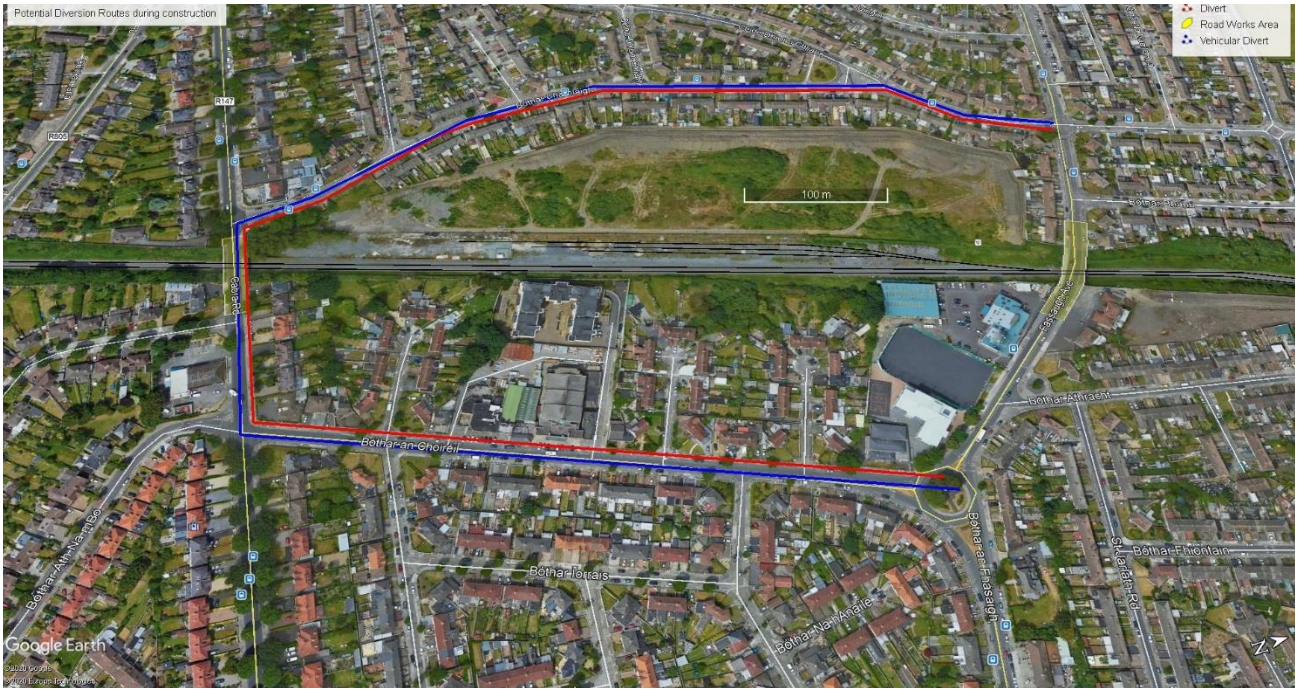


Figure 5-5 Potential Impact on Vehicular and Vulnerable Road Users during Construction

5.1.1.6. Royal Canal and LUAS Twin Arch Bridge (OBO8)

5.1.1.6.1. Option 0: Do-Nothing

The Do-Nothing Option proposes no changes to the existing rail infrastructure.

5.1.1.6.2. Option 1: Do-Minimum

Option 1 proposes track lowering to achieve the compliant clearances required for electrification. The proposed electrification solution involves the installation of OHLE multiple fitted tunnel arms. In addition to track lowering, the tracks will also need to be realigned horizontally to obtain compliant lateral clearances.

5.1.1.6.3. Option 2

Option 2 proposes to achieve an OHLE solution by reconstructing the bridge, track lowering would also be required to achieve the compliant clearances required for electrification.

The existing Royal Canal and LUAS Twin Arch Bridge (OBO8) would be replaced with a new single span long buried portal.

The electrification solution involves the installation of OHLE Multiple fitted Tunnel arms. Track lowering would also be required to achieve the compliant clearances required for electrification and to minimize impact to the Luas and Royal Canal levels.

Option 2 would apply should Option 1 be deemed unfeasible.

5.1.1.7. Maynooth Line Twin Arch Bridge (OBO9)

5.1.1.7.1. Option 0: Do-Nothing

The Do-Nothing Option proposes no changes to the existing rail infrastructure.

5.1.1.7.2. Option 1: Do-Minimum

Option 1 proposes track lowering to achieve the compliant clearances required for electrification. There are no changes to the existing Maynooth Line Twin Arch Bridge (OBO9) structure.

5.1.1.7.3. Option 2

Option 2 proposes bridge reconstruction, as well as track lowering to achieve the compliant clearances required for electrification.

The existing Maynooth Line Twin Arch Bridge (OBO9) would be replaced with a new single span buried portal. The electrification solution involves the installation of OHLE Multiple fitted Tunnel arms. Track lowering would also be required to achieve the compliant clearances required for electrification and to minimize impact to the Maynooth Line levels.

Option 2 would apply should Option 1 be deemed unfeasible.

5.1.1.8. Glasnevin Cemetery Road Bridge (OBO10)

5.1.1.8.1. Option 0: Do Nothing

The Do-Nothing Option proposes no changes to the existing rail infrastructure. There are no changes to the existing OBO10 structure.

5.1.1.8.2. Option 1: Do-Minimum

Option 1 proposes track lowering to achieve the compliant clearances required for electrification. There are no changes to the existing Glasnevin Cemetery Bridge (OBO10) structure, other than raising the parapets to 1.8m height for pedestrian protection and solid infill/sheeting to prevent pedestrians making contact with wires.

5.1.1.8.3. Option 2

Option 2 proposes partial bridge reconstruction to achieve the compliant clearances required for electrification.

This option proposes to replace the bridge deck at a higher soffit level. The existing abutments would be retained, and the abutment seats would be raised as required to accommodate the new deck. The bridge parapets would be upgraded to H4a Containment and 1.8m parapet height for pedestrian protection.

Option 2 would apply should Option 1 be deemed unfeasible.

5.1.2. Electrification

McKee Barracks Bridge (OBO3), Blackhorse Avenue Bridge (OBO4) and Old Cabra Road Bridge (OBO5) have sufficient vertical clearance such that they can be electrified under all Options without any track lowering or major structural interventions. This is assuming that a steel service bridge on the south side of Blackhorse Avenue Bridge (OBO4) would be removed prior to electrification.

Cabra Road Bridge (OBO6), Fassaugh Avenue Bridge (OBO7), Royal Canal and LUAS Twin Arch Bridge (OBO8), Maynooth Line Twin Arch Bridge (OBO9) and Glasnevin Cemetery Road Bridge (OBO10) currently have insufficient vertical clearance to be electrified with OHLE. Each would need intervention requiring a combination of track lowering, and / or structural intervention and / or OHLE system solutions.

For Cabra Road Bridge (OBO6) and Fassaugh Avenue Bridge (OBO7), Options 1 and 2 provide sufficient vertical clearance for an OHLE configuration with graded contact wire, twin contact equipment (zero system height), and a contact wire height of 4.2m through each bridge. The OHLE would be fitted with elastic bridge arms supported from a single location on each structure.

For Royal Canal and LUAS Twin Arch Bridge (OBO8) and Maynooth Line Twin Arch Bridge (OBO9), these two tunnels are in proximity to each other so must be considered together when defining the OHLE solution for each Option.

For these tunnels Options 1 and 2 provide sufficient vertical clearance for an OHLE configuration with graded contact wire, twin contact equipment (zero system height), and a contact wire height of 4.2m through each of the tunnelsDue to the width and shape of the tunnels, the OHLE would be fitted with tunnel arms supported from the structure at multiple locations.

For Glasnevin Cemetery Road Bridge (OBO10) Options 1 and 2 provide sufficient vertical clearance for an OHLE configuration with graded contact wire.

5.1.3. Cabra Station Passive Provision

The provision of a new station at Cabra does not form part of the scope of DART+. However, passive provision for a potential station was assessed in accordance with the project requirements.

5.1.4. Geotechnical (All Do-Something Options)

All Options (excluding Option 0) for track alignment and electrification interventions will require detailed geotechnical design for the following elements:

- Track bed formation design and assessment of the stability of the existing structures for any proposed track lowering
- Overhead Line Equipment foundation design

The horizontal alignment of the railway currently includes the necessity to include drainage, cables and minimum clearance to the running rail. Therefore, it is anticipated that retaining structure interventions will be required along both sides of the GSWR branch line to achieve the required horizontal clearances.

5.1.5. Roads

It is proposed to achieve the required clearances under the remaining structures with minimal intervention at road level; with the exception being Glasnevin Cemetery Bridge (OBO10) where the carpark and cemetery access ramps are proposed for amendment with the bridge deck reconstruction.

5.1.6. Drainage

At locations where track lowering is proposed to achieve the necessary clearance under the current structures, these changes may require the upgrade of the existing drainage system at certain locations along this section of the line.

The drainage system at Fassaugh Avenue Bridge (OBO7) currently falls to the south (at approximately 1% gradient), towards the northern portal of the Phoenix Park Tunnel.

The track profile presents a low point between OB08 and OB09, which is also associated with recurring flooding events.

At the Royal Canal and LUAS Twin Arch Bridge (OBO8) and Maynooth Line Twin Arch Bridge (OBO9), it is proposed to lower the track by approx. 100 mm from the current level, plus the change from DMU's to EMU's, which requires a reduction of 200mm in relation to maximum water level permissible in the track. This is not expected to change in a significant way the drainage catchments and gradients. However, it could present a potential impact to the performance of the existing pumping station located between structures OB08 and OB09. There is a pumping station that drains the excess of water on the cutting located immediately to the west of the northern arch of Royal Canal and LUAS Twin Arch Bridge (OBO8), see **Figure 2-16**. This facility directs the inflows to the attenuation tank located to the northwest, being then infiltrated into the ground.

Since the pumping station also seems to receive inflows from the track when the water depth reaches a certain level, the track lowering can represent an alteration on the current hydraulic balance. As a result, more water could potentially need to be pumped, with an extra head of 100 mm. Consequently, the existing tank could potentially receive additional volume as well. Further assessment is therefore required in order to fully understand the pumping station performance and the possibilities for the existing system (pumping station, pressure pipe, attenuation tank and soakaway) to cope with the potential changes.

5.1.7. Cable and Containments (All Do-Something Options)

All Options would require the relocation of a variety of service cables, utilities and containments throughout, as well as new containment routes to accommodate all new railway systems cabling throughout These will be migrated in accordingly at each stage of construction.

5.2. Construction Compounds (All Do-Something Options)

Four Construction Compounds are required between North of Phoenix Park and Glasnevin Junction. The four proposed construction compounds:

- Heuston West
- Cabra
- Fassaugh Avenue
- Glasnevin Cemetery

5.2.1. Heuston West Construction Compound

A construction compound is required to the west of Heuston Station, adjacent to the existing platform 10, particularly for works to be undertaken to the Phoenix Park Tunnel and the construction of the new Heuston West Station. However the compound is equally important to the section of track north of the Phoenix Park tunnel owing to the limited access to the deep cutting within which it is situated.

A compound will need to be constructed on both sides of the existing railway as access on the western side is also required for the installation of an underground attenuation tank which is to be located in this area. Equipment and material will need to be stored on this side of the railway due to the extent and type of work involved.

Figure 5-6 Heuston West Proposed Construction Compound Location

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

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 Con Colbert Road to the M50. Inbound traffic could use the Con Colbert Road and access directly to the Heuston Station Access Road. If the tracks on Phoenix Park Tunnel Branch Line are required to be out of service during the main construction period this will allow materials to be transferred between the construction compounds on either side of the existing railway.

The proposed construction compound is located on Irish Rail property adjacent to platform 10 and the Clancy Quay residential development. Due to the identified position of the new station construction and presence of existing rail lines to the east and south, no other suitable construction compound locations were identified in this very constrained area of the route.

5.2.2. Cabra Construction Compound

The proposed construction compound at Cabra is located on the branch line which runs from Heuston Station to Glasnevin Junction, it is 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. Lineside work including Permanent Way, Signalling, Electrification and Telecomms installations will also take place.

Figure 5-7 Cabra Proposed Construction Compound

The rail line from the Phoenix Park tunnel to Glasnevin junction runs in a deep cutting with steep embankments on either side. The construction compound is located in an area where the ground levels off and opens up, providing good access to the rail corridor, the area is currently used by Irish Rail for track maintenance.

As noted earlier, the proposed construction compund is located on Irish Rail property with direct access to the rail line. A new residential development is currently under construction immediately adjacent to the site. Access to the site will be from Carnlough Road to Cabra Road, Navan Road to the M50. An option to include an access/exit point on Fassaugh avenue requires further assessment, due to potential sighting issues, the access/exit point would be located adjacent to Fassaugh Ave on a bend in the road. The construction compound has also been identified by the DART+ West Project as a potential construction compound.

5.2.3. Fassaugh Avenue Construction Compound

Another construction compund is required for electrification works on the branch line from Heuston Station to Glasnevin Junction and for localised track lowering works. The proposed site is located on the eastern side of the rail corridor.

The site is currently a disused public house and is in private ownership. Access to Fassaugh Avenue construction compund would be via Fassaugh Avenue, Quarry Road, Cabra Road, Navan Road to the M50.

Figure 5-8 Fassaugh Avenue Proposed Construction Compound

The rail corridor on this section of the route passes through a built-up urban area. The line is located in a deep cutting with steep embankments on either side. This particular site was identified as it is located on the eastern side of the rail corridor, which would supplement the Cabra compound, which is located to the south on the western side of the rail corridor.

Planning permission has been granted for this site which may impact on its availability as a construction compound.

5.2.4. Glasnevin Cemetery Compound

A construction compound is required in this area, primarily to facilitate works to Glasnevin Cemetery Road Bridge (OBO10). The proposed location for the construction compound is in the parking area immediately adjacent to the bridge. To the south of the bridge lies Glasnevin Cemetery, to north of the bridge on either side of the proposed construction compound are residential properties, therefore not providing a feasible alternative option to the car park. The site will need to facilitate continual 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 estate road and the Finglas road to the M50.

Figure 5-9 Glasnevin Cemetery Preferred Construction Compund Location

The car park site is thought to be in private ownership and would therefore need to be acquired temporarily for the duration of the relevant works.

6. Options Selection Process

6.1. Options Selection Process

A clearly defined appraisal methodology has been used in the selection of the 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) and informed by TII's Project Management Guidelines (TII PMG 2019).

The Option Selection Process involves a two-stage approach (if / as appropriate):

- Stage 1 Preliminary Assessment (Sifting)
- Stage 2 Multi Criteria Analysis (MCA)

The starting principle of the optioneering process and a focus of the Project Team has been to reduce the potential impacts on the surrounding environs by accommodating necessary works and interventions within the existing rail corridor, where practicable. However, a number of discrete elements extend beyond the boundary of the existing railway. The optioneering process has focused on these 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 construction compounds.

The above selection process has been used to assess the options associated with the following elements on the section between North of Phoenix Park Tunnel to Glasnevin Junction:

- Civil and OHLE Infrastructure - Bridges
- Construction Compounds

6.1.1. Stage 1: Preliminary Assessment Process (Sifting)

The Stage 1: Preliminary Assessment (Sifting) involves an initial assessment of a long list of options, each of which are assessed against Engineering, Economic and Environmental criteria.

The assessment is based on whether an option meets the Project Objectives / Requirements and whether the option is technically feasible. All feasible options are brought forward to the second stage of the assessment process (MCA) to be explored in greater detail.

The options assessed, ranged from a 'Do-Nothing' Option, Do-Minimum' Option to a range of 'Do-Something' Options, each of the options were assessed to determine if they were feasible and met the Project Objectives / Requirements.

This process has been carried out separately for the Civil and OHLE Infrastructure - Bridges and for the Construction Compounds.

The Options for the Bridges were analysed to determine if they could accommodate the installation of the new Overhead Line Electrification (OHLE) system. There are no proposals to add tracks in this area, so widening of the rail corridor is not envisaged. Where the sifting results in only one feasible option, a multi-criteria analysis (MCA) is not required for that one option.

6.1.2. Stage 2 Multi Criteria Analysis (MCA)

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 under the Department of Transport, Tourism and Sport (DTTAS), Common Appraisal Framework (CAF) for Transport Project and Programmes (March 2016). These parameters were split into a number of sub-criteria considered relevant to the DART+ South West Project.

The assessment compares the options, identifying and summarising the comparative merits and disadvantages of each alternative under all applicable criteria and sub-criteria leading to a Preferred Option.

Relevant considerations include:

- This is a comparative analysis between the various options, 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 and qualitative and/or quantitative indices may be relevant in every case.
- For each Option there are potential design variations. In due course design variations will be subject to detailed technical analysis (in respect of the Preferred Option).
- For each Option an indicative envelope was identified for permanent and temporary works, property and/or land take; a worst-case scenario was considered. Detailed design, 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.

The options which were brought forward from the Preliminary Screening were developed further to facilitate the more detailed Stage 2 Multi Criteria Analysis.

The MCA Process involved assessing the performance of each option against relevant quantitative and qualitative indicators, the assessment was carried out by a multi-disciplinary team including commercial, technical, safety and environmental specialists.

Presented in a matrix format, each specialist included a commentary of his/her analysis for each option. They then compared the options relative to each other based on whether an option had a 'some' or 'significant' advantage or disadvantage over other options or whether all options were 'comparable / neutral'. This basis of comparison is consistent with the NTA Guidelines which use the following five-point ranking scale when comparing options against each other for comparative analysis. See **Table 6-1**.

Table 6-1 Comparison Criteria

Comparison Criteria Legend

Significant Comparative Advantage over Other Options
Some Comparative Advantage over Other Options
Comparable to Other Options / Neutral
Some Comparative Disadvantage over Other Options
Significant Comparative Disadvantage over Other Options

6.2. Civil and OHLE Option Selection – Bridges

6.2.1. Stage 1 Sifting

Table 6-2 to **Table 6-9** provide details of the assessment undertaken as part of the Stage 1 Preliminary Assessment (Sifting) Process used in the selection of the Preferred Option for the Corridor Bridges. See **Appendix A Sifting Backup Process** for details. Options which were assessed as feasible and fulfilled the project requirements were brought forward to Stage 2 MCA for a more detailed assessment.

Table 6-2 Sifting Process for McKee Barracks Bridge (OBO3)

Option	Requirements		Description
0	Engineering	Constructability	Not applicable. No intervention proposed.
		Geometrical fitness for intervention	Not applicable. No intervention proposed.
		Safety	Not applicable. No intervention proposed.
		Electrical clearance for electrification	PASS. Standard clearance. Free running solution
		Track alignment and drainage (standards)	Not applicable. No intervention proposed.
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
	Economy		Compatible with the investment guidelines and programme for DART+
	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		PASS. Proceed to Stage 2 Assessment

Option 0 passes: the bridge is to be left as is with compliant clearance for electrification and a free running solution. As Option 0 is feasible and meets the project requirements, Stage 2: MCA is not necessary.

Table 6-3 Sifting Process for Blackhorse Avenue Bridge (OBO4)

Option	Requirements		Description
0	**Engineering**	Constructability	Not applicable. No intervention proposed.
		Geometrical fitness for intervention	Not applicable. No intervention proposed.
		Safety	Not applicable. No intervention proposed.
		Electrical clearance for electrification	FAIL Not achieved.
		Track alignment and drainage (standards)	Not applicable. No intervention proposed.
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
	Economy		Compatible with the investment guidelines and programme for DART+
	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		**FAIL. Do not progress to Stage 2 Assessment**
1	**Engineering**	Constructability	PASS. Assuming Service bridge can be diverted.
		Geometrical fitness for intervention	PASS. Minor interventions without geometrical fitness concerns are possible.
		Safety	PASS. Minor interventions that pose no safety concerns are possible.
		Electrical clearance for electrification	PASS. Standard clearance for electrification and 4.4 m cw height and free running solution
		Track alignment and drainage (standards)	Not applicable. No intervention proposed.
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
	Economy		Compatible with the investment guidelines and programme for DART+.
	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		**PASS. Proceed to Stage 2 Assessment**
2	**Engineering**	Constructability	PASS. Assuming Service bridge cannot be diverted.
		Geometrical fitness for intervention	PASS. Minor interventions without geometrical fitness concerns are possible.
		Safety	PASS. Minor interventions that pose no safety concerns are possible.
		Electrical clearance for electrification	PASS. Standard clearance for electrification and 4.4 m cw height and free running solution
		Track alignment and drainage (standards)	PASS Pending detailed analysis
		Structural soundness of the Bridge (if track interventions)	PASS Pending detailed analysis
		Keep current functionality of roads	PASS Pending detailed analysis
	Economy		Compatible with the investment guidelines and programme for DART+.
	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		**PASS. Proceed to Stage 2 Assessment**

Option 0 fails on providing compliant clearance for electrification. The service bridge on the southern face makes the electrification not feasible. As Options 1: Do Minimum, is feasible and meets the project requirements, Stage 2: MCA is not necessary..

Table 6-4 Sifting Process for Old Cabra Road Bridge (OBO5)

Option	Requirements		Description
0	Engineering	Constructability	Not applicable. No intervention proposed.
		Geometrical fitness for intervention	Not applicable. No intervention proposed.
		Safety	Not applicable. No intervention proposed.
		Electrical clearance for electrification	PASS. Standard clearance. Free running solution
		Track alignment and drainage (standards)	Not applicable. No intervention proposed.
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
	Economy		Compatible with the investment guidelines and programme for DART+
	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		PASS. Proceed to Stage 2 Assessment

Option 0 passes: the bridge is to be left as is with compliant clearance for electrification and free running solution. As Option 0 is feasible and meets the project requirements, Stage 2: MCA is not necessary.

Table 6-5 Sifting Process for Cabra Road Bridge (OBO6)

Option	Requirements		Description
0	Engineering	Constructability	Not applicable. No intervention proposed.
		Geometrical fitness for intervention	Not applicable. No intervention proposed.
		Safety	Not applicable. No intervention proposed.
		Electrical clearance for electrification	FAIL Not achieved.
		Track alignment and drainage (standards)	Not applicable. No intervention proposed.
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
	Economy		Compatible with the investment guidelines and programme for DART+
	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		FAIL. Do not progress to Stage 2 Assessment
1	Engineering	Constructability	PASS in principle until a more detailed analysis is carried out after GI.
		Geometrical fitness for intervention	PASS Pending detailed analysis
		Safety	PASS Pending detailed analysis
		Electrical clearance for electrification	PASS. Electrical clearance approval for. 4.2 m cw height
		Track alignment and drainage (standards)	PASS Pending detailed analysis
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
	Economy		Compatible with the investment guidelines and programme for DART+.
	Environment		No impact on Environmental sites of National of International significance.

Option	Requirements		Description
		SIFTING OUTCOME	**PASS. Proceed to Stage 2 Assessment**
2	**Engineering**	Constructability	PASS in principle until a more detailed analysis is carried out after GI.
		Geometrical fitness for intervention	PASS Pending detailed analysis
		Safety	PASS Pending detailed analysis
		Electrical clearance for electrification	PASS. Electrical clearance approval for 4.2 m cw height or Standard Electrical clearance
		Track alignment and drainage (standards)	PASS Pending detailed analysis
		Structural soundness of the Bridge (if track interventions)	PASS Pending detailed analysis
		Keep current functionality of roads	Not applicable. No intervention proposed.
		Economy	Compatible with the investment guidelines and programme for DART+
		Environment	No impact on Environmental sites of National of International significance.
		SIFTING OUTCOME	**PASS. Proceed to Stage 2 Assessment**

Option 0 fails on providing compliant clearance for electrification. As Option 1: Do Minimum, is feasible and meets the project requirements, Stage 2: MCA is not necessary.

Table 6-6 Sifting Process for Fassaugh Avenue Bridge (OBO7)

Option	Requirements		Description
0	**Engineering**	Constructability	Not applicable. No intervention proposed.
		Geometrical fitness for intervention	Not applicable. No intervention proposed.
		Safety	Not applicable. No intervention proposed.
		Electrical clearance for electrification	FAIL Not achieved.
		Track alignment and drainage (standards)	Not applicable. No intervention proposed.
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
		Economy	Compatible with the investment guidelines and programme for DART+
		Environment	No impact on Environmental sites of National of International significance.
		SIFTING OUTCOME	**FAIL. Do not progress to Stage 2 Assessment**
1	**Engineering**	Constructability	PASS in principle until a more detailed analysis is carried out after GI.
		Geometrical fitness for intervention	PASS Pending detailed analysis
		Safety	PASS Pending detailed analysis
		Electrical clearance for electrification	PASS. Electrical clearance approval for. 4.2 m cw height
		Track alignment and drainage (standards)	PASS Pending detailed analysis.
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
		Economy	Compatible with the investment guidelines and programme for DART+.
		Environment	No impact on Environmental sites of National of International significance.
		SIFTING OUTCOME	**PASS. Proceed to Stage 2 Assessment**

Option	Requirements		Description
2	Engineering	Constructability	PASS in principle until a more detailed analysis is carried out after GI.
		Geometrical fitness for intervention	PASS Pending detailed analysis
		Safety	PASS Pending detailed analysis
		Electrical clearance for electrification	PASS. Electrical clearance approval for 4.2 m cw height or Standard Electrical clearance
		Track alignment and drainage (standards)	PASS Pending outcome of GI investigations.
		Structural soundness of the Bridge (if track interventions)	PASS Pending outcome of GI investigations
		Keep current functionality of roads	Not applicable. No intervention proposed.
		Economy	Compatible with the investment guidelines and programme for DART+
		Environment	No impact on Environmental sites of National of International significance.
		SIFTING OUTCOME	**PASS. Proceed to Stage 2 Assessment**

Option 0 fails on providing compliant clearance for electrification. As Option1: Do Minimum, is feasible and meets the project requirements, Stage 2: MCA is not necessary.

Table 6-7 Sifting Process for Royal Canal and LUAS Twin Arch Bridge (OBO8)

Option	Requirements		Description
0	**Engineering**	Constructability	Not applicable. No intervention proposed.
		Geometrical fitness for intervention	Not applicable. No intervention proposed.
		Safety	Not applicable. No intervention proposed.
		Electrical clearance for electrification	FAIL Not achieved.
		Track alignment and drainage (standards)	Not applicable. No intervention proposed.
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
		Economy	Compatible with the investment guidelines and programme for DART+
		Environment	No impact on Environmental sites of National of International significance.
		SIFTING OUTCOME	**FAIL. Do not progress to Stage 2 Assessment**
1	**Engineering**	Constructability	PASS in principle until a more detailed analysis is carried out after GI.
		Geometrical fitness for intervention	PASS Pending detailed analysis
		Safety	PASS Pending detailed analysis
		Electrical clearance for electrification	PASS. Electrical clearance approval for. 4.2 m cw height
		Track alignment and drainage (standards)	PASS Pending outcome of GI investigations
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
		Economy	Compatible with the investment guidelines and programme for DART+.
		Environment	No impact on Environmental sites of National of International significance.
		SIFTING OUTCOME	**PASS. Proceed to Stage 2 Assessment**
2	**Engineering**	Constructability	PASS in principle until a more detailed analysis is carried out after GI.

Option	Requirements		Description
		Geometrical fitness for intervention	PASS Pending detailed analysis
		Safety	PASS Pending detailed analysis
		Electrical clearance for electrification	PASS. Electrical clearance approval for 4.2 m cw height or Standard Electrical clearance
		Track alignment and drainage (standards)	PASS Pending outcome of GI investigations
		Structural soundness of the Bridge (if track interventions)	PASS Pending detailed analysis
		Keep current functionality of roads	Not applicable. No intervention proposed.
		Economy	Compatible with the investment guidelines and programme for DART+
		Environment	No impact on Environmental sites of National of International significance.
		SIFTING OUTCOME	**PASS. Proceed to Stage 2 Assessment**

Option 0 fails on providing compliant clearance for electrification. The bridge does has not enough clearance for electrification. Options 1 and 2 pass and proceed to stage 2 assessment.

Table 6-8 Sifting Process for Maynooth Line Twin Arch Bridge (OBO9)

Option	Requirements		Description
0	**Engineering**	Constructability	Not applicable. No intervention proposed.
		Geometrical fitness for intervention	Not applicable. No intervention proposed.
		Safety	Not applicable. No intervention proposed.
		Electrical clearance for electrification	FAIL Not achieved.
		Track alignment and drainage (standards)	Not applicable. No intervention proposed.
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
		Economy	Compatible with the investment guidelines and programme for DART+
		Environment	No impact on Environmental sites of National of International significance.
		SIFTING OUTCOME	**FAIL. Do not progress to Stage 2 Assessment**
1	**Engineering**	Constructability	PASS in principle until a more detailed analysis is carried out after GI.
		Geometrical fitness for intervention	PASS Pending detailed analysis
		Safety	PASS Pending detailed analysis
		Electrical clearance for electrification	PASS. Electrical clearance approval for. 4.2 m cw height
		Track alignment and drainage (standards)	PASS Pending outcome of GI investigations
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
		Economy	Compatible with the investment guidelines and programme for DART+.
		Environment	No impact on Environmental sites of National of International significance.
		SIFTING OUTCOME	**PASS. Proceed to Stage 2 Assessment**
2	**Engineering**	Constructability	PASS in principle until a more detailed analysis is carried out after GI.
		Geometrical fitness for intervention	PASS Pending detailed analysis

Option	Requirements		Description
		Safety	PASS Pending detailed analysis
		Electrical clearance for electrification	PASS. Electrical clearance approval for 4.2 m cw height or Standard Electrical clearance
		Track alignment and drainage (standards)	PASS Pending detailed analysis
		Structural soundness of the Bridge (if track interventions)	PASS Pending detailed analysis
		Keep current functionality of roads	Not applicable. No intervention proposed.
	Economy		Compatible with the investment guidelines and programme for DART+
	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		**PASS. Proceed to Stage 2 Assessment**

Option 0 fails on providing compliant clearance for electrification. As Option 1: Do Minimum, is feasible and meets the project requirements, Stage 2: MCA is not necessary.

Table 6-9 Sifting Process for Glasnevin Cemetery Road Bridge (OBO10)

Option	Requirements		Description
0	**Engineering**	Constructability	Not applicable. No intervention proposed.
		Geometrical fitness for intervention	Not applicable. No intervention proposed.
		Safety	Not applicable. No intervention proposed.
		Electrical clearance for electrification	FAIL Not achieved.
		Track alignment and drainage (standards)	Not applicable. No intervention proposed.
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
	Economy		Compatible with the investment guidelines and programme for DART+
	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		**FAIL. Do not progress to Stage 2 Assessment**
1	**Engineering**	Constructability	PASS in principle until a more detailed analysis is carried out after GI.
		Geometrical fitness for intervention	PASS Pending detailed analysis
		Safety	FAIL Not Achieved
		Electrical clearance for electrification	PASS. Electrical clearance approval for. 4.2 m cw height
		Track alignment and drainage (standards)	PASS Pending outcome of GI investigations.
		Structural soundness of the Bridge (if track interventions)	Not applicable. No intervention proposed.
		Keep current functionality of roads	Not applicable. No intervention proposed.
	Economy		Compatible with the investment guidelines and programme for DART+.
	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		**FAIL. Do not progress to Stage 2 Assessment**
2	**Engineering**	Constructability	PASS in principle until a more detailed analysis is carried out after GI.
		Geometrical fitness for intervention	PASS Pending detailed analysis
		Safety	PASS Pending detailed analysis

Option	Requirements		Description
		Electrical clearance for electrification	PASS. Electrical clearance approval for 4.2 m cw height or Standard Electrical clearance
		Track alignment and drainage (standards)	PASS Pending outcome of GI investigations
		Structural soundness of the Bridge (if track interventions)	PASS Pending outcome of GI investigations
		Keep current functionality of roads	Not applicable. No intervention proposed.
	Economy		Compatible with the investment guidelines and programme for DART+
	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		**PASS. Proceed to Stage 2 Assessment**

Option 0 fails on providing compliant clearance for electrification. Both Option 1 and Option 2 were 'feasible'; however, Option 1 required more detailed analysis. This analysis revealed the existing bridge deck is in a bad state of repair, represents safety risks and will require replacement in the near future.

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 of similar depth is also under consideration. This is subject to further design development.

No track lowering is envisaged under Glasnevin Cemetery Bridge (OBO10). Design development has focused on the provision of a bridge structure that minimises the impact to the cemetery car parking.

6.2.2. Sifting Summary

The table below summaries the Main Options developed for each of the bridges, showing which options passed the sifting process and were brought forward to Stage 2: MCA.

Table 6-10 Summary of Sifting Process Results for Corridor Bridges

Structure details	Options		
	Option 0: Do Nothing	Option 1: Do Minimum	Option 2
McKee Barracks Bridge (OBO3)	PASS	N/A	N/A
Blackhorse Avenue Bridge (OBO4) - Services	FAIL	PASS	PASS
Old Cabra Road Bridge (OBO5)	PASS	N/A	N/A
Cabra Road Bridge (OBO6)	FAIL	PASS	PASS
Fassaugh Avenue Bridge (OBO7)	FAIL	PASS	PASS
Royal Canal and LUAS Twin Arch Bridge (OBO8)	FAIL	PASS	PASS
Maynooth Line Twin Arch Bridge (OBO9)	FAIL	PASS	PASS
Glasnevin Cemetery Road Bridge (OBO10)	FAIL	FAIL	PASS

6.2.3. Stage 2 Multi Criteria Analysis (MCA)

At the current stage of design development, the Preferred Option (exception being Glasnevin Cemetery Bridge (OBO10) aligns with all do-nothing or do-minimum options to develop the electrification works under the existing bridges; which anticipates little or no intervention to the bridges. Glasnevin Cemetery Bridge (OBO10) on account of the age and condition of its bridge deck and certain track drainage requirements requires a deck reconstruction (note without full abutment reconstruction). Where the structural clearance required to achieve electrical clearances beneath the bridges is sub-standard, clearances by means of track lowering and fitted OHLE system solutions have been proposed.

6.3. Construction Compounds

Construction Compounds are required at specific construction sub-sites; they are distributed along the scheme by geographical 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.).

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

As discussed in **Section 5 Options,** four potential sites have been identified as proposed construction compounds at Heuston West, Fassaugh Ave, Cabra, and Glasnevin Cemetery. **See Figures 5-10 to 5-13 and Figures 8-1 to 8-4** for an indication of the proposaed locations

The selection process for the proposed construction compounds, required to 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.

6.3.1. Heuston West

A construction compound is required for the works in this section and in particular the section in the deep cutting immediately north of the Phoenix Park Tunnel, localised track works and track drainage works; it is also integral for the construction of the new Heuston West Station and the Phoenix Park Tunnel works. The preferred location for this compound is located within the Heuston environs on lands within the ownership of CIÉ. The proposed location is to the west of Heuston Station, adjacent to the existing platform 10 and the Liffey Railway Bridge. The construction compound is also the location of the proposed Heuston West Station.

6.3.2. Cabra

A construction compound is proposed on the branch line in an area adjacent to the Cabra Road / Carnlough Road Junction. The proposed compound is located on CIÉ property with direct access to the rail line. The DART+ West Project have also identified this as a potential location for a construction compound. A new residential development is currently under construction immediately adjacent to the site. Access to the site will be from Carnlough Road to Cabra Road, Navan Road to the M50.

6.3.3. Fassaugh Avenue

A construction compound is proposed for Fassaugh Avenue on the eastern side of the rail corridor to supplement the Cabra compound which is located approx. 500m to the south. The site is currently a disused public house and is in private ownership. Access to the site would be via Fassaugh Avenue, Quarry Road, Cabra Road, Navan Road to the M50. Planning permission has been granted for this site which may impact on the availability and suitability of this site.

6.3.4. Glasnevin Cemetery

A small construction compound is required in this area, primarily to facilitate works to Cemetery Road bridge. The site will need to facilitate continual access to the Cemetery by the public and Cemetery workers. As noted earlier, the provision of a temporary pedestrian bridge is under consideration, the bridge will need to be installed alongside the existing bridge.

7. Preferred Option Design Development

7.1. Review of Preferred Option

The proposals in this section of the project are largely unchanged from PC1; the baseline information or outcomes of design development since PC1 (inclusive of stakeholder input) have not changed significantly. Bridges OBO3, OBO5 remain as 'Do Nothing' options (i.e. no structural, track lowering nor service bridge interventions). While the following remain as 'Do Minimum' - Option 1; OBO4 requires service bridge removal whereas OBO6, OBO7, OBO8 and OBO9 all require track lowering.

The only bridge that has been amended from PC1, to reflect a change in intervention category to Option 2, is the Glasnevin Cemetery Bridge (OBO10). The bridge deck is nearing the end of its design life and in addition the topographical constraints on track drainage design solutions limit the potential for track lowering.

The necessity also to amend the cess width to include for walkways, cables and minimum clearance to the running rail from Phoenix Park Tunnel to the tie-in just east of the Glasnevin Cemetery Bridge (OBO10) requires earthworks retaining to be provided for the bulk of this section (**Sections 7.3.1 and 8.1)** outlines the options being considered but also not exhaustive).

7.2. Review of Stakeholder Feedback

The cultural heritage of the area is acknowledged. Amendments were made to eliminate the loss of parking in the cemetery carpark. The quality of the cemetery access bridge is of concern and has been developed accordingly as the preferred option for reconstruction. While limited work to the exiting bridges that are deemed of aesthetic benefit is proposed, other than to improve road and rail safety.

Concerns about noise are noted throughout the scheme. From an operational point of view the electrification of the line was welcomed in the feedback with submissions stating reduced noise and climate impacts as benefits of an electric line. Construction noise will be monitored throughout the length of the project and where deemed an issue, localised controls (i.e. hours of work appropriate to the work tasks) as well as methodologies proposed by the contractor including screening mitigation will be considered to limit impact to the surrounding inhabitants.

The impact on vehicular and vulnerable users traffic routes would be minimal. The impact on branch line train users is under review with the methodology proposed for the electrification of the Phoenix Park Tunnel requiring safe working operations; disruption to the train timetable is to be expected due to the tunnel space constraints.

7.3. Design Development

The following sub-sections provide greater clarity on the development of the design towards the preferred option, this section includes the following:

1. Structures
2. Permanent Way
3. Signalling, Electrical and Telecommunications (SET)
4. Roads
5. Drainage

7.3.1. Structures

7.3.1.1. Bridges

7.3.1.1.1. Glasnevin Cemetery

As noted earlier in the report, electrifying the line requires the installation of overhead electrical lines along the railway. In many instances the existing bridges are too low to accommodate the overhead lines at their normal heights and special measures are warranted to facilitate the electrification. Rail track lowering is currently nominal under this bridge due to the integrated geometric design covering the area to the west of the bridge and up to the project tie-in point just east of the Glasnevin Cemetery Bridge (OBO10).

In relation to Glasnevin Cemetery Bridge, the preferred option involves the construction of a new deck with the same span and width but to include 1.8m high parapets with an of H4a containment classification. The current design assumes the replacement of the existing reinforced concrete slab deck with a thicker deck to allow for the latest design standards and current operational loading requirement. In addition, the existing utility crossings will be integrated into the deck slab. The deck thickness is subject to further design development in order to provide a system that further attempts to reduce the extent of carpark re-grading and where possible improve the duration of construction to limit the proposed restrictions to cemetery vehicular access during construction (refer to **Section 8.6** expands of the provisions proposed to continue vulnerable user access during construction of the bridge. See **Appendix B Supporting Drawings** for details.

See **Figure 7-1** and **Figure 7-2** for the general arrangement of the bridge and a western elevation

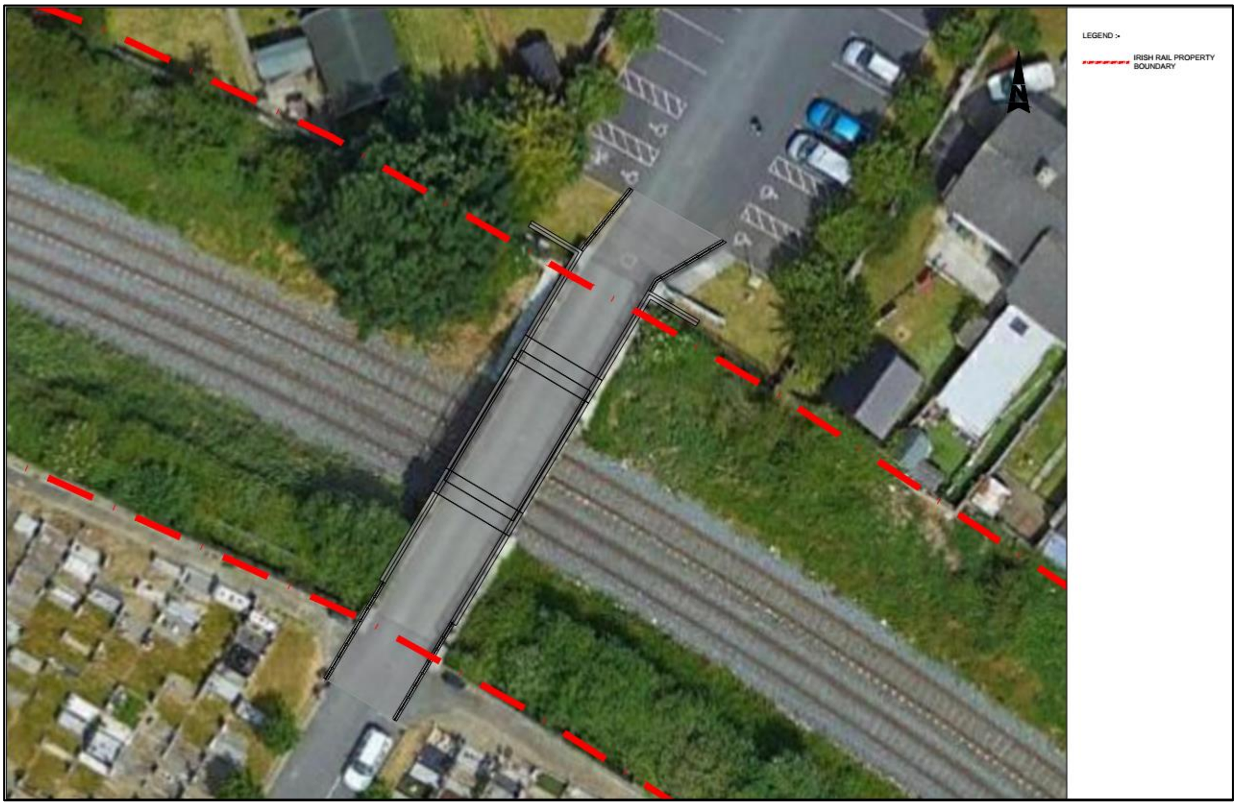


Figure 7-1 Glasnevin Cemetery Bridge (OBO10) General Arrangement

Design development has focused on providing a bridge structure that facilitates (as a minimum) the same road corridor width that currently exists over the structure and limiting the impact on the current operations and more importantly the burial ground itself. Summary of the proposed bridge details:

- Proposed Bridge Type = Prestressed Beams and In-situ Deck seated on Secant Piles Abutment.
- Proposed Bridge Span (incl. Abutment Length) = 12m (approx.)
- Proposed Bridge Width (incl. Parapets) = 5.9m (see **Figure 7-3** for shared user space)
- Proposed Bridge Slab Depth = 0.5m
- Proposed Parapet = H4A containment walls 1.8m higher than adjacent shared use road levels
- Proposed Utility Space Proofing = include duct and pipe containment for water and electrical connectivity

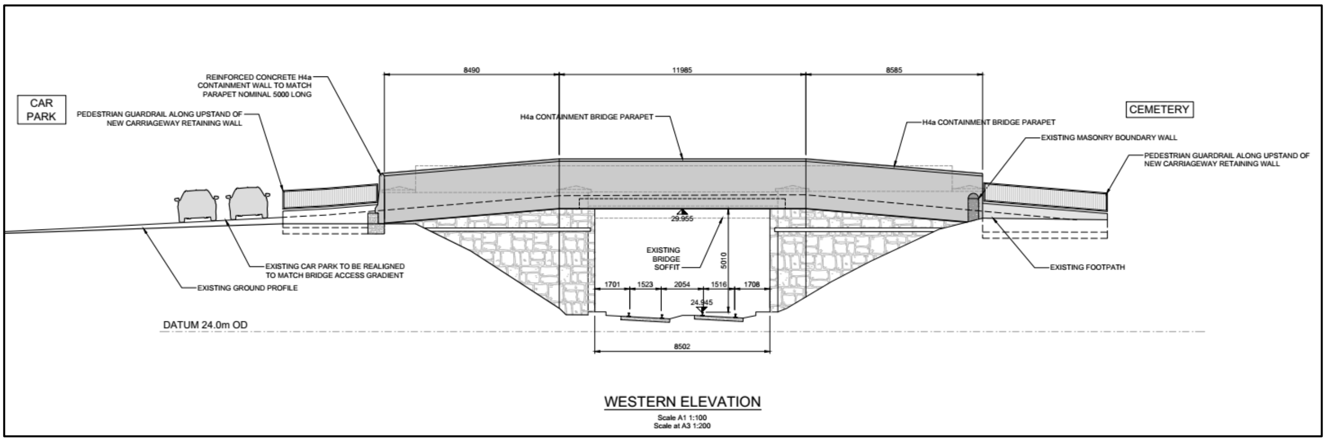


Figure 7-2 Glasnevin Cemetery Bridge (OBO10) Longitudinal Section – Facing East

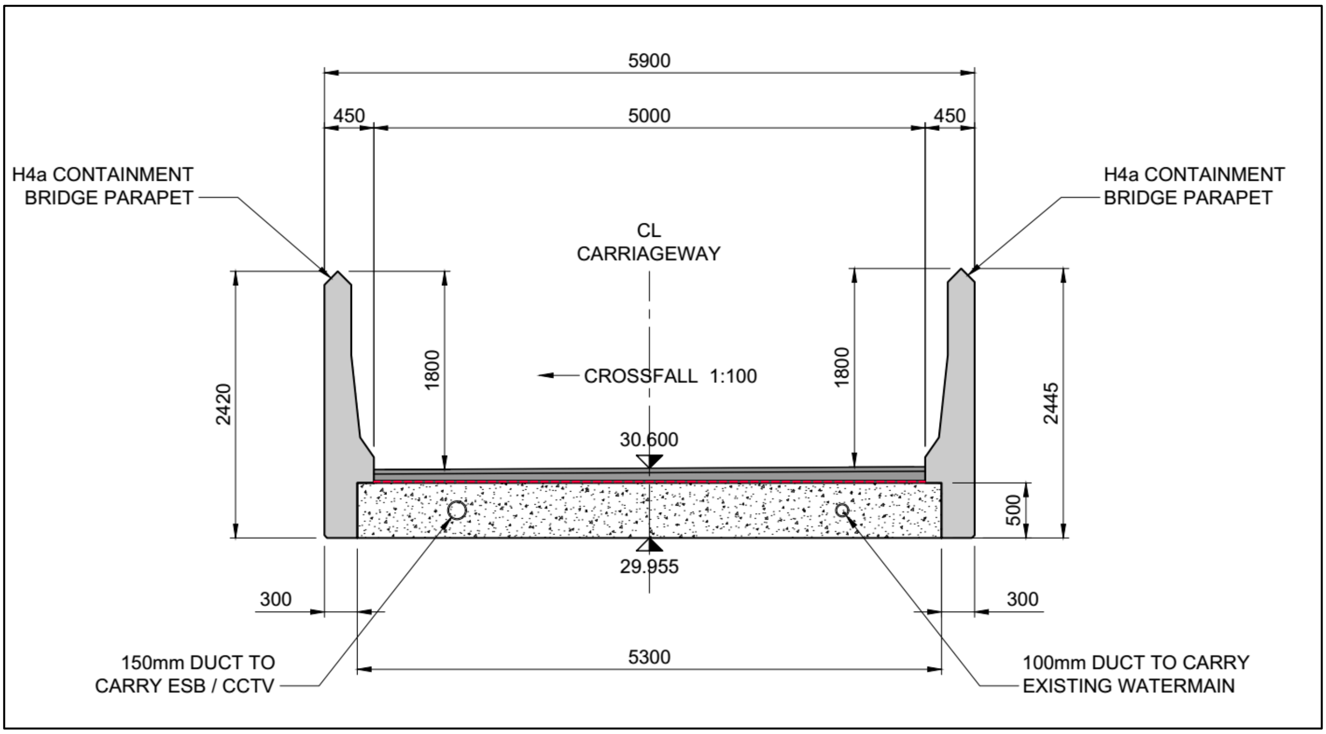


Figure 7-3 Glasnevin Cemetery Bridge (OBO10) Cross Section – Facing North

There are currently a number of options being evaluated for parapets and approach road containment walls for the new bridges. The main criteria for the parapet is that they achieve 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 1200m high RC parapets with perforated or glazed sections to the remaining 600mm to achieve the min height requirement. All parapets will have a H4a containment level. More information on parapets and approach on road containment walls will be available at Railway Order stage.

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, see **Figure 7-4**. There a many different finishes available to use and the panels can be coloured. See below some examples.

Figure 7-4 Parapets and/or H4a containment wall finishes for precast concrete

Other options are to fully clad the precast panels with masonry cladding to match the exiting parapets, see **Figure 7-5**, or to retain and repurpose the existing masonry in the parapets to be used as cladding to the new precast parapets. Other options being considered take into account landscape and visual considerations where a desire has been expressed to retain views of the Dublin mountain skyline from some of the structures.

Figure 7-5 Precast panels fully cladded with masonry

7.3.1.2. Retaining Walls

To facilitate the widening where required along both track cess edges and retain the slopes of the cutting, cantilever retaining walls will be utilised. The wall height will typically vary from 0.5 to 1.5 m in height.

An example of a typical cross-section of the wall arrangement and as well as examples of finished walls are shown in **Figures 7-6** and **7-7**; respectively.

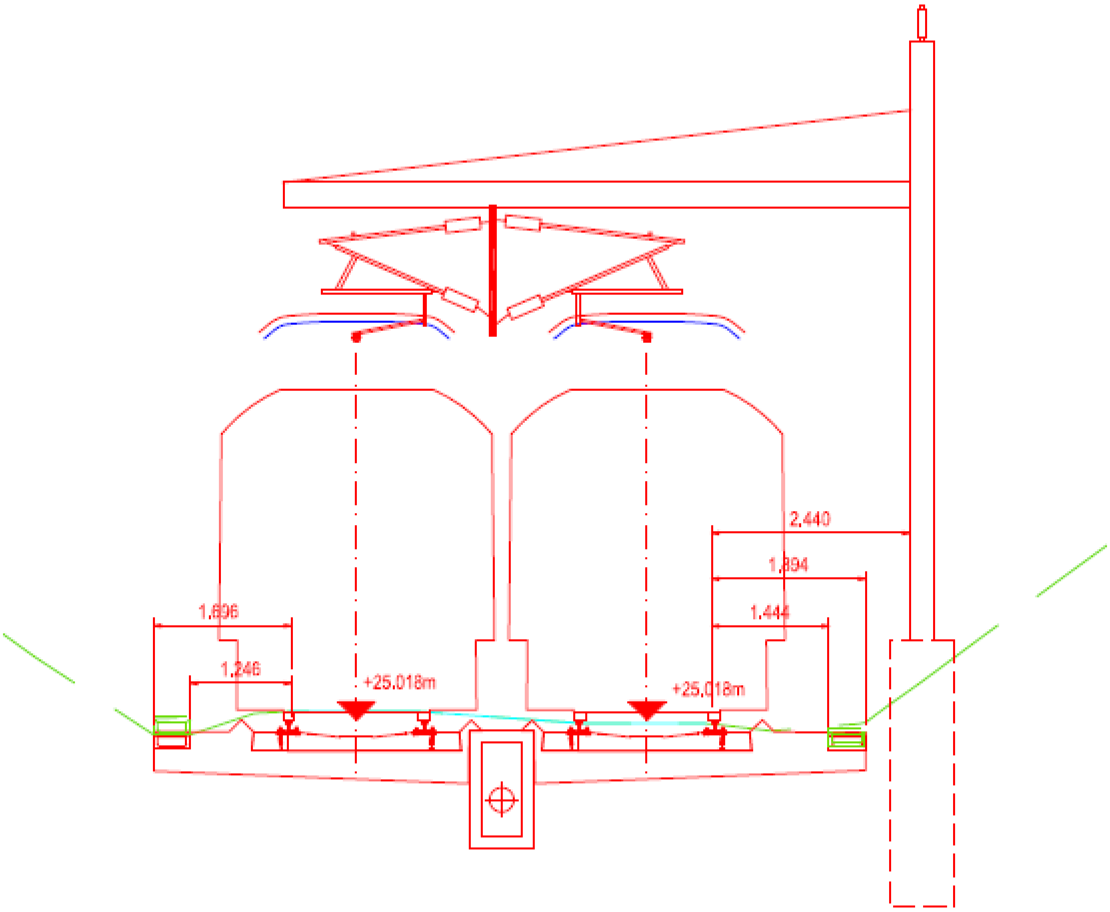


Figure 7-6 Typical Retaining Walls along GSWR line – Facing East

Figure 7-7 Examples of Retaining Walls

7.3.1.3. Signalling Cantilevers

Where possible, signalling infrastructure will be located within IE existing land; however, in areas where the track encroaches into adjacent land, then consideration will be given to nominal additional land take for signalling structure access. 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.

Access to the top of man access cantilevers will be from steps within the cess unless local access from IE land is safer and operationally more efficient.

7.3.2. Track Bed Design

Track lowering is proposed to achieve vertical clearances beneath the bridges along the GSWR line and therefore a new track bed design is required along this section and to facilitate the track lowering. The new track bed formation shall be constructed consisting of subgrade, sub-ballast and ballast.

7.3.3. Permanent Way

The proposed 2-track layout comprises the existing tracks being realigned, to optimise structural and track interval clearances from Phoenix Park Tunnel to Glasnevin Cemetery Road Bridge (OBO10), inclusive, and is shown in the figure below. See **Appendix B Supporting Drawing** for details.

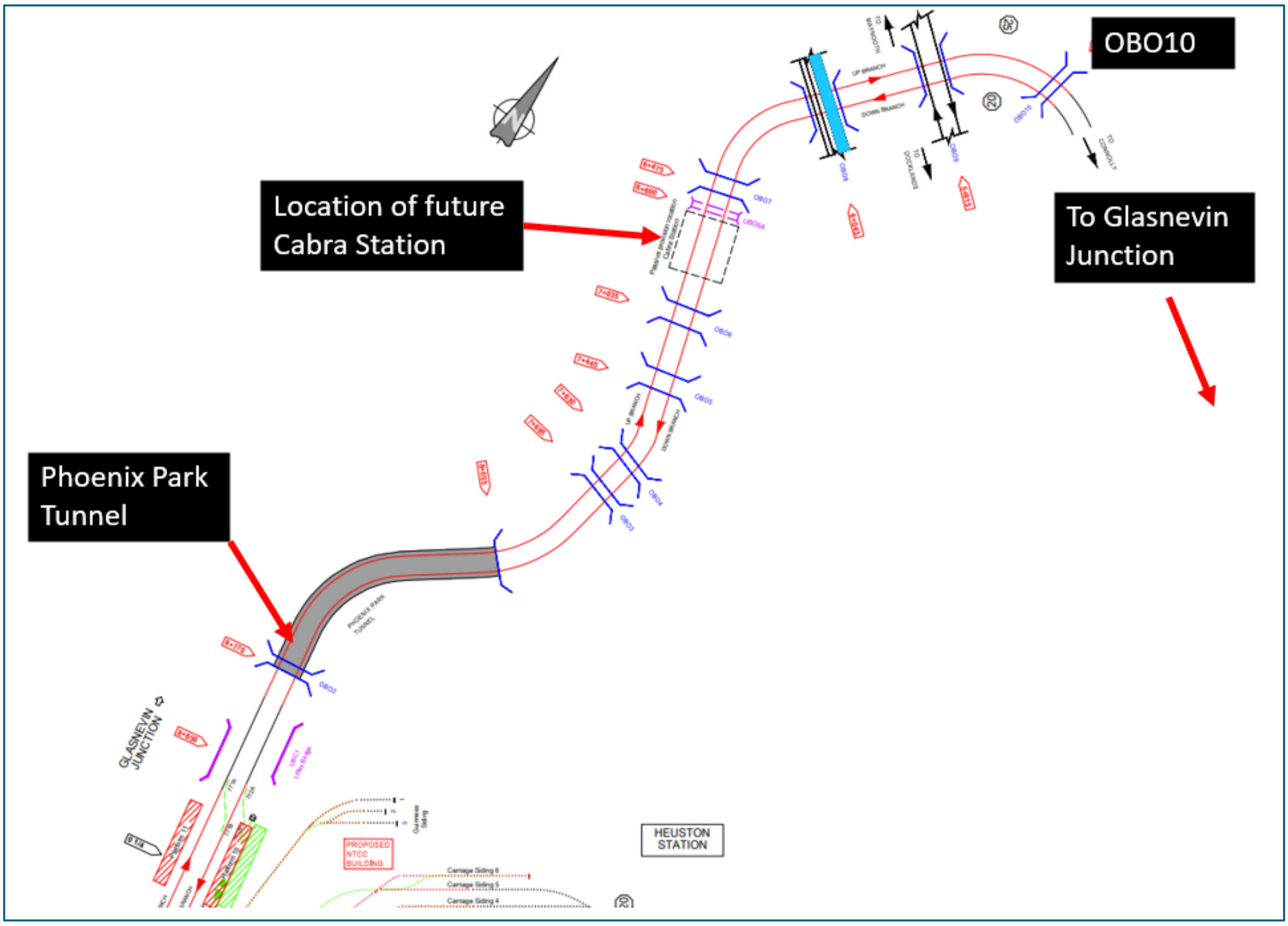


Figure 7-8 Phoenix Park Tunnel to Glasnevin Cemetery Road Bridge (OBO10) – Track Plan Layout

(new tracks = red, removed tracks = dashed green, structures = blue)

The track alignment through 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.

Horizontally, to the east of Phoenix Park Tunnel, the future Cabra Station is sited on a length of horizontal straight track between OBO6 and OBO7, which is ideal for constructing the platform to standard offsets to facilitate passenger stepping to the train.

Vertically, the Up and Down Slow tracks are nominally co-planar (at the same level and gradient) through the section, in particular to accommodate the passive provision for a future Cabra Station by providing a compliant gradient of 0.200% (1 in 500) through the extents of the proposed station platforms. Track lowers have been introduced where necessary through the overline bridge structures detailed in the Structures section of this report, in order to achieve the minimum acceptable contact wire height of 4.2m, or better, for the Slow tracks.

The magnitude of the track lowers ranges up to a maximum of approximately 450mm at Fassaugh Road Bridge (OBO7).

The existing line speed in the section has been maintained for the proposed layout – i.e. 25mph (40km/h) on the Up Branch line and 20mph (32km/h) on the Down Branch line.

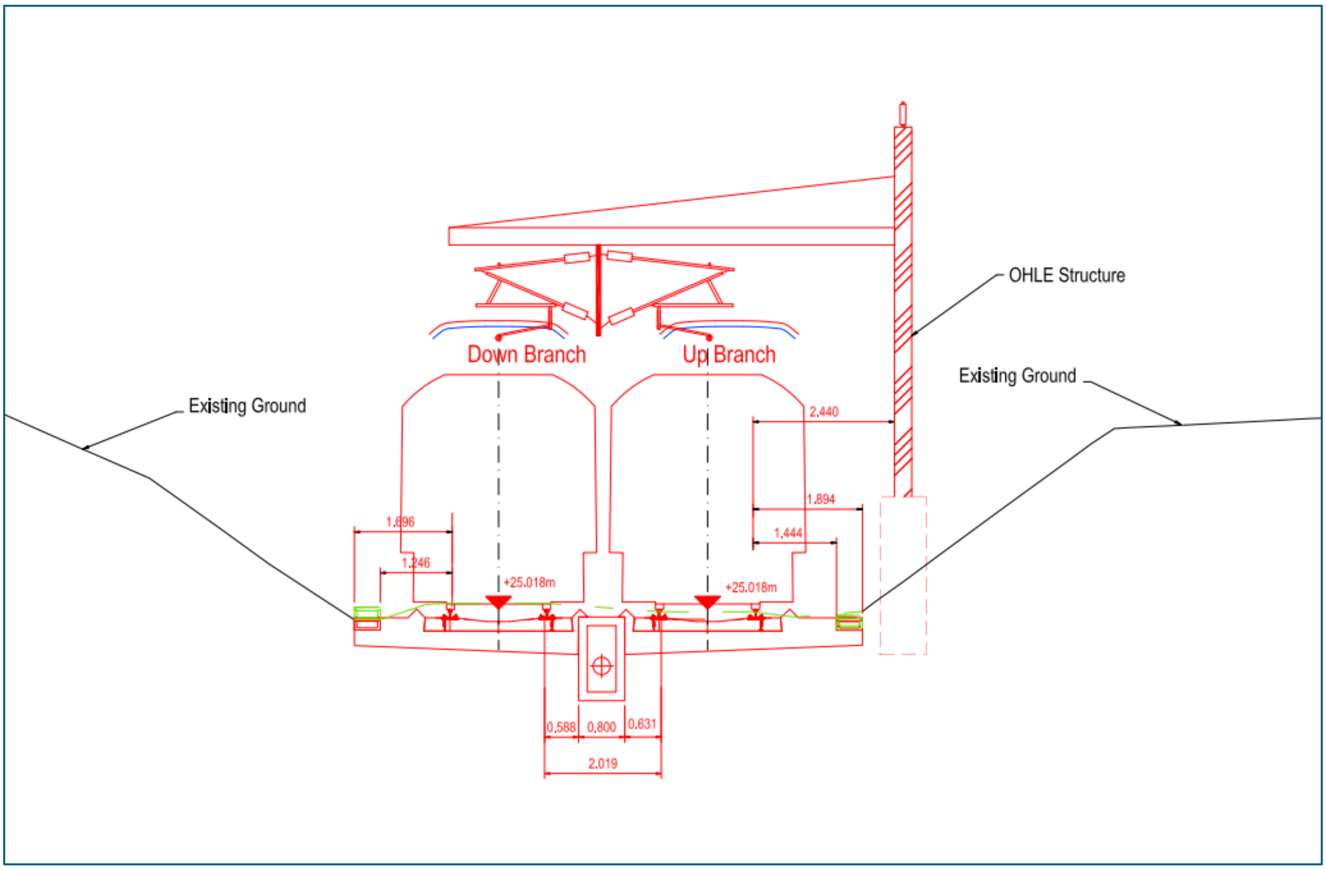


Figure 7-9 Typical Cross section west of Glasnevin Cemetery Bridge (OBO10), view from Glasnevin Junction

7.3.4. Signalling, Electrical and Telecommunications (SET)

This section provides detail on the proposed SET equipment and components which will be distributed along this section of the railway. More information on the typical SET equipment is included in **Volume 2 Option Selection – Technical Report.**

7.3.4.1. Signalling

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.

A Signalling scheme plan has been developed for the entire route, the section pertaining to this area is detailed in **Figure 7-10**. The scheme plan shows the number and type of signals that will be allocated on this section of the route and the points and crossings that they interface with. The following section details the physical signalling infrastructure that will be installed.

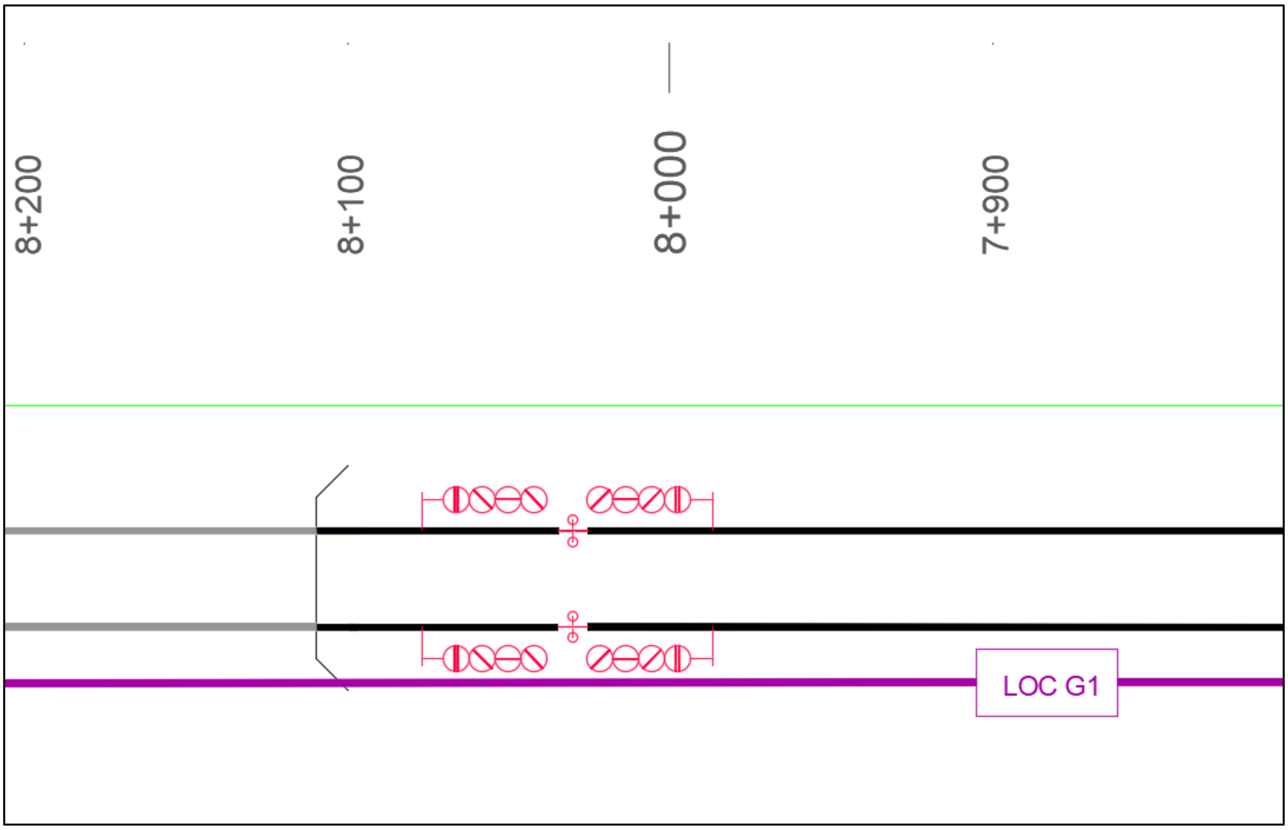


Figure 7-10 Signalling Scheme Plan (North Entrance at Phoenix Park Tunnel)

Legend:

- Purple line: 650 V line
- Purple square: LV cabinet
- Orange square: OBJ cabinet (signalling)
- Green square: OBJ influence area
- Black lines: Tracks
- Red: Signals

The physical signalling infrastructure has been developed and is indicated in **Figure 7-11**. This figure shows an LV Cabinet (red box). All equipment is expected to be located within the existing IE land boundary to minimise the impact to the public.

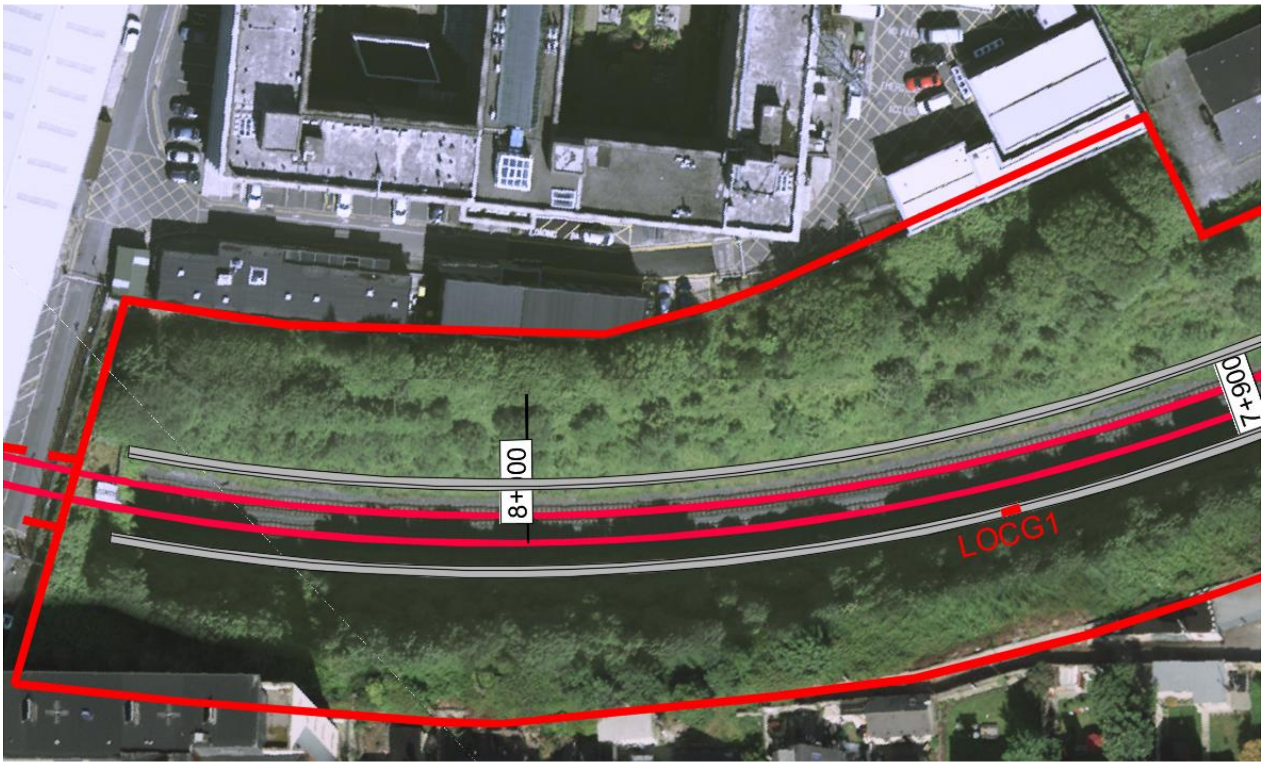


Figure 7-11 Signalling Infrastructure (North Entrance at Phoenix Park Tunnel)

7.3.4.1.1. Signalling Post

There are currently no proposed signalling cantilevers or gantries in this section and trackside signals would be located on signal posts adjacent to trackside. A typical signalling post is shown in **Figure 7-12.**

Figure 7-12 Typical Signalling Post

7.3.4.1.2. Object Controller Cabinet (OBJ)

There are no Object Controller Cabinets planned for this section of the route.

7.3.4.1.3. 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 in **Figure 7-13**.

Figure 7-13 Typical Location Cases

7.3.4.1.4. Cable Containment

A cable containment strategy has been progressed and following review of several alternatives such as traditional concrete troughing, direct buried cable routes and secure anti-slip walkways (see **Figure 7-14**), with ladder rack being used on the tunnel walls. Secure troughing occupies the same footprint as concrete troughing but is of a lighter more manageable construction. As this trunking also acts as a designated non-slip walkway it will help to mitigate space constraint issues along the route as well as minimise the aesthetic impact to the public. It also has the added advantage that it provides security of cabling from theft and damage as well as providing easy maintenance going forward. This has no impact to the public domain.

Figure 7-14 Containment walkway

Cable containment route will run adjacent to the track in accordance with standard railway practice and will cross under the track where required using under track crossings (UTX) and secure turning chamber. Type of containment at each stage of the track will be shown at the permanent way cross section drawings. See **Appendix C Drawings**..

7.3.4.2. Telecommunications

No new TER is needed in this section.

7.3.4.3. Electrification

In area to the North of the Phoenix Park Tunnel to Glasnevin Junction section, in twin track area, the electrification equipment will be supported by TTC structures at north side of the lines to support OHLE on both tracks, and STC structures where the OHLE to be terminated with anchor arrangement required in limited space as detailed in **Section 3.2.1**.

In areas where there are retaining walls on both side of the lines or limited boundary, the distance between the running rail to the OHLE mast can be reduced if required.

McKee Barracks Bridge (OBO3) and Old Cabra Road Bridge (OBO5) are sufficiently high in their existing configuration for the OHLE to pass through the bridge without connection to them. Electrification under these bridges will be a “Free-running” arrangement with a contact wire height of 4.7m with 4.4m minimum contact wire height under all conditions. OHLE masts are expected to be positioned between 20m and 30m either side of the bridge from outer edge of the these bridges.

For Blackhorse Avenue Bridge (OBO4), OHLE through the bridge will be fitted with graded down contact wire height with a minimum contact wire height of 4.4m through the bridge under all conditions due to the limited soffit height available. It will be fitted with elastic bridge arm supported from the bridge at a single location in the middle of the bridge due to its length. The steel service bridge on the south side of the Blackhorse Avenue Bridge (OBO4) will need to be removed prior to electrification.

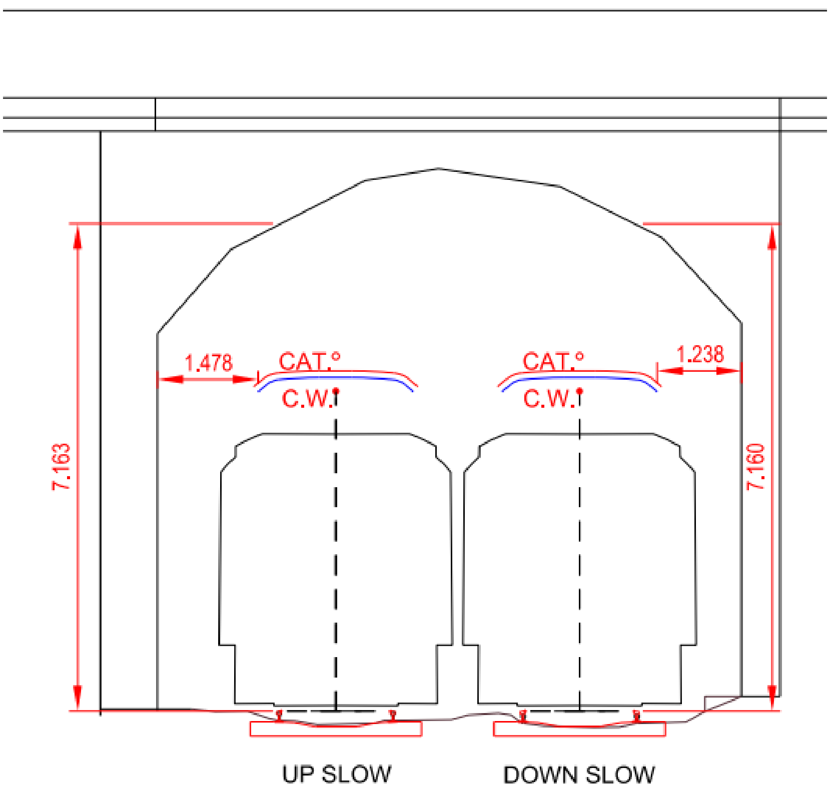


Figure 7-15 Example cross section for free running OHLE system in twin area.

For Cabra Road Bridge (OBO6) and Fassaugh Avenue Bridge (OBO7), will be similar to above with graded down contact wire height with a minimum contact wire height of 4.2m through the bridge under all conditions due to the limited soffit height available. Electrical clearance from the live OHLE to the bridge will be 100mm static and 80mm dynamic. The fitted bridge arm for OBO7 will be placed at the Arch section of the bridge. Track lowering required to achieve the proposed soffit height.

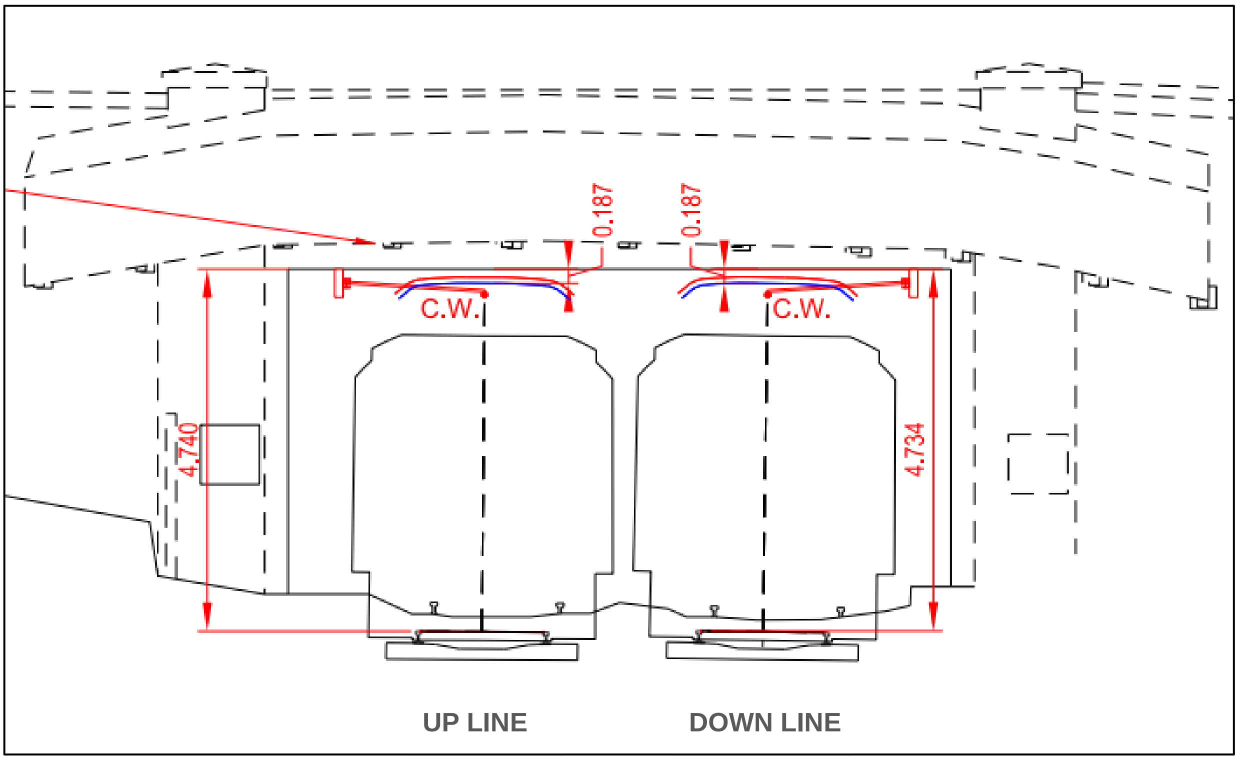


Figure 7-16 Example cross section for fitted OHLE system in twin area.

For Grand Canal and Luas Twin Arches (OBO8) and Maynooth Line Twin Arch Bridge (OBO9), OHLE through the bridge will be fitted with graded down contact wire height with a minimum contact wire height of 4.2m through the bridge under all conditions due to the limited soffit height available. It will be fitted with tunnel arms supported from the bridge at multiple locations due to its length. Track lowering is required to achieve the proposed soffit height.

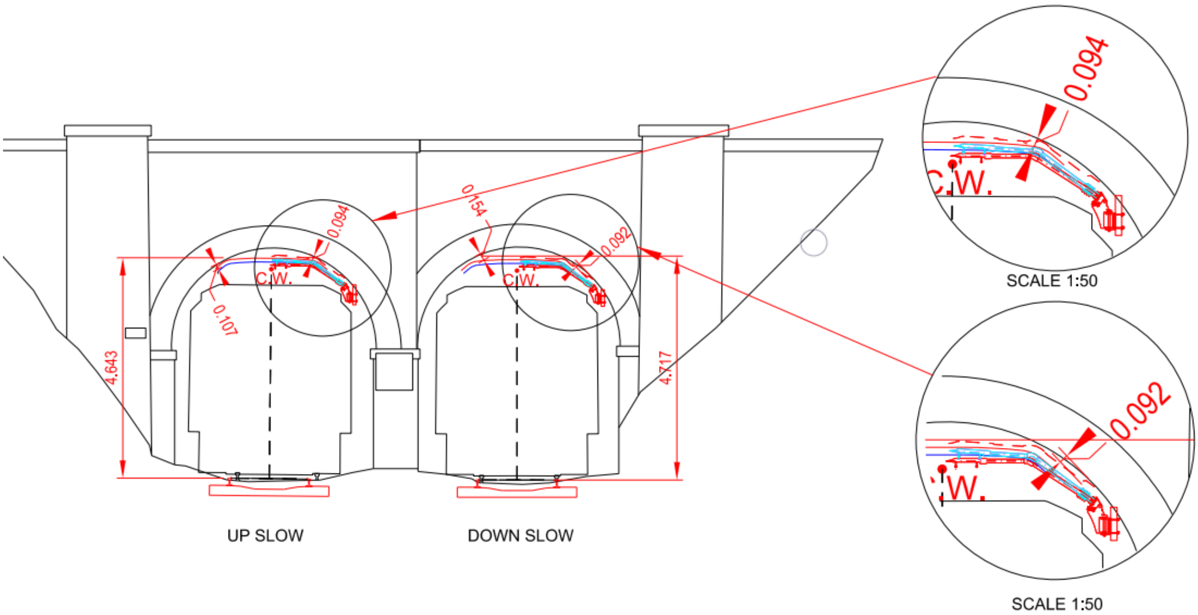


Figure 7-17 Example cross section for fitted tunnel arm OHLE system in twin area.

For Glasnevin Cemetery Road Bridge (OBO10), the bridge deck will be reconstructed with a soffit height of 4.9m so that the OHLE can be fitted as it passes through. As the bridge is narrow, the OHLE shall be supported either side of the bridge on the standalone masts with elastic bridge arms with a 4.4m minimum contact wire height under all conditions. This arrangement will not require OHLE fixing to the bridge.

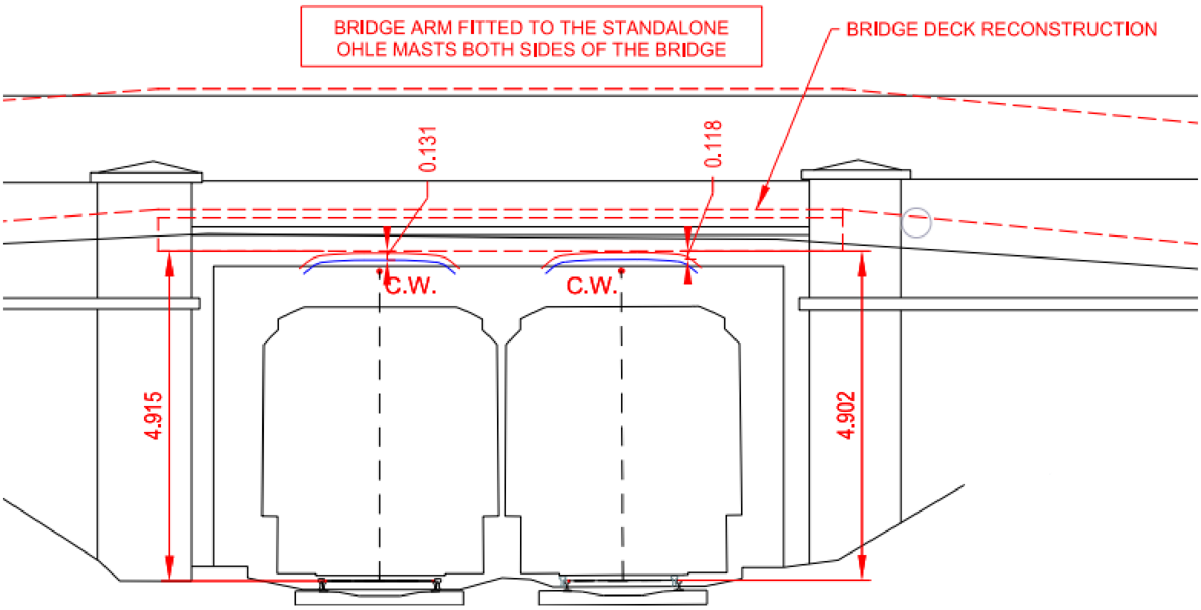


Figure 7-18 Example cross section for fitted at each side of bridge

7.3.5. Roads

The only roads design amendments for this section of the project are for Glasnevin Cemetery Car Park and access ramps over the bridge; to accommodate the current proposed Glasnevin Cemetery Road Bridge (OBO10) deck reconstruction.

7.3.5.1. Glasnevin Cemetery Road Bridge (OBO10)

The overriding factors that influenced the final proposal to raise the bridge deck height at Glasnevin Cemetery Road Bridge (OBO10); in order to facilitate the electrification of the railway and obtain minimum clearance to the overhead lines were the topographical constraints on track lowering, coupled with the bridge deck nearing the end of its useful life. The existing road is a single carriageway that is a shared use crossing for both vehicles and vulnerable users, however specific markings will indicate the priority be given to vulnerable users.

Speeds within this location are at a minimum with access to the cemetery solely for funerals, visitation and general site maintenance vehicles; nevertheless full H4a containment on the northern side of the bridge adjacent to the existing carpark may be required. owing to the low speeds, proximity to existing graves and limited access to the cemetery it is deemed that H4a containment is not necessary on the southern approach to the bridge. Raised masonry walls are being considered on the graveyard side of Glasnevin Cemetery Road Bridge access ramp. See **Appendix B Supporting Drawings** for details.

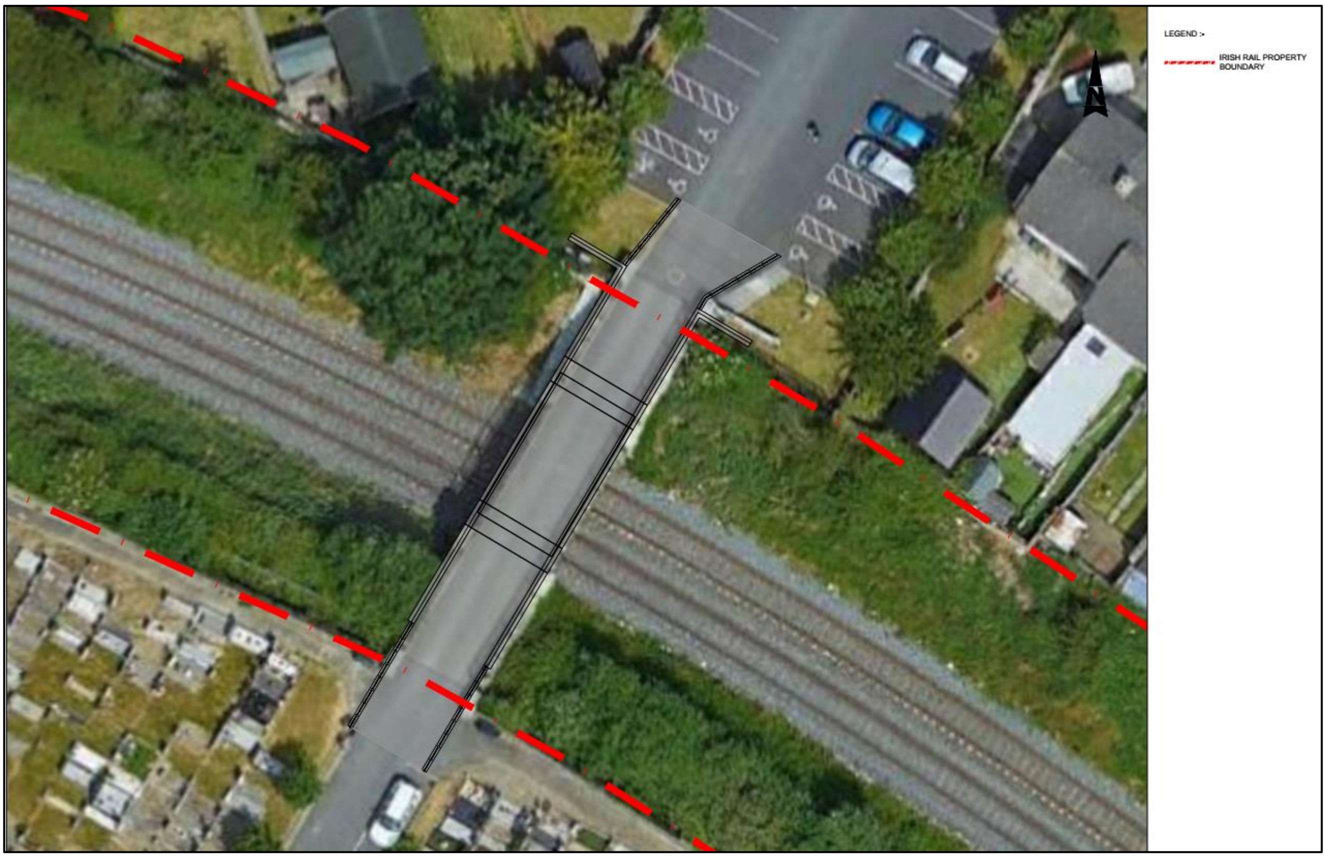


Figure 7-19 Existing layout of Glasnevin Cemetery Road Bridge (OBO10)

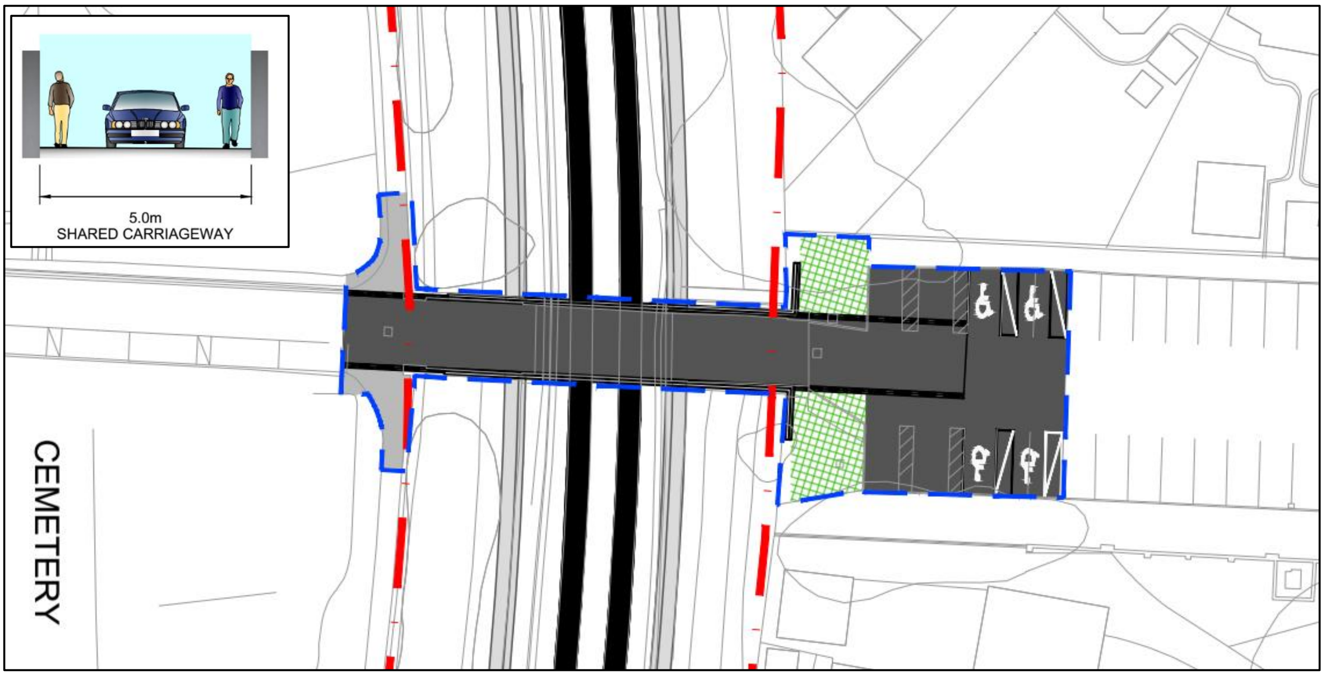


Figure 7-20 Glasnevin Cemetery Road Bridge (OBO10) Plan – Original Proposal

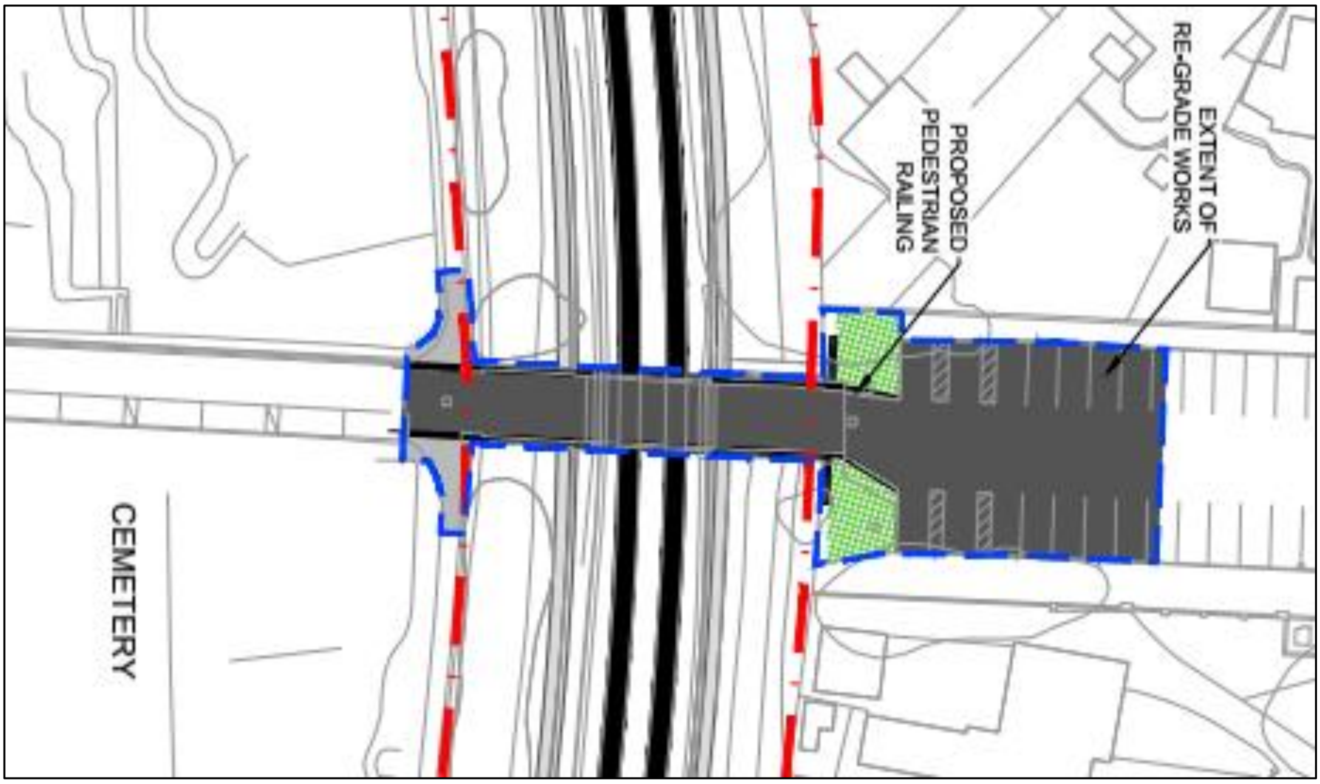


Figure 7-21 Glasnevin Cemetery Road Bridge (OBO10) Plan – Preferred Option

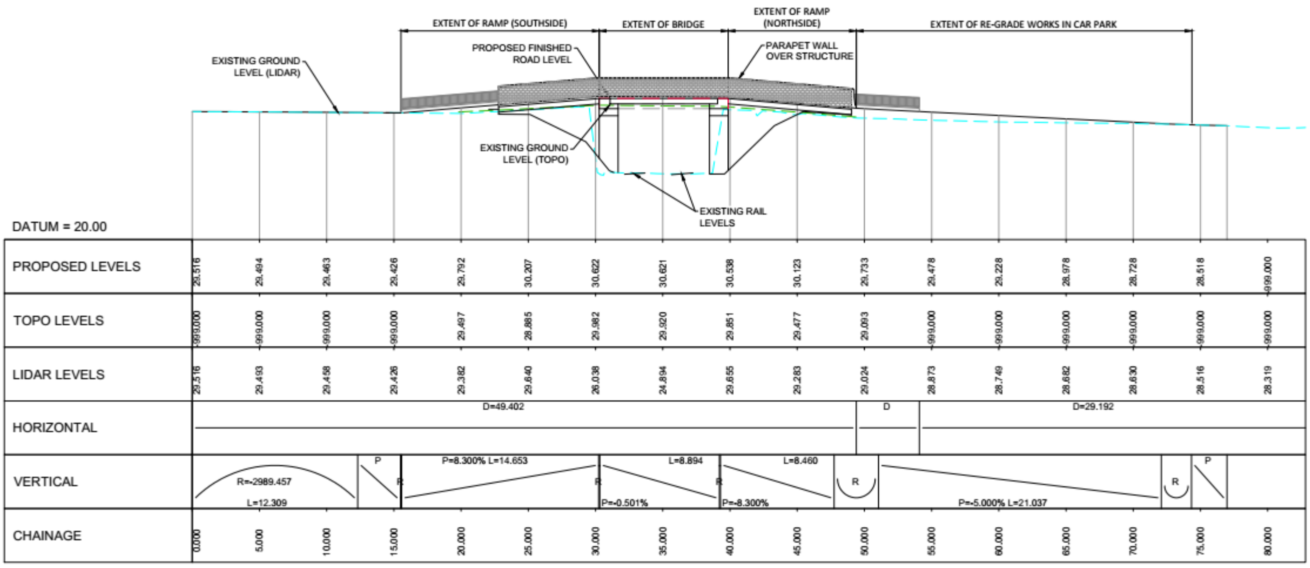


Figure 7-22 Glasnevin Cemetery Access Road - Profile

The proposal requires the raising of the bridge deck. This initially resulted in the proposed new bridge access ramp encroaching north into the carpark, to the extent that it reduced the available standard parking spaces by 6No. A key requirement is to ensure that vulnerable users could effectively negotiate the proposed ramp (the existing ramp is at the fringe of a desirable gradient but acceptable due to its short length. This would have effectly required the re-configuration of the existing space to ensure no loss of the 4 no. disability spaces.

To ensure no parking spaces are lost to the proposed changes in the northern carpark and the parking configuration is reinstated as per the current layout, it proposed to provide for the regrading of a portion of the carpark (as indicated in **Figure 7-21**). Owing to the short length of the actuall access ramp to the bridge deck , a 8.3% (max.) gradient is permitted in order to provide access for wheelchair users. This is only proposed from the edge of the bridge abutment to the rail corridor boundary, thereafter a more preferrable 5% is proposed for the remainder of the section up to the car park edge as well as for the 20m (approx.) of proposed carpark grading. The regrading will result in the rail corridor side of the car park raising by 500-600mm (max.). This will require the carpark kerb line and adjacent greenspaces to be reinstated and regraded accordingly.

Existing utility services such as a small water supply pipe and electricity supply to the existing electric gate and the cemetery will accommodated through the proposed bridge deck to improve the protection of the utilities supplied to the graveyard.

7.3.6. Drainage Requirements

The drainage proposals for this track section includes reinstating the existing drainage system to new track levels, taking into account the change from DMU’s to EMU’s, which implies a reduction of 200mm for the maximum water levels permissible in the track against the current situation, and the increase of the current dimensions of the wet well at the existing pumping station to accommodate the volume exceedance collected by the drainage system.

8. 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 (OBO10).

8.1. Summary of the Proposed Works

This section of the project primarily includes the electrification of the 2 no. tracks through this section. The alignment of the tracks in the Phoenix Park Tunnel and the section between the tunnel and the Glasnevin tie-in point is also being modidified.

While the extent of track lowering as currently proposed would be nominal when compared to the Cork Line, the steepness of the existing embankments coupled with localised track corridor widening may require slightly higher than anticipated retaining walls.

There are a number of critical utility crossings that will be reinstated with revised clearances to the proposed new electrification infrastructure. With a full track closure anticipated for the Phoenix Park Tunnel construction, it is envisaged that these crossings would not necessarily be programme critical but would need to be well coordinated to take advantage of closures required for other sections of the branch Line.

The railway corridor between the northern end of the Phoenix Park Tunnel and Glasnevin Cemetery Road Bridge, the cross section varies through this area but is predominantly in cutting, with property boundaries close to the top of the cut slopes.

8.2. Retaining Structures

In sections of the corridor where there is a level difference between the tracks and the adjacent land and track lowering is required, there may be a require to install localised retaining structures. Retaining structures may also be required to facilitate the installation of OHLE masts where the corridor is constrained.

Several different wall types are proposed depending on the height of the retained soil, the soil conditions and the proximity of buildings to the corridor.

8.2.1. 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 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.

8.2.2. 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 the 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 Irish Rail. In this case a wayleave or other ownership mechanism may be required under certain properties.

8.3. Bridges

8.3.1. Glasnevin Cemetery Road Bridge (OBO10)

The requirement for reconstruction of the bridge would result in the full closure of the existing crossing to the burial sites from the main carpark. The resultant raising would also require reworking of the existing access ramps to the bridge to allow for and if possible, improve vulnerable user access over the bridge. It has been assessed that this is achievable but will require the inclusion of pedestrian railing on the ramp edges or stone masonry wall of similar height in keeping with the aesthetics of the existing bridge walls.

The current proposal requires the pre-installation of a temporary pedestrian and wheelchair accessible bridge, with appropriate ramps for wheelchair access, in a location 3-6m (Approx.) to the south east of the existing structure. The existing deck would need to be demolished under night-time possession or during a potential full closure associated with the Phoenix Park Tunnel works. The old deck seating would be removed, and the area levelled in preparation for a larger seating beam. New precast abutment seats would be installed to raise the deck 600mm (Approx.). The deck would then be constructed with parapets and where feasible the carpark re-grading preparatory works would commence while the bridge is under construction, to reduce duration of impact.

A compound is currently proposed to be located in the carpark to complete the bridge and carpark works this will require temporary occupation of the western portion of the carpark. This is necessitated to provide a site for craning in of precast elements in particular.

8.3.2. Parapet Works

The parapets across the the Glasnevin Cemetery Bridge (OBO10) deck replacement are proposed to be design to provide H4a level containment, as per the bridge reconstructions on the Cork Line.

However, other parapet works are anticipated to all the bridges where the aperture width of the fencing portion of the parapet is considered non compliant (Refer to **Section 2.4** for the relevant bridges). All masonry stone or concrete block portions of these composite parapets are greater that the minimum 1.2m required but in these instances a solid infill will l be required to bring the parapet into compliance for electrified railways. This will result in some of the parapets being higher than the 1.8m (min.) total height required.

The construction process will require scaffolding platforms and mesh to be erected from the roadside and cantilevered below to prevent material dropping to the rail. This work will need to ensure that safety clearances are maintained during operation. Footpaths and potentially the nearside lane of traffic will need to be closed on one side before moving over to the other side to complete the operations. No temporary works will be required at track level for parapet works, but the installation of the scaffolding will need to be undertaken under a possession. Any narrowing of the road above will need to conform to the Chapter 8 of the Traffic Signs Manual.

8.4. Permanent Way

Track lowering will be required through this area areas to facilitate the electrification of the realigned tracks. 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
- Construction of track drainage

8.5. 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 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. On the branch line there are only 2 No. tracks, so possessions of the tracks will be required to install all OHLE equipment unless a single possession/closure is provided to complete the Phoenix Park Tunnel works.

8.6. Construction Compounds

Works on this linear scheme will require construction compounds at specific locations. The sites will need to accommodate offices for the contractor and client teams, storage facilities, recycling facilities, parking for cars and plant and potentially fabrication areas. It is a prerequisite that the construction compounds are located close to and ideally with direct access to the site. The sites must be fully serviced with electricity, water, sewerage and telecoms and must have good access to the public road.

The construction compounds are required at specific construction sub-sites and also distributed along the scheme by geographical features. For example, compounds will be required at each of the bridge reconstruction locations as well as for material processing and storage of construction components. The construction compounds will be used to support earthworks, ecological clearances, enabling works, site clearance, utility diversions work, civil works, the demolition of bridges, OHLE, track installation, signalling and telecoms equipment and all ancillary works.

Layouts have been developed for each compound, but final layouts will be developed by the contractors at construction stage. Fencing and in some cases screening along with topsoil bunds where topsoil has been removed may be required for each construction compound. Noise screening and temporary guide rail fencing may be required at access locations to the railway corridor. Security fencing will be required for security purposes of both the workforce and the public. Gated access to the site and compounds will be required to check vehicles and personnel arriving on site are permitted to gain access. An access road will also be required from each compound to the site and also joining up to the public road. These access roads will be the main route for vehicles entering the site, including deliveries and arrival and departure of the workforce.

The construction compounds will be located such that they require minimal modification, if any, over the duration of the construction programme. The compounds will typically consist of areas of hardstanding for vehicles and materials and therefore the water runoff will be managed and treated as required.

Construction compunds will need to accommodate offices for the contractor and client teams, storage facilities, recycling facilities, parking for cars and plant and potentially fabrication areas. It is a requirement that the construction compunds are located close to and ideally with direct access to the various work sites and have good access to the public roads network.

Some construction compounds are required at very specific geographic locations, in close proximity to specific work elements, for example, construction compounds will be required at each of the bridge reconstruction locations.

Section 5 Options outlines the preferred locations for the construction compounds required for this area; **Section 6 Options Selection Process** provides a detail of the option selection methodology.

Four construction compounds are required between North of the Phoenix Park Tunnel and Glasnevin Junction:

- Heuston West
- Fassaugh Avenue
- Cabra
- Glasnevin Cemetery

8.6.1. Heuston West Construction Compound

The proposed construction compound is located on Irish Rail property adjacent to platform 10 and the Clancy Quay residential development. The compound will need to be split and works phased to allow the construction of the station, Phoenix Park tunnel works and the construction of the new Heuston West station. See **Figure 8-1** for the proposed Heuston West construction compound layout.

Figure 8-1 Heuston West Proposed Construction Compound Location

8.6.2. Cabra Construction Compound

The proposed construction compound at Cabra is located on the branch line which runs from Heuston Station to Glasnevin Junction, it is adjacent to the Cabra Road/Carnlough Road Junction. Access to the site will be from Carnlough Road to Cabra Road, Navan Road to the M50. The site is located on Irish Rail Property and is currently used by Irish Rail for track maintenance.

Figure 8-2 Cabra Proposed Construction Compound Location

8.6.3. Fassaugh Avenue Construction Compound

Another construction compund is required for electrification works on the branch line from Heuston Station to Glasnevin Junction and for localised track lowering works. The proposed site is located on the eastern side of the rail corridor. The site is currently a disused public house and is in private ownership. Access to Fassaugh Avenue construction compund would be via Fassaugh Avenue, Quarry Road, Cabra Road, Navan Road to the M50.

Figure 8-3 Fassaugh Avenue Proposed Construction Compound Location

8.6.4. Glasnevin Cemetery Compound

A construction compound is required in this area, primarily to facilitate works to Cemetery Road bridge. The proposed location for the construction compound is in the parking area immediately adjacent to the bridge. To the south of the bridge lies Glasnevin Cemetery, to north of the bridge on either side of the proposed construction compound are residential properties, therefore not providing a feasible alternative option to the car park. The site will need to facilitate continual 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 estate road and the Finglas road to the M50. The car park site is thought to be in private ownership and would therefore need to be acquired temporarily for the duration of the relevant works.

Figure 8-4 Glasnevin Cemetery Preferred Construction Compund Location

8.7. Temporary Traffic Management

8.7.1. Glasnevin Cemetery Bridge (OBO10)

Glasnevin Cemetery Bridge (OBO10) 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. This temporary bridge will be installed in advance of the new bridge works and will also include for temporary diversion of the existing water and electrical supply to the cemetery. (See **Figure 8-5**)

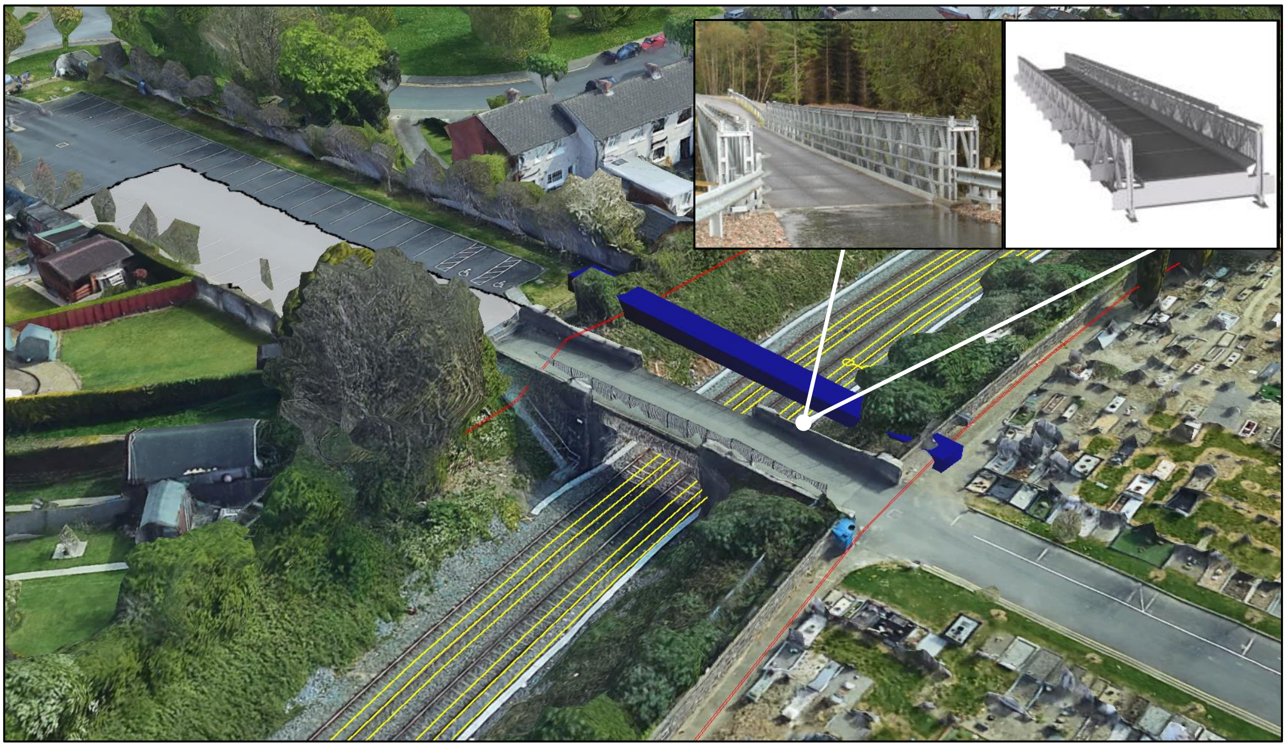


Figure 8-5 Proposed temporary vulnerable user diversion (incl. bridge)

8.8. Restrictions

There are restrictions associated with working on or adjacent to the live railway line. Irish Rail 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).

Materials delivery times will predominantly be outside peak traffic hours; particularly for construction HGV's known to restrict natural flow of traffic; this is also governed by the Dublin City HGV Cordon for vehicles above 5 axles for the project areas south east of the GSWR Railway. Special Permitting will be required for departures from this in accordance with the City Cordon conditions of access. In addition, where possible, long duration night works will be limited in areas close residential units 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, as well as local residents and/or employers in the area. The methodologies will be fully reviewed by the Irish Rail 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).

Appendix A – Sifting Process Backup

A.1 Sifting Process Backup - Corridor Bridges

- McKee Barracks Bridge (OBO3)
- Blackhorse Avenue Bridge (OBO4)
- Old Cabra Bridge (OBO5)
- Cabra Road Bridge (OBO6)
- Fassaugh Avenue Bridge (OBO7)
- Royal Canal and LUAS Twin Arch Bridge (OBO8)
- Maynooth Line Twin Arch Bridge (OBO9)
- Glasnevin Cemetery Road Bridge (OBO10)

Appendix B – Supporting Drawings

The following drawings accompany the Technical Report for this area:

Bridge Drawings

DP-04-23-DWG-ST-TTA-44240: Glasnevin Bridge (OBO10) General Arrangement

DP-04-23-DWG-ST-TTA-44241: Glasnevin Bridge (OBO10) Bridge Deck Plan

DP-04-23-DWG-ST-TTA-44242: Glasnevin Bridge (OBO10) Bridge Deck Longitudinal Section and Elevation

DP-04-23-DWG-ST-TTA-44243: Glasnevin Bridge (OBO10) Bridge Deck Cross-Section

Roads Drawings

DP-04-23-DWG-CV-TTA-43061: Glasnevin Cemetery Road Bridge (OBO10) Road - Plan and Profile

Permanent Way Drawings

DP-04-23-DWG-PW-TTA-43980: OBO3 to OBO10 Track Plan Layout and Longitudinal Profile (Sheet 1 of 4)

DP-04-23-DWG-PW-TTA-43981: OBO3 to OBO10 Track Plan Layout and Longitudinal Profile (Sheet 2 of 4)

DP-04-23-DWG-PW-TTA-43982: OBO3 to OBO10 Track Plan Layout and Longitudinal Profile (Sheet 3 of 4)

DP-04-23-DWG-PW-TTA-43983: OBO3 to OBO10 Track Plan Layout and Longitudinal Profile (Sheet 4 of 4)

DP-04-23-DWG-PW-TTA-43985: OBO3 to OBO10 Cross Section @Ch 5+700