DART+ South West

Volume 3E – Technical Optioneering Report – Sarsfield Road Bridge to Memorial Road

Iarnród Éireann

November 2021

Contents

Tables

Figures

Glossary of Terms

Reference	Description
ABP	An Bord Pleanála
ACA	Architectural Conservation Area
AOD	Above Ordnance Datum
APIS	Authorisation for Placing in Service
ASA	Application for Safety Approval
AsBo	Assessment Body
ASPSC	Application Specific Project Safety Case
ATP	Automatic Train Protection
CAF	Common Appraisal Framework
Cantilever	OHLE structure comprising horizontal or near horizontal members supporting the catenary projecting from a single mast on one side of the track.
Catenary	The longitudinal wire that supports the contact wire.
CAWS	Continuous Automatic Warning System
CBI	Computer-Based Interlocking
CCE	Chief Civils Engineers Department of IE
CCRP	City Centre Re-signalling Project
CCTV	Closed Circuit Television
CDP	County Development Plan
CIÉ	Córas Iompair Éireann
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
Cutting	A railway in cutting means the rail level is below the surrounding ground level.

Reference	Description
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
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).

Reference	Description
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
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

Reference	Description
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
STC	Single Track Cantilever
TII	Transport Infrastructure Ireland
TMS	Train Management System
TPH	Trains per Hour
TPHPD	Trains per Hour per Direction

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

1. Introduction

1.1. Purpose of 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 from West of Sarsfield Road Bridge (UBC4) to the West of Memorial Road Bridge (OBC3). 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 (OLE)
- Environment
- Highways
- Geotechnical
- Substations
- 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 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.

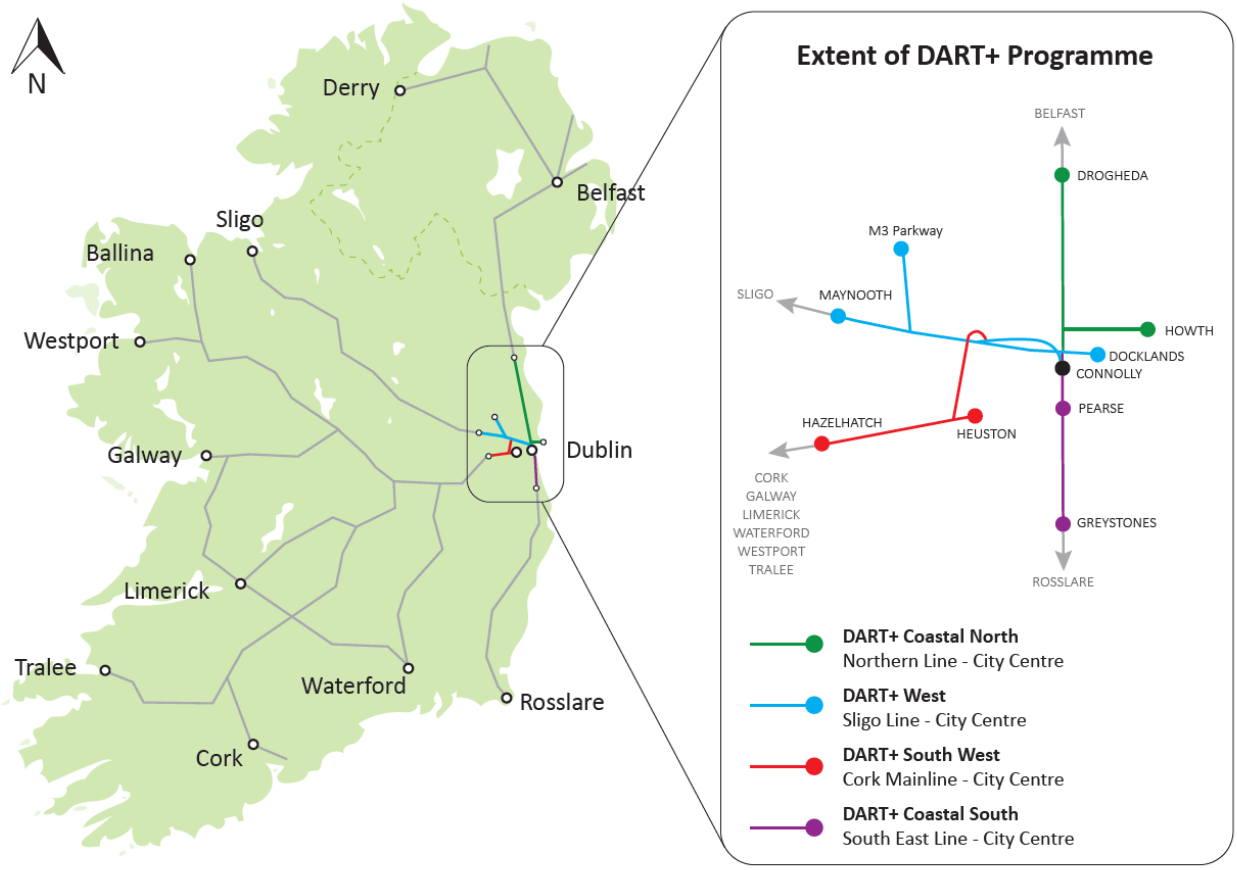


Figure 1-1 Schematic of Overall DART+ Programme

The current electrified DART network is 50km long, extending from Malahide / Howth to Bray / Greystones, and 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.

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

1.3. DART+ South West Project

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

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

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

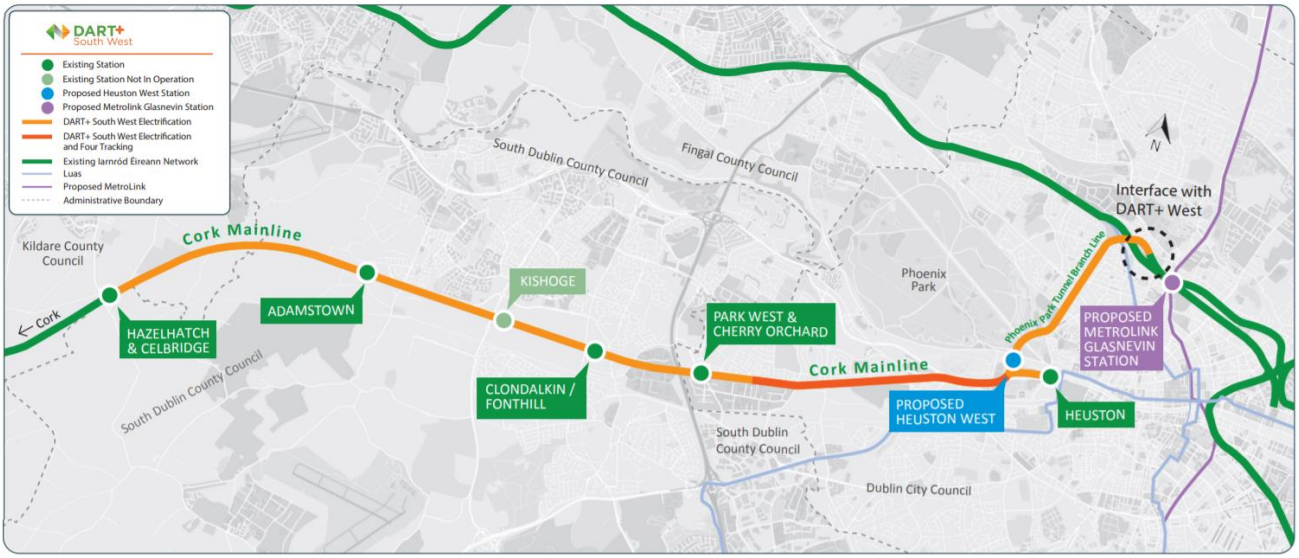


Figure 1-2 DART+ South West Route Map

1.4. Capacity Increase Delivered by DART+ South West Project

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 include:

- 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 / interventions of bridges to achieve vertical and horizontal clearances.
- Remove rail constraints along the Phoenix Park Tunnel Branch Line.
- Delivery of a new Heuston West Station.

The 'Preferred Option' will be compatible with 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 Station, the route also extends through the Phoenix Park Tunnel to Glasnevin. The area descriptions and extents are set out in **Table 1-1** and **Figure 1-2**.

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 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
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

A large volume of stakeholder submissions were received during the six week public consultation period, which ran from 12th May 2021 to 23rd June 2021, an additional week was provided, extending the consultation period until 30th 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.

Overall, most stakeholder submissions for this section of the project had regard to Sarsfield Road Bridge (UBC4) underpass; associated traffic volumes and safety. The underpass is referred to as ‘inappropriately’ narrow; with submissions noting that works should be considered to widen the bridge to allow for appropriate cycle and pedestrian facilities through the underpass; but also respondents generally preferred options requiring minimal works.

Stakeholders requested that disruptions to current rail services be minimised during construction. It was specifically queried whether construction will result in reduced track or platform space.

Many respondents note that excessive traffic in the area around Kilmainham, Inchicore and Sarsfield Road and believed the project should improve the status quo.

Traffic management safety concerns were highlighted around Sarsfield Road and Con Colbert Road junction, where ‘frequent traffic accidents due to speeding’ were cited.

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 section is 470m (approx.) in length and extends from the west side of Sarsfield Road Bridge (UBC4) to 50m west of Memorial Road Bridge (OBC3). The Permanent Way in this area consists of 3 no. tracks. The tracks fall in level from west to east towards Heuston Station. There is currently no longitudinal drainage system installed along the Permanent Way.

The area has 1 No. road underbridge. Sarsfield Road Bridge (UBC4) carries 3 no. rail tracks over the single-carriageway Sarsfield Road below. Sarsfield Road Bridge (UBC4) is a major feature of the area. It is a single-span highly skewed steel rail bridge supported on masonry abutments with steel bearings.

Sarsfield Road facilitates traffic moving in a north-south direction beneath the rail corridor. The carriageway width beneath the bridge is narrow. A yield system is in operation which permits only a single lane of traffic beneath the structure. Sarsfield Road is in a deep cutting that is supported by masonry retaining walls on all 4 no. sides of Sarsfield Road Bridge (UBC4); the bridge is a major feature of the area.

The Truck Rental is a commercial property located on the south-east side of Sarsfield Road Bridge (UBC4). The property is retained along Sarsfield Road with a masonry retaining wall. Its northern boundary with the rail corridor is formed with a masonry and blockwork retaining wall. A steel Portal Signal Gantry (OBC3A) is located 190m (approx.) west of Sarsfield Road Bridge (UBC4). A horse sanctuary/field is located on the north side of the corridor opposite the Truck Rental/Logistics Company.

At Sarsfield Road Bridge (UBC4), the rail corridor is on an embankment. Further to the east, the railway is at grade then generally returns to a cutting which gradually steepens on approach to Memorial Road Bridge (OBC3). The south side of the rail corridor is retained with a battered masonry retaining wall. The north side of the rail corridor is formed with earthwork cutting slope. The area does not currently have any provisions for electrification. The major infrastructure features of the area are illustrated in **Figure 2-1**.

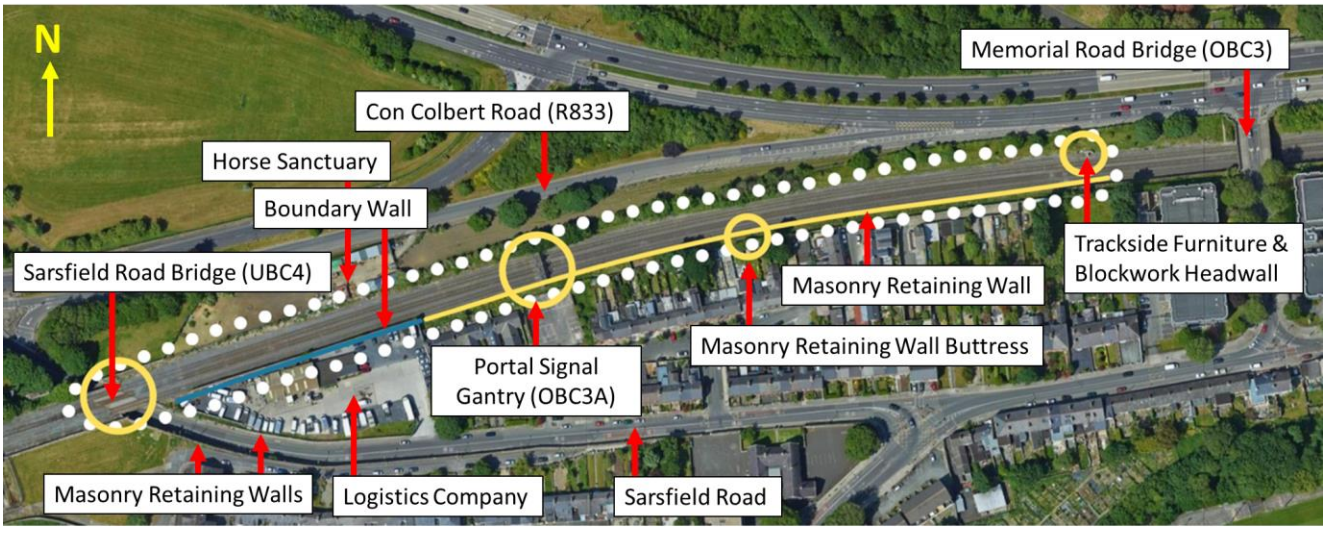


Figure 2-1 Aerial view (white dotted outline of area)

The main Environmental features are described in **Section 2.7 Environment**.

2.2. Challenges

The project objective is to increase the number of tracks between Park West & Cherry Orchard Station and Heuston Station to 4 no. tracks and to electrify 2 no. tracks (northern side) from Hazelhatch & Celbridge Station to Glasnevin Junction. There are significant challenges that constrain the options available to achieve the Permanent Way and Overhead Line Electrification (OHLE) project requirements.

The existing Sarsfield Road Bridge (UBC4) structure, which currently carries 3 no. tracks, has insufficient width to carry an additional track. The intervention options proposed to involve reconstructing the bridge with new structures that have sufficient width for 4 no. tracks. As this structure is an underbridge, the installation of overhead line electrification (OHLE) at the bridge is not a significant challenge.

Sarsfield Road is in a deep cutting. Masonry retaining walls up to 5m (approx.) retain the adjacent grounds on all 4 sides of the structure. The Sarsfield Road Bridge (UBC4), although not protected, is noted as part of the Dublin Industrial Heritage associated with the Phoenix Park Tunnel Branch Line. Minimising the potential impact on the walls and abutments and maintaining their stability is a challenge.

The low point on Sarsfield Road is beneath the existing bridge. The road levels increase to the north and to south along the road (i.e. away from the bridge). A replacement structure capable of carrying 4 no. tracks would be wider than the existing bridge. A large culvert combined sewer culvert located (with limited road cover) under the northbound carriageway below the bridge and the departs the roadway to the south of the structure (at the confluence of combined sewer systems from the north and south) and passes under the retaining wall and railway continuing in north easterly direction. There are a significant number of utilities beneath the existing Sarsfield Road. These existing services present a challenge in terms of reducing levels on Sarsfield Road.

2.3. Permanent Way and Tracks

The area covered in this report extends from Sarsfield Road Bridge in the west to Memorial Road Bridge to the east. There are 3 no. tracks, named from north to south as Up Main, Down Main and Relief Line. The maximum speed is 40mph (approx. 60km/h) (refer to **Figure 2-2**).

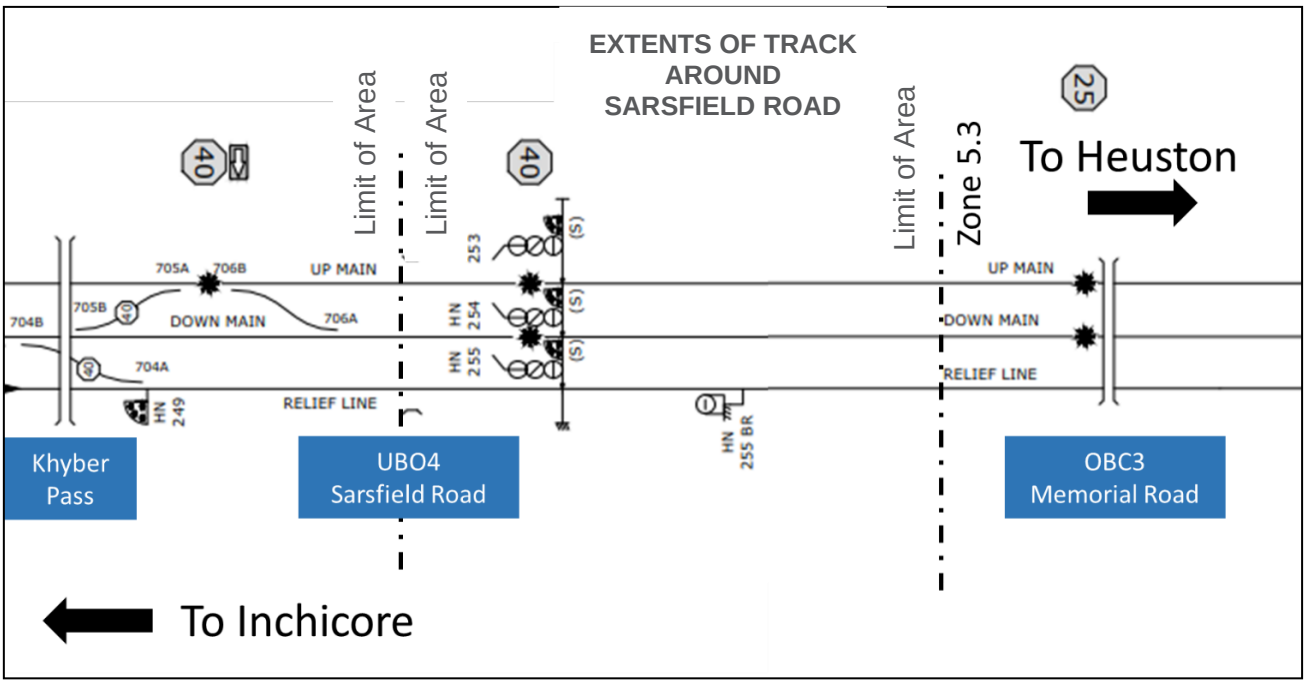


Figure 2-2 Track diagram showing the area

The railway corridor transitions from being at grade at the east side, to a cutting at the west end (tracks at a lower level than the surroundings). The Sarsfield Road Bridge (UBC4) deck is skewed with a relative angle between the road axis and tracks of 40 degrees (approximately).

The track form through the Sarsfield Road Bridge consists of channels of embedded slab track encased in Corkelast. The rail is 'floating' as there is no fixation between the rails and the bridge deck, other than the Corkelast. There are some baseplates fixed to the concrete that sits off the ends of the bridge structure, but these are not attached to the bridge.

This system was chosen to maximise the vertical road clearance. The transitions between the embedded slab track system and the ballasted track are the weak point of this solution. The geometry through the transitions is difficult to maintain, and as a result, the wear rate of the track components is greater. **Figure 2-3** shows a clearance of 1.7m from boundary wall to outer rail, which is an area of limited clearance and a safety concern as there is less than the required distance for a position of safety.

Figure 2-3 Clearance from boundary wall to outer rail - Facing East

To the east of Sarsfield Road Bridge (UBC4), on the south side, the corridor width is limited by the boundary wall between the Truck Rental/Logistics Company property and the rail corridor. This wall is at 1.7m to the nearest rail, which is an area of limited clearance and a safety concern as there is less than the required distance of 2.04m to provide a position of safety. This is adjoined by a masonry retaining wall to the east which continues to Memorial Road Bridge (OBC3).

Figure 2-4 View of the 1000m radius curve - Facing East

The track geometry is straight over Sarsfield Road Bridge (UBC4) and then ties into a 1,000m (approximately) radius curve which continues to the east boundary of the area. The track gradient is 1% (approximately) and falls

towards Heuston. The track-form is comprised of a ballasted track with 54E1 rail and concrete sleepers. Breather switches protect the bridge from thermal forces.

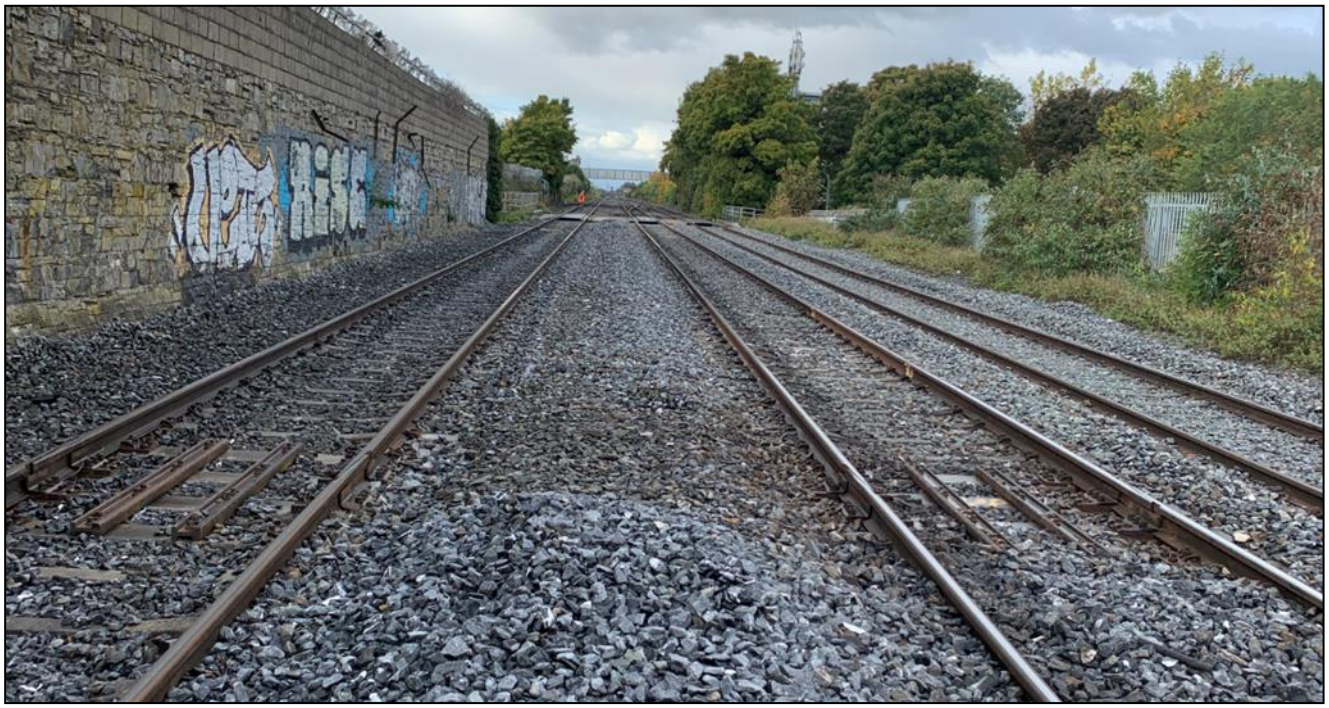


Figure 2-5 Breather switches on Relief Line (LHS) and Down Main (Centre)

2.4. Structures

2.4.1. Sarsfield Road Bridge (UBC4)

UBC4 carries 3 no. rail tracks over the single-carriageway Sarsfield Road. It is a single-span highly skewed steel rail bridge supported on masonry abutments with steel bearings. The bridge incorporates maintenance access walkways on the north and south side of the structure. The vertical clearance from Sarsfield Road below to bridge soffit is 4.37m. The clear (skewed) span of the structure is 11m (approx.). The carriageway beneath the structure is 5m (approx.) wide (square dimension). There are 2 no. footways beneath the structure. The footway is 1.6m wide on the west side and 1m wide on the east side.

Figure 2-6 Sarsfield Road Bridge (UBC4) - South Elevation

Figure 2-7 Sarsfield Road Bridge (UBC4) - North Elevation

Figure 2-8 Sarsfield Road Bridge (UBC4) - East footway & West abutment

Figure 2-9 Sarsfield Road Bridge (UBC4) Deck level - Facing East

Figure 2-10 Sarsfield Road Bridge (UBC4) East & West abutments

2.4.2. Portal Signal Gantry (OBC3A)

Portal signal gantry (OBC3A) is a portal signal gantry located 190m (approx.) west of Sarsfield Road Bridge (UBC4). The steel gantry is supported by a steel gantry column leg on the north side and is supported by a short steel column leg positioned on top of the battered masonry retaining wall on the south side. The gantry has secured ladder access at north support to facilitate access for inspection and maintenance. This portal gantry will need to be removed to facilitate four-tracking and electrification.

The gantry supports signals HN253, HN254 and HN255. They protect the Points and Crossovers (P&C) at Inchicore. A banner repeater (BR) is located on the south retaining wall at Ch 251+020.

Figure 2-11 Portal signal gantry (OBC3A) - west of Sarsfield Road Bridge (UBC4)

2.4.3. Retaining Walls

There are 2 no. existing retaining walls along the rail line in the area. A battered masonry retaining wall runs west along the south side of the tracks for 330m (approx.) from the east boundary of the area. This wall is typically 2m (approx.) high and increases to 3m (approx.) at the east boundary of the area. The wall appears to be in good condition generally. The wall incorporates a buttress which is located 170m from the east boundary of the area. The wall provides support to the south side of the portal signal gantry (OBC3A) located 190m (approx.) west of Sarsfield Road Bridge (UBC4).

A second retaining wall forms the northern boundary of the Truck Rental/Logistics Company with the rail line. The bottom of the wall is constructed in masonry. The upper section has been extended in blockwork to a total height of 3m (approx.). This wall adjoins the west end of the masonry retaining wall described above.

Sarsfield Road Bridge (UBC4) is abutted by retaining walls on all 4 sides. These walls retain the adjacent existing ground level to facilitate a significant drop in vertical levels on Sarsfield Road to bring the carriageway under the rail corridor at Sarsfield Road Bridge (UBC4). The retaining walls are up to 5m high and are constructed in masonry. The retaining walls are highest on the south side of Sarsfield Road Bridge (UBC4). There are a number of cast iron service pipes protruding from the south-east and south-west walls. The retaining walls incorporate anchors along their lengths on the south-east and south-west sides. The anchor caps are visible at road level. The walls also incorporate buttresses along their length for stability.

Figure 2-12 Masonry Retaining Wall on the south side of the rail corridor

Figure 2-13 Masonry retaining wall buttress & logistics company retaining wall

The existing southern track is in close proximity to the face of the walls, as such the track renewal options to take into consideration the stability of this wall.

Figure 2-14 Sarsfield Road south-west retaining & south-east retaining walls

Figure 2-15 Sarsfield Road north-west & north-east retaining walls

2.4.4. Other Structures

A blockwork head wall creates space for trackside furniture at the toe of the cutting slope near the east boundary of the area. The headwall is located aproximately 10m from the east boundary of the area on the north side of the tracks.

Figure 2-16 Blockwork headwall at on the north side of tracks (east end of the area)

2.5. Road Network

The low point on Sarsfield Road is beneath the existing bridge. The road levels increase to the north and to south along the road (i.e., away from the bridge). A large combined sewer culvert is located (with limited road cover) under the northbound carriageway below the bridge and departs the roadway to the north of the structure (at the confluence of combined sewer systems from the north and south) and passes under the retaining wall and railway continuing in north easterly direction. Numerous other services located in the road corridor also present a challenge in terms of reducing levels on Sarsfield Road, therefore to retain the existing clearance under the new UBC4 structure, which will incorporate 4 no. tracks (wider structure), the deck and associated track works will require raising to avoid unnecessary and disproportionate impact on the road levels and utility services underneath.

This road is part of the proposed Liffey Valley BusConnects route; which currently proposes no change to the existing yield arrangement on approach to the bridge (refer to **Figure 2-17** below). The close proximity of Sarsfield Road Bridge (UBC4) to Memorial Road Bridge (OBC3) and South Circular Road Bridge (OBC1) rail crossing

points means traffic changes on one crossing tends to have a downstream impact on another; to a greater or lesser degree. Refer to **Section 8.6** for details of temporary traffic management and works sequencing proposals taking due consideration of the same of the aforementioned.

The Sarsfield Road carriageway (beneath the structure) is aproximatelly 5m wide (square dimension). There are footways beneath the structure; one 1.6m wide on the west side and 1m wide on the east side.

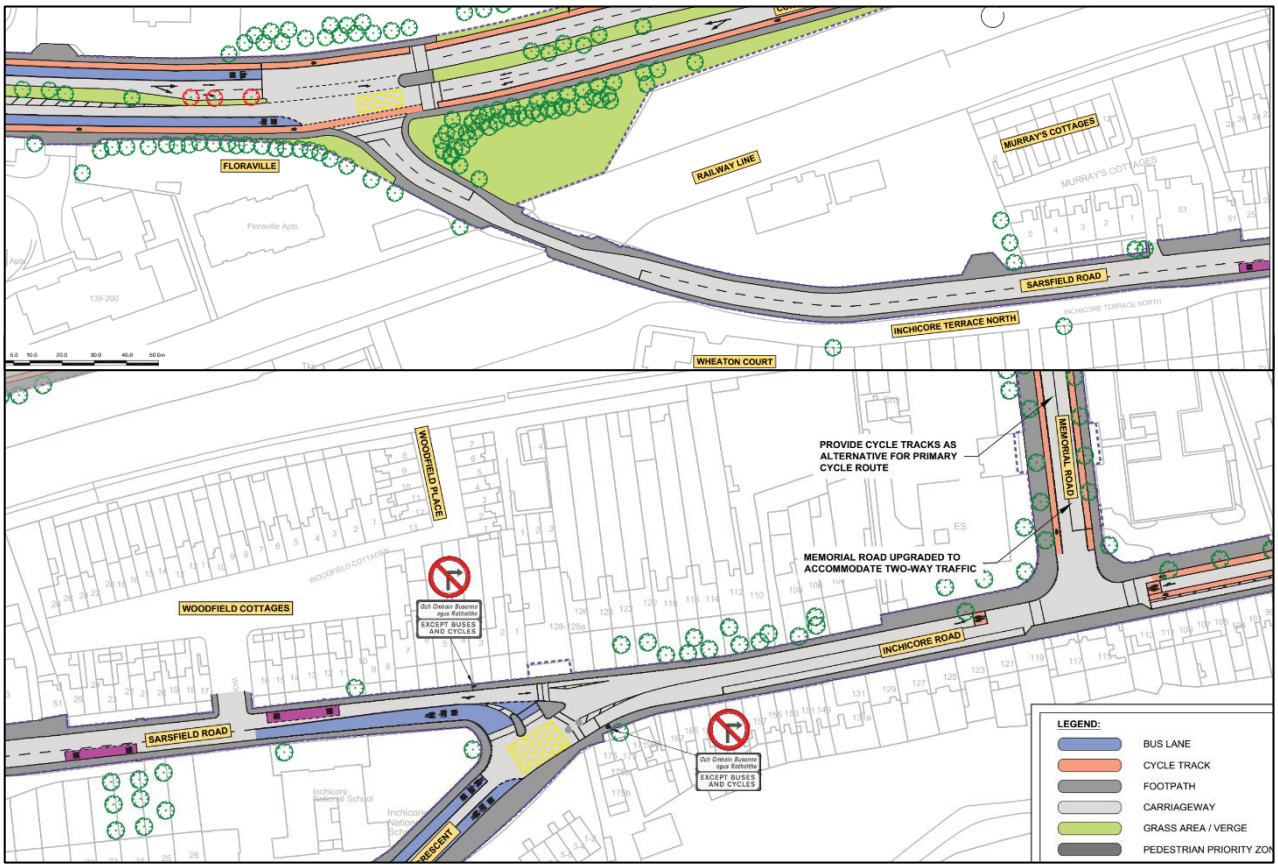


Figure 2-17 Proposed Liffey Valley BusConnects Scheme (Sarsfield Road)

2.6. Ground Conditions

The topography of the area is generally flat and slopes gently south-east to north-west. The railway is situated on a small embankment on the westerly approach to Sarsfield Road Bridge (UBC4). Further east of Sarsfield Road Bridge (UBC4), the railway then transitions from at grade to cutting towards Memorial Road Bridge (OBC3).

To the east of Sarsfield Road Bridge (UBC4), a long and narrow strip plot (known colloquially as 'horse fields') and the Con Colbert Road bound the railway to the north, and commercial/residential buildings are present close to the southern boundary of the railway.

The general superficial deposits within this area are shown to comprise 2 no. different superficial deposits. To the west of Sarsfield Road Bridge (UBC4), the superficial geology is shown to comprise of till. To the east of Sarsfield Road Bridge (UBC4), the area is shown to comprise of urban (made ground) deposits, which are likely to be overlying a layer of till. The bedrock deposits across the entire area are shown to comprise limestone and shale.

Ground investigation information was reviewed from five boreholes within 50m of Sarsfield Road Bridge (UBC4) close to the railway corridor.

Ground conditions located 25m west of the Sarsfield Road Bridge (UBC4) encountered a thin layer of topsoil underlain by made ground between 0.2m below ground level (bgl) (25.67m AOD) and 5.8m bgl (20.07m AOD). The borehole was terminated at 5.8m bgl as a culvert had been encountered during drilling.

Ground conditions encountered 35m west of the Sarsfield Road Bridge (UBC4) comprised of clay and gravel between ground level and 5.5m bgl (20.50m AOD). There was no recovery between ground level 5.5m bgl (20.5m AOD); therefore, limited information is available for this material. The clay and gravel were underlain by a firm to locally soft clay, becoming hard at depth. Bedrock consisting of strong to very strong limestone with moderately strong mudstone and shale was met at 16.2m bgl (9.80m AOD).

Two (2 No.) boreholes (one inclined) were both completed in a similar location south-east of the bridge within the Logistics Company premises. The made ground was recorded between ground level and 1.2m bgl (24.61m AOD). The made ground was underlain by clay and gravel. Firm to stiff clay was recorded below the clay and gravel. Bedrock was recorded between 18.60m bgl (9.54m AOD) and 17.37m bgl (8.40m AOD) and comprised strong to very strong limestone and moderately strong mudstone and shale. No recovery was noted in places within the superficial deposits.

Ground conditions 40m south of Sarsfield Road Bridge (UBC4) comprised topsoil overlying made ground between ground level and 1.2m bgl (24.35m AOD). The made ground was underlain by clay, recorded locally as firm to stiff and very sandy overlying bedrock deposits. Bedrock described as moderately strong to strong limestone and moderately strong to weak mudstone and shale was encountered at 12.82m bgl (12.73m AOD). No recovery was recorded between ground level and 2.5m bgl (23.05m AOD).

No groundwater was encountered during the drilling within any exploratory holes adjacent to Sarsfield Road Bridge (UBC4).

A Ground Investigation is currently ongoing to verify the data obtained in the historical investigations.

2.7. Environment

Sarsfield RoadBridge (UBC4), although not listed on the Record of Protected Structures (RPS) or listed on the National Inventory of Architectural Heritage (NIAH) is nonetheless noted as part of the industrial heritage record associated with the Phoenix Park Tunnel Branch Line. West of this underbridge on the southern side of the rail corridor, there is a truck rental company. The land use then gives way to residential development associated with Sarsfield Road, Woodfield, and Murray's Cottages. This area also hosts two features listed on the NIAH and on the Record of Protected Structures for Dublin City: Cleary's Pub and the Inchicore National School.

North of the corridor at Sarsfield Road Bridge there is a strip of open space, a horse sanctuary/field (opposite Truck Rental/Logistics company), before giving way to sparse planting. Further north is Con Colbert Road. The open green space associated with Liffey Gaels GAA club is located to the north-west and the open space associated with the National War Memorial Gardens to the north-east.

2.8. Utilities

The area contains a significant number of utilities typical of an urban environment such as this. Service providers with network assets in this area include the following:

- ESB Networks
- Gas Networks Ireland
- 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
- Private water supply pipe (possibly Irish Rail owned)

Data in the form of utility service records have been gathered from all providers in the area. The majority of services are present at road level, most of which are following the road alignment to pass under the railway at this location.

The Creosote Stream is located directly under the abutments of this bridge, the stream flowing in a north-easterly direction. The majority of services in the road are crossing above this culvert and hence are at a shallow depth below the road/footpath surface level.

As many of the services are located within the existing street at this location, piling works required for modifications to the existing bridge will be responsible for the majority of diversions in this area. The proposed design will avoid impacting road levels which will reduce the number of diversions required.

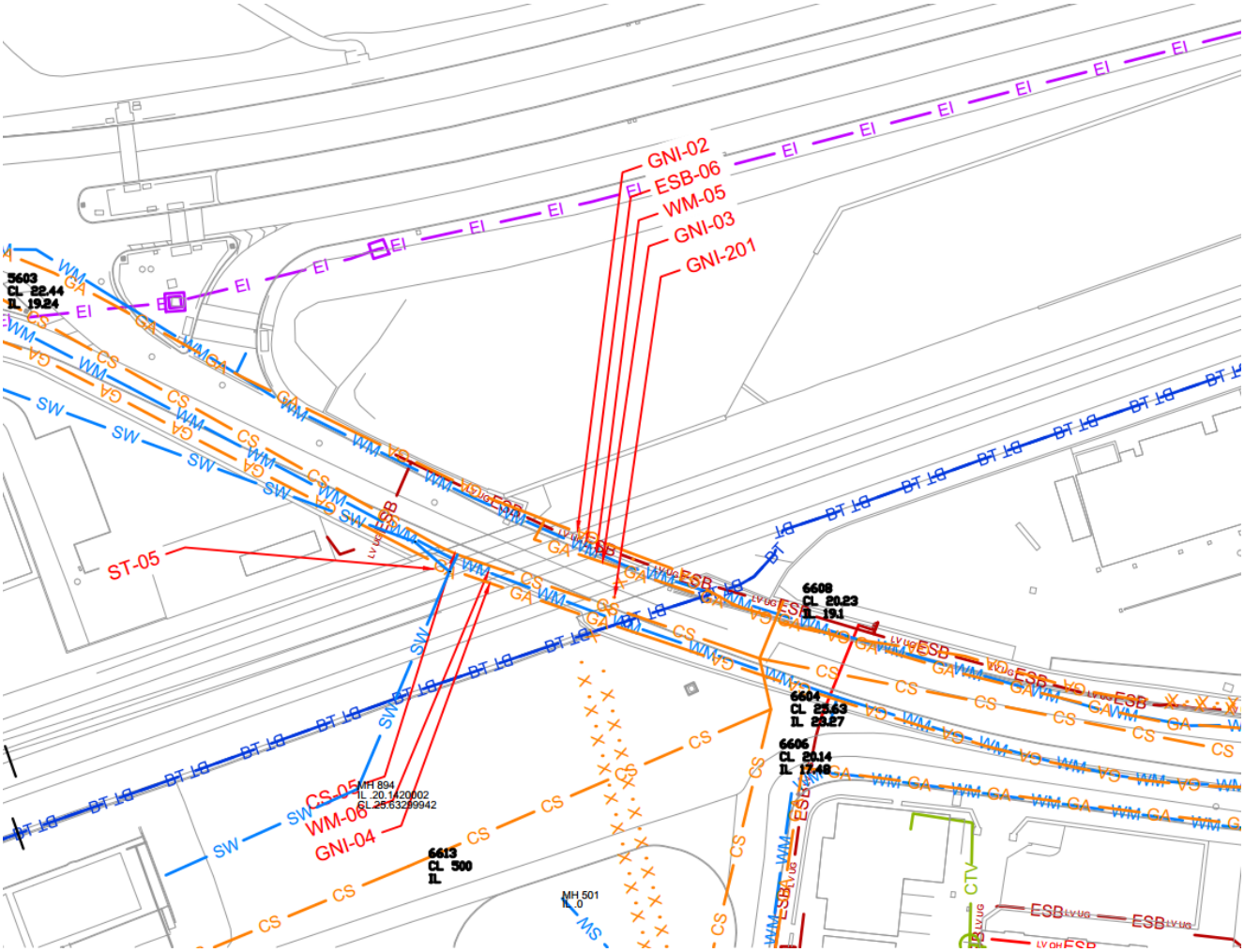


Figure 2-18 Existing Utilities at Sarsfield Road Bridge (UBC4)

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:

- Four tracking Park West to Heuston.
- Electrification of DART+ track
- Electrical clearance to structures
- Keep current functionality of existing roads and services/utilities (electricity, gas, water, etc)
- Track alignment and drainage requirements (in accordance with their respective standards).

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 proposed that a standardised approach to electrification will be adopted, but those area-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 to Relocatable Equipment Buildings (REB), Location cases and Object Controllers where required along the route in order 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.

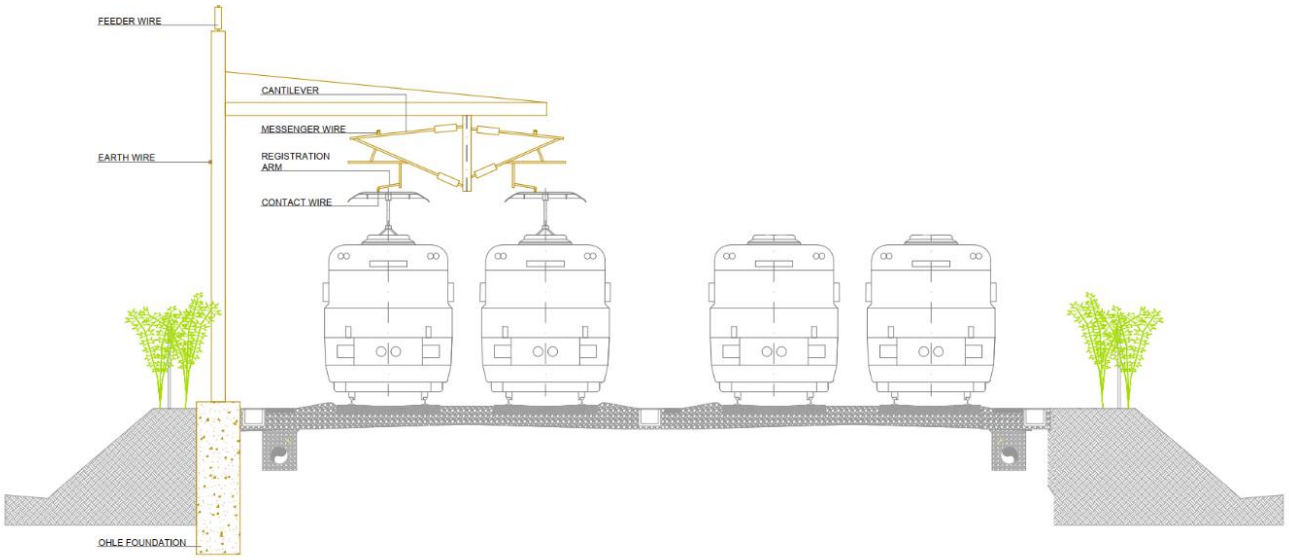
3.2.1. Electrification System

The Overhead Line Equipment (OHLE) system architecture is currently being developed. The DART wide programme will adopt a 1500V DC (Direct Current) 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 four track open route.

In 4 no. track areas, Two Track Cantilevers (TTCs) will generally only be placed on the north side of the line, to support OHLE on the northern two tracks. 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.

Figure 3-1 Typical OHLE arrangement in four track open route – Facing East

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.

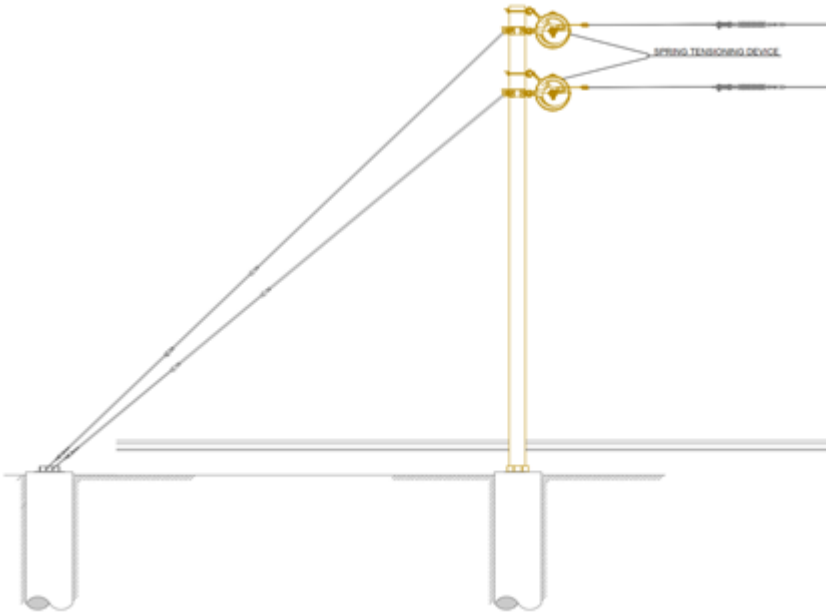


Figure 3-2 Typical anchor structure

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 high-voltage substations on the DART+ South West scheme, but none of them fall witin 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 constraintsrelate to the proximity of the truck rental/logistics company to the south of the corridor as well as the residential development, also to the south. From a landscape perspective, the War Memorial Gardens is a designated area. The Sarsfield Road Bridge (UBC4), although not protected, is noted as part of the Dublin Industrial Heritage associated with the Phoenix Park Tunnel Branch Line. 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 terrestrial and freshwater habitats have been carried out to date.

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. Stakeholder feedback from PC1 noted that almost all of the highlighted Architectural Heritage lies within the Kilmainham and Inchicore area and that due recognition and preservation of these sites is upheld while works are ongoing.

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 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 has reiterated the presence of local education facilities including Inchicore National School and Gael Scoil Inse Chór. Further issues or concerns raised during PC1 are described in the **Public Consultation No. 1 Findings Report, Volume 4**.

4.2. Roads

The existing clearance from the road surface to the soffit of the bridge is signed as 4.37m. The existing underpass approach road gradients are 3.5% (approx.) and 4.75% (approx.), to the north and south, respectively. Any extension of the bridge footprint to the north or south, to accommodate the additional track, would require either track raising/changes to bridge structural depth or lowering of the roads. It should be noted that taking into account impact on utilities and road network from any changes to road levels, this option will not be feasible. Hence our preferred option presented later in the document is to raise the decks and associated tracks.

The culvert beneath the road at the existing Sarsfield Road Bridge (UBC4) location is the main impediment to being able to lower the road. There are also several utilities located in the carriageway and footpaths that also cross above the culvert at depths that are not considered preferable for utility companies; these utilities also constrain the ability to lower the road in order to improve structural clearance for vehicular traffic.

The existing road cross-sectional widths between the bridge abutments provide limited opportunity to improve the safety for cyclists and pedestrians.

4.3. Property

The density and proximity of the residential properties along the south side of the rail corridor is a major constraint in terms of achieving the four-tracking requirements by adding the additional track to the south side of the corridor. Please refer to Property Boundary lines on the Bridge and Permanent Options Drawings in **Appendix B Supporting Drawings**.See **Figure 4-1** for the residential and commercial property locations in the area.

Figure 4-1 Residential and Commercial Property Locations in the Area

4.4. Permanent Way

Details of existing rail corridor widening constraints in the area are demonstrated in **Table 4-1.**

Table 4-1 Details of the constraints to install the 4 no. tracks along the area

ID	Name	Description
1	Existing width of the railway corridor	The existing width of the railway corridor is not adequate for the installation of an additional track.
2	Existing masonry retaining wall	Any modification to the existing retaining wall on the south would involve a major reconstruction of the wall and a possible impact on the properties.
3	Chapelizod Bypass	The widening of the railway corridor to the north for the additional 4th track is constrained by the Chapelizod Bypass.
4	Safety and Maintainability	The existing alignment contains areas of insufficient clearance to structures (retaining walls). The new design should consider the provision of adequate horizontal clearances for safety and maintenance inspections. This requirement is a constraint.
5	Track alignment in the area	The alignment design must be compatible with that in adjacent areas around the Inchicore Works and Memorial Road.
6	Track levels at Sarsfield Road Bridge (UBC4)	The track levels on Sarsfield Road Bridge must be compatible with the rail levels at Khyber Pass Footbridge (OBC5) due to their proximity.
7	Sarsfield Road	The embedded slab track system does not make it possible to modify the track geometry through the bridge. Modifications in levels or horizontal positions of the rails would require reconstruction of the bridge deck.

The clearance requirements for the positioning of new/renewed track from property boundaries are shown in the **Figure 4-2**. The space required for the installation of new property walls, OHLE masts and walkways are considered. **Figure 4-3** shows the rail corridor width.

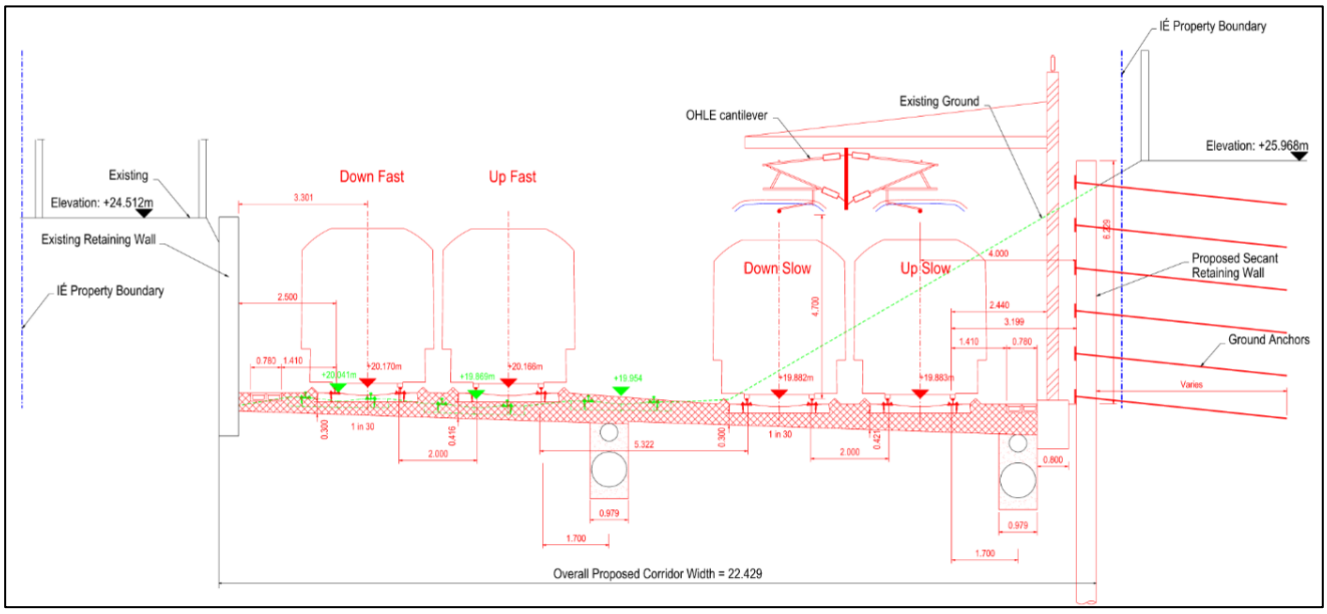


Figure 4-2 Minimum distance from property boundary to the nearest track – Facing West

Figure 4-3 Rail Corridor Width

4.5. Existing Structures

The existing Sarsfield Road Bridge (UBC4) structure, which currently carries 3 no. tracks, has insufficient deck width for placement of an additional track. A replacement structure option capable of carrying 4 no. tracks would be wider than the existing bridge. The soffit level of this bridge would be positioned at a suitable (higher) level where required so that the existing vertical clearance from the road below of 4.37m can be maintained. This, in turn, requires higher rail levels and vertical constraints on the Perway design. Options that include proposals to increase the span would require increased structural depth. This also imposes a constraint in terms of the vertical levels to road and rail at the structure. A non-ballast slab track design would minimise the structural depth required for any span considered.

A large culvert (river) runs beneath the structure from south-west to north-east. This is a constraint in terms of the foundation design for replacement bridge Options.

An additional track and/or realigned tracks on the approaches to UBC4 will impart horizontal forces on the back of the existing masonry retaining walls. As such the walls would need to be stabilised as required for these Options. The retaining walls are of historical interest and proposals that impact the walls need to be minimised.

4.6. Geotechnical

Based on the existing information, onerous ground or groundwater conditions are not anticipated throughout the area. A culvert carrying the Creosote River runs south-west north-east directly beneath Sarsfield Road Underbridge. This poses a constraint in terms of the foundation design for possible replacement bridge Options. There is insufficient room between the existing retaining walls and cutting slopes to place an additional track.

Where Options require additional horizontal space to place a 4th track in the northern cutting slopes, it is proposed that a cantilever retaining wall would be used for shallow cuttings (i.e. adjacent to horse sanctuary field) and a bored pile retaining wall would be used for deep cuttings.

Existing nearby walls, buildings, structures and earthworks may require monitoring (e.g. vibration monitoring) during piling of any new structures to ensure no structural damage is caused during construction to the proposed foundation construction works.

The condition of the existing masonry walls that support Sarsfield Road Bridge (UBC4) is unknown as is their ability to retain additional loads from the proposed railway onto the back of the wall. The existing retaining walls may need to be stabilised via ground anchors (at road level) to accommodate the additional horizontal loading from the new tracks. New retaining walls would be required to provide the necessary horizontal width for the railway.

4.7. Existing Utilities

The significant number of utilities in the area will be constraints during both the design and construction phases.

Most services are located at road level along Sarsfield Road. Any works to the abutments of this bridge will directly or indirectly impact (due to proximity) existing buried services. All services in the existing road corridor would need to be maintained or outage durations absolutely minimised. All existing utilities pose constraints to the area-wide options at this location. the nouth eastern bridge deck abutmnets will be piled behind the existing reatining walls and abutmnet. This will cause substantial vibrations in close proximity to exiting underground services. Temporary diversions will be required to relocate the services for the duration of the works.

5. Options

This section presents the options associated with the following elements in the Sarsfield Road Bridge to Memorial road area:

- Civil and OHLE infrastructure solutions
- Construction Compounds locations

5.1. Civil and OHLE Options

5.1.1. Sarsfield Road Bridge (UBC4)

The existing Sarsfield Road Bridge (UBC4) structure, which currently carries 3 no. tracks, has insufficient deck width for placement of an additional track. The potential intervention options are to either fully reconstruct the bridge with new decks or to endeavour to reuse the existing bridge and add a new adjacent deck to carry 1 No. additional track. The bridge span does not present an issue in terms of providing OHLE above it.

In addition, the bridge must be compatible with the permanent way solution through Inchicore and as previously mentioned the existing road to bridge soffit clearance is to be maintained as a minimum clearance for any proposal.

A total of 4 no. Options were developed for the area and were presented at PC1. The Options included 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, in this case, means that the design endeavours to achieve the project requirements with the lowest level of intervention required to achieve the four-tracking and OHLE requirements.

A summary of Options presented at PC1 as part of the Emerging Preferred Option Selection process is presented in the table below. A detailed description of each Option is included in **Section 5.2 Sarsfield Road to Memorial Road Corridor Options Description**. Please refer to **Section 5.4 Permanent Way (All Do-Something Options)** for a description of the permanent way Options for the area (that are compatible with the bridge Options referred to in **Table 5-1**).

Table 5-1 Options Summary

Option	Description
Option 0: Do Nothing	The existing infrastructure remains unchanged. There are no interventions.
Option 1: Do Minimum	This option proposes to reuse the existing 3 no. tracks on the existing bridge and provide 1 No. additional track on a new bridge on the south side of the existing structure.
Option 2	This option proposes to replace the existing bridge with 2 no. new decks capable of carrying 4 no. tracks.
Option 3	This option proposes to retain the existing bridge (width of 2 no. tracks) and placement of ballast on top to become a ballasted bridge structure. A new bridge would be constructed on the southern side of the existing bridge (carrying 2 no. new tracks).

Except for Option 0 (Do-Nothing), there are some design disciplines that have technical features that are common to all Options (e.g. OHLE and Cable & Containment). Similarly, there are technical aspects that have been considered but are determined to have no (or insignificant) bearing on the development or selection of Options. To remove repetition among the Option descriptions, these issues are addressed at the end of the Option description section.

5.1.1.1. Option 0: Do-Nothing

The Do-Nothing Option proposes no changes to the existing road or rail infrastructure. The rail corridor would not be widened (inside or outside the Iarnród Éireann property boundary). The bridge deck horizontal constraints at Sarsfield Road Bridge (UBC4) would not be resolved; and accordingly, this option would not facilitate the inclusion of the additional 4th track. The project requirements would not be achieved.

5.1.1.2. Option 1: Do-Minimum

This Option proposes to reuse the existing 3 no. tracks on the existing Sarsfield Road Bridge (UBC4) and provide 1 No. additional track on a new bridge that would be located on the southern side of the existing structure. However, this option is not feasible as the rails on the existing bridge cannot be adjusted, and their current line and level are not compatible with horizontal and vertical permanent way design constraints for the area.

5.1.1.3. Option 2

This option proposes to replace the existing Sarsfield Road Bridge with 2 no. new bridges each carrying 2 no. tracks.

The existing bridge would be replaced with 2 no. new bridges, each carrying 2 no. tracks. The northern bridge would have a span of 14m (approx.) and positioned at the existing abutment location, while the southern bridge would have a span of 21m (approx.) and be positioned to the south of the existing abutments. Both bridges would be supported on piled abutments positioned behind the existing abutments and retaining walls. The decks would be supported on steel bearings. Each of the proposed bridges would have a width of 8.3m (approx.) and carry 2 no. tracks with a 1.4m (approx.) wide walkways on the outer side of each structure (see **Figure 5-1** and **Figure 5-2** for a cross section through one deck). The inner longitudinal beams would be steepled to prevent them from being climbed or used to cross the bridge (along span). The top of the existing retaining walls would need to be removed (in some localised areas) to allow for the construction of the new bridges. Anchoring of the retaining walls at the new bridge location is anticipated. This would be to counteract the destabilising effects of horizontal forces that would be imparted to the back of the walls due to the additional track and the realignment. Retaining walls would be required to support the track on the approach and departure to the structures to minimise land take requirements. The final alignment of the bridges, their spans and equally the deck type would depend on the Permanent Way solution in the area.

Road Analysis:

- Owing to the constraints previously listed, carriageway lowering is not being considered. Track raising along with revised superstructure design depths will be used to accommodate the necessary changes to achieve the same minimum signed clearance of 4.37m to highest carriageway level at bridge entry.
- During construction, traffic travelling south to north would be diverted via Memorial Road Bridge (OBC3); while traffic travelling north to south would need to be accommodated via the South Circular Road junction with Con Colbert Road (R148). If BusConnects' (Lucan and Liffey) schemes are implemented prior to DART+ South West (this project) then there would also be opportunity to divert north to south traffic via Memorial Road.
- The aim would be to replace the bridge using a short duration (weekend) track closure; resulting in a full road closure for the same or nominally longer period to allow for site preparation.

Utilities Analysis:

- Utilities diversions would likely be required to facilitate piling works for the new bridge structure; particularly to protect gas and electrical mains. There diversions may require localised temporary lane closures on approach to the bridge but at this stage the aim would be to avoid full underpass closure.

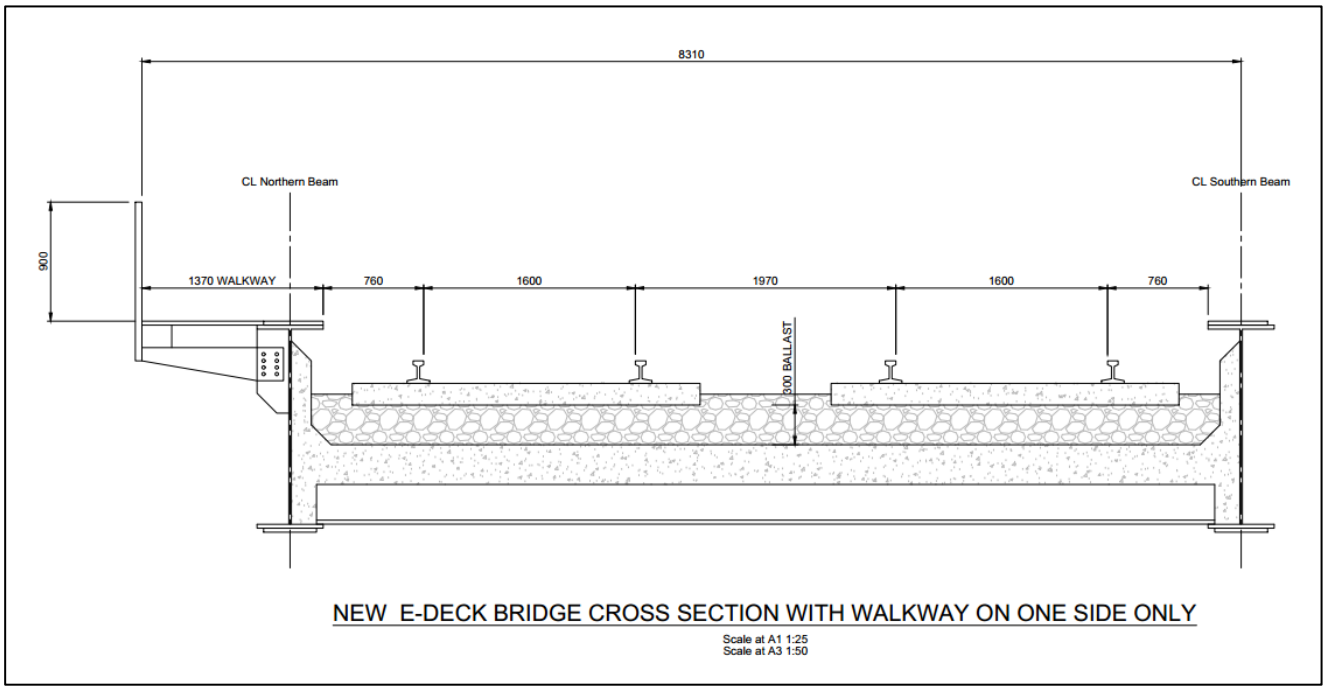


Figure 5-1 Typical cross-section of a ballasted track deck for one of two bridges

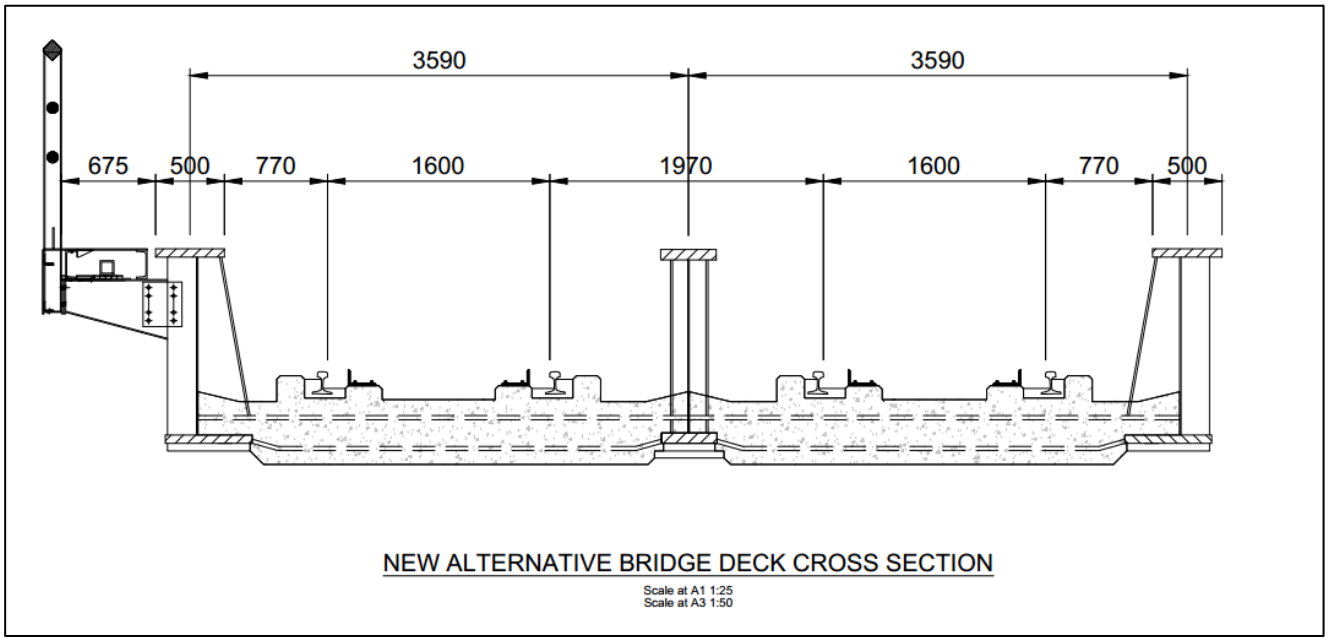


Figure 5-2 Typical cross-section of a slab track deck for one of two bridges – Facing East

5.1.1.4. Option 3

This Option proposes to retain the existing bridge and place 300mm depth of ballast on top with a new track alignment for 2 no. of the proposed realigned four track arrangement. A new E-type ballasted bridge carrying 2 no. additional tracks would be constructed to the south. However, the existing bridge would not be suitable to receive a 300mm depth of ballast and as such this Option is not considered feasible.

5.1.2. OHLE Arrangements (All Do-Something Options)

The length of the underbridge is such that OHLE structures can be positioned clear of the underbridge structure, to remove any requirement for OHLE fixings to the bridge.

The proposed bridge deck options include walkways, and for some options, a central girder. These would form standing surfaces which would need assessment for electrical safety clearances. These are expected to be compliant since the contact wire height at this location would be 4.7m.

The metallic elements of the reconstructed bridge are likely to require bonding in accordance with the project earthing and bonding strategy, which would be developed at a later stage in the design development.

5.1.3. Permanent Way (All Do-Something Options)

There are 2 no. Permanent Way Options for the area. In the Permanent Way Option 1, the widening would be to the north of the existing tracks, while in the Permanent Way Option 2 the track widening would be to the south. The differences between the options are related to the design alternatives at Inchicore Works (also to the north or to the south).

The Permanent Way Options proposals provide for a standard horizontal clearance interval between the Slow and Fast lines. For the Fast lines on the south side of the corridor the vertical alignment would not be significantly changed to reduce potential interventions required in the area east of Sarsfield Road Bridge (UBC4) and to integrate with the track configuration on the approach to the Inchicore Works. For the Slow lines to the north side there will be a requirement to lower the tracks on the approach to Memorial Road Bridge (OBC3), in order to provide the necessary electrical clearances under the bridge.

For all intervention Options, the track formation would be completely renewed. It is proposed that a new track drainage system would be installed and connected to a proposed attenuation facility located near Heuston Station, before discharging to the River Liffey. The drainage design will be developed at a later stage of design development.

5.1.4. Geotechnical (All Do-Something Options)

All engineering options (excluding Bridge Option 0) require some form of four tracking and electrification and will require a detailed geotechnical design for the following elements:

- Earthworks and track-bed formation design for new tracks
- Overhead Line Equipment foundation (preliminary) design

For Bridge Options 1 through to Option 3 (inclusive), any new bridge or existing bridge modifications would also require detailed geotechnical design.

The proposed structural elements that require detailed geotechnical design include:

- New bridge abutment piles and/or new decking and wingwall modifications (e.g. ground anchors to retain existing retaining walls).
- New retaining wall designs along with much of the northern and southern boundary of the railway. The retaining walls would be required to provide the necessary horizontal width for the four-tracking. These are likely to be a combination of reinforced cantilever retaining walls and bored pile retaining walls.
- Existing nearby walls, buildings, structures, and earthworks may require monitoring (e.g. vibration monitoring) during any nearby piling works for new structures to ensure no structural damage or instability is caused.

- New earthworks or retaining walls likely to require encroachment on land outside the existing southern railway boundary to the east of Sarsfield Road Bridge (UBC4) to accommodate the new alignments.

5.1.5. Roads and Bridges (All Do-Something Options)

All Options would require the provision of new lighting under the bridge to replace existing lighting; the specification of which would be agreed with Dublin City Council.

All Options would require discussions with BusConnects to co-ordinate implementation programmes where possible, as well as the sequencing of this bridge construction with respect the interventions proposed at Memorial Road Bridge (OBC3) and South Circular Road Junction, respectively.

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

All Do-Something Options would require the relocation of a variety of track side service cables, utilities and containments throughout the area.

5.2. Construction Compounds

One Construction Compounds is required at the vicinity of Sarsfield Road Bridge (UBC4).

- Sarsfield Road

5.2.1. Sarsfield Road

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

The Sarsfield Road compound consists of 3No. discrete sites proposed to facilitate the bridge reconstruction, underground attenuation tank installation, and localised works in the rail corridor. The general principle is to provide access to each corner of a bridge where it is being replaced.

The Dan Ryan Truck Rental site which is located on the south side of the corridor, adjacent to Sarsfield Road Bridge will be potentially impacted by the works in this area, primarily due to the widening of the rail corridor, as such, the site has been identified as a potential location for a construction compound. This site would provide access to the works on the South East corner of the Sarsfield Road bridge and the boundary wall to the south of the corridor. A crane platform will be required to accommodate a crane which will be used to move materials to their permanent locations including the installation of bridge beams.

To the south west of the bridge is an existing flat grassed area and is required for access to the works on the south west of the bridge and for craning in of bridge beams. This is area will be used to provide site offices, welfare facilities and storage, this section of the construction compound extends to the east to facilitate construction of the new underground attenuation tank.

The area to the north east of the bridge provides access to that corner of the bridge, although some works would be required to gain access, this area is constrained by private property to east.

The north west corner is constrained by private property and would necessitate significant works to provide suitable access, as such it has been ruled out. See **Figure 5-3** and **5-4** for Location and Alterative Access Roads respectively.

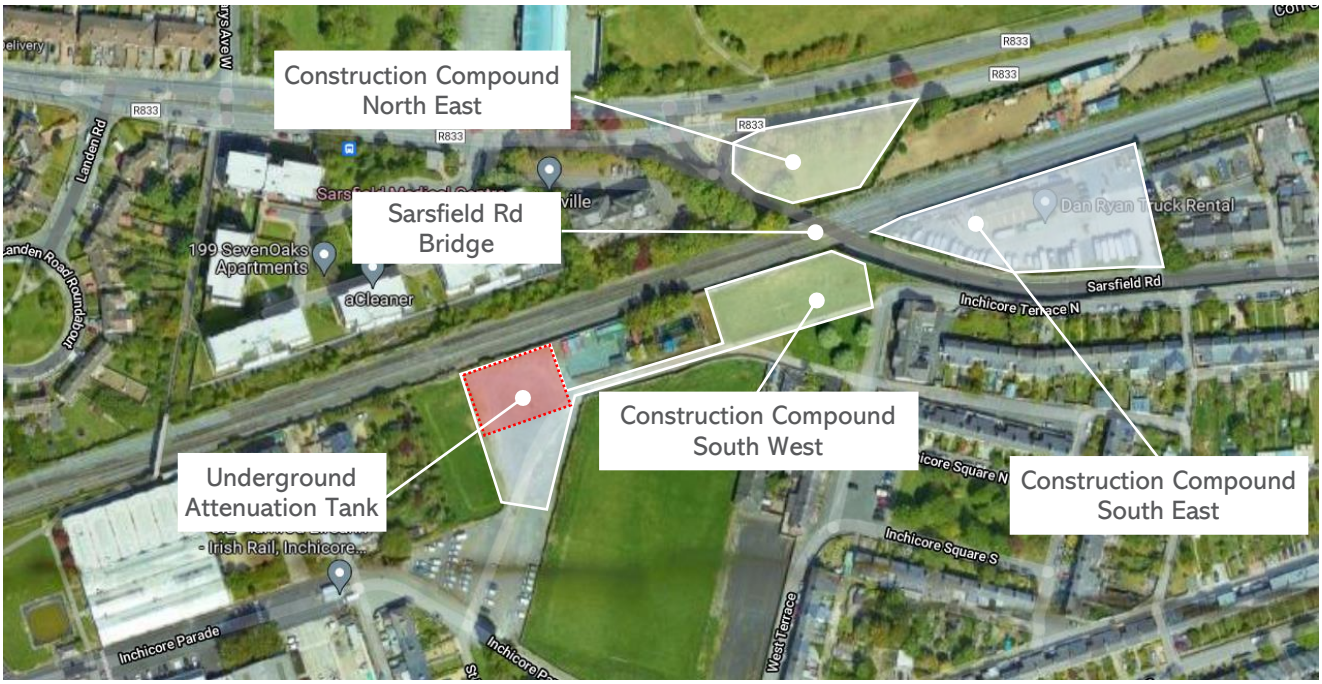


Figure 5-3 Sarsfield Proposed Construction Compound Locations

Figure 5-4 Alternative Access roads

Construction traffic can travel through the Inchicore Depot to Inchicore Terrace, Sarsfield Road, and on to Con Colbert Road. However, Inchicore Terrace is quite narrow, so an alternative is to travel through the Inchicore Depot to Jamestown Road, Kylemore Way, Kylemore Road to the Naas Road.

6. Options Selection Process

6.1. Option 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, 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 asess the options associated with the following elements:

- Civil and OHLE at Sarsfield Road Bridge (UBC4)
- 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 length of the section under consideration covers 470m (approx.) and extends from West of Sarsfield Road Bridge (UBC4) to the West of Memorial Road Bridge (OBC3). A total of 3 no. Options were initially developed for this area.

The options assessed for selecting the Preferred Option for the corrdior between Sarsfield Road and Memorial Road, 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.

Where the sifting results in only one feasible option being retained, it is not required to complete a multi-criteria analysis (MCA) on that one option.

6.1.2. Stage 2: Multi-Criteria Analysis (MCA)

Stage 2 Multi-Criteria Analysis (MCA) comprises a detailed multi-disciplinary comparative analysis of those options which passed through Stage 1: Preliminary Assessment (Sifting).

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

6.2.1. Stage 1 Sifting

The 'Do-Something' Options in this area involve the widening of the existing rail corridor to accommodate the required 4 no. tracks. Widening of the rail corridor is proposed on the north and south sides of the existing tracks to minimise impact on the private residential and commercial properties located on the southern side of the existing rail corridor. Existing structures in this area were analysed to determine if they could accommodate the additional tracks and installation of the new Overhead Line Electrification (OHLE) system.

The restriction to OHLE clearances is minimal in the area and are mainly posed by the existing signalling gantry; while the main horizontal constraints to four-tracking (as previously mentioned) are the adjacent properties and the Permanent Way boundary retaining walls. The proximity of the area to the adjacent Inchicore yard tie-in poses the greatest constraint to variability of vertical profile changes and along with the existing Sarsfield Road (with its associated under carriage utilities/drainage) this poses a further constraint to achieving a preferred underbridge clearance through road lowering; however the existing bridge clearance under the track is considered a minimum acceptable clearance).

Table 6-1 and **6-2** 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 Project (see Appendix A). Sifting construction site locations are done separately. See **Section 6.3.2 Construction Support Sites (CSS).**

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 the selection of the Preferred Option for the project corridor

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.
		four-tracking Park West-Heuston	FAIL. No intervention proposed. four-tracking is not achieved.
		Electrification of DART+ tracks	FAIL. No intervention proposed. Electrification of the DART+ tracks not achieved.
		Vertical electrical clearance in structures	PASS. Vertical electrical is achieved as it is an Underbridge.
		Bridge Design Standards	Not applicable. No intervention proposed.
		Keep current functionality of roads	PASS. 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. No issue.
		Geometrical fitness for intervention	FAIL. Reusing the existing tracks at their current line and level is not compatible with Perway vertical and horizontal design constraints.
		Safety	PASS. No issue.
		four-tracking Park West-Heuston	PASS. This option would achieve the 4 tracking.

Option	Requirements		Description
		Electrification of DART+ tracks	PASS. This option would achieve the electrification of DART+ tracks.
		Vertical electrical clearance in structures	PASS. Vertical electrical is achieved as it is an Underbridge.
		Bridge Design Standards	PASS. Noted that it is not proposed to increase 4.37m from road level to bridge soffit level.
		Keep current functionality of roads	PASS. Changes to the carriageway layout are not 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. It would be possible to construct this option.
		Geometrical fitness for intervention	PASS. No issues.
		Safety	PASS. No issues.
		four-tracking Park West-Heuston	PASS. This option would achieve 4 tracking.
		Electrification of DART+ tracks	PASS. This option would achieve electrification of DART+ tracks.
		Vertical electrical clearance in structures	PASS. Vertical electrical is achieved as it is an Underbridge.
		Bridge Design Standards	PASS. Noted that it is not proposed to increase 4.37m from road level to bridge soffit level.
		Keep current functionality of roads	PASS. Changes to the carriageway layout are not 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**
3	**Engineering**	Constructability	FAIL. Current structure not suitable for the amendments proposed.
		Geometrical fitness for intervention	PASS. No issues.
		Safety	PASS. No issues.
		four-tracking Park West-Heuston	PASS. This option would achieve 4 tracking.
		Electrification of DART+ tracks	PASS. This option would achieve electrification of DART+ tracks.
		Vertical electrical clearance in structures	PASS. Vertical electrical is achieved as it is an Underbridge.
		Bridge Design Standards	PASS. Noted that it is not proposed to increase 4.37m from road level to bridge soffit level.
		Keep current functionality of roads	PASS. Changes to the carriageway layout are not 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**

The following options did not meet the necessary Engineering Feasibility and Project Requirements and were not brought forward to Stage 2 (MCA) of the assessment process:

- **Option 0** - The Do-Nothing Option proposes no changes to the existing road or rail infrastructure, as such, this option would not facilitate the inclusion of the required 4 no. tracks or the installation of the OHLE system. The project requirements would not be achieved as such this option was not brought forward.
- **Option 1 -** This Option proposes to reuse the existing 3 no. tracks on the existing Sarsfield Road Bridge (UBC4) and provide 1 No. additional track on a new bridge on the south side of the existing structure. However, this option is not feasible as the rails on the existing bridge cannot be adjusted, and their current line and level are not compatible with horizontal and vertical Perway design constraints for the area.
- **Option 3 -** This option proposes to retain the existing bridge and place 300mm depth of ballast on top with a new track alignment for 2 no. tracks. A new E-type ballasted bridge carrying 2 additional tracks would be constructed to the south. The existing bridge is not suitable to receive a 300mm depth of ballast and as such this option is not feasible.

Table 6-3 Summary of Sifting Process Results

Main Option	Result	Brought forward to MCA
Option 0: 'Do Nothing'	FAIL	No
Option 1: Do Minimum	FAIL	No
Option 2	PASS	YES
Option 3	FAIL	No

Table 6-3 summarizes the assessment completed as part of the Sifting Process, a total of 3No. Main Bridge Options were developed for the area. Following the assessment completed as part of the Sifting Process, as shown in the table above, 1 No. Option; namely Option 2 was shortlisted.

However since there is only 1 No. Option being brought forward for the bridge, the Options Selection Process was completed at Stage 1 – Sifting. The Preferred Bridge Option for the area is therefore Option 2 and **Section 7 Preferred Option Design Development** describes in detail the preferred option.

6.3. Construction Compounds

The works are taking place in a spatially constrained location, the proposed location for the Construction Compounds are the only ones with available space in this area. The construction compounds are required to serve the localised works in this area. As no other suitable alternative locations in the area were identified through the option development process, the selected construction compound locations did not require multi-criteria analysis.

7. Preferred Option Design Development

7.1. Review of Preferred Option

The baseline information or outcomes of design development since PC1 (inclusive of stakeholder input) have not materially affect any of the previously assessed options outlined in **Section 5 Options** and **Section 6 Options Selection Process.** As such, Option 2 has been validated, and its design progressed as the Preferred Option.

An updated topographical survey was received after PC1, the latest survey data showed a slight difference in vertical height data from the previously available data. This new information has been assessed and it has not materially impacted the previously assessed options, as such Option 2 remains the preferred option.

7.2. Review of Stakeholder Feedback

Public feedback acknowledged that the project would give commuters options when travelling, which in turn would reduce the numbers of single occupancy vehicles on the roads, causing less congestion and less air pollution. The Liffey and Lucan Bus Connects schemes in particular will improve public transport access, vulnerable user safety and directness as well as noise and their scope will implemented under their own projects.

The width of existing road corridor in the location of the works is limited by the existing historically significant stone masonry retaining walls/bridge abutments. The width between the existing abutments is insufficient to improve the status quo of existing footpath widths and any cycle segregation.

The current scope of this project is to improve the DART+ South West rail network as part of the overall DART+ Programme; and not a road traffic improvement project unless the projects reinstatement works can include improvements (as in the case of Le Fanu, Kylemore, Memorial Road and possibly South Circular Road). The project is geographically constrained which generally allows for limited temporary improvements in the same. The phasing of the proposed new decks and piling of abutments has been proposed to reduce the impact in the temporary state. (refer to **Section 8.6 Temporary Traffic Management**).

7.3. Design Development

The following sub-sections provide greater clarity on the development of the design of 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

The previously mentioned constraints on vertical and horizontal geometry selection as well as the need to achieve at the very least the existing road clearance resulted in the southern deck of the bridge shifting a little further south from that represented in PC1. Owing to the cant in the line (the track section being on a curve) the northern deck is nominally higher than the southern deck. See **Figure 7-1** and **Figure 7-2** for a general arrangement of the bridge and the longitudinal section representing the southern deck. Drawings DP-04-23-DWG-ST-TTA-57140

to DP-04-23-DWG-ST-TTA-57144 are representative for Option 2, and are included in **Appendix B Supporting Drawings.**

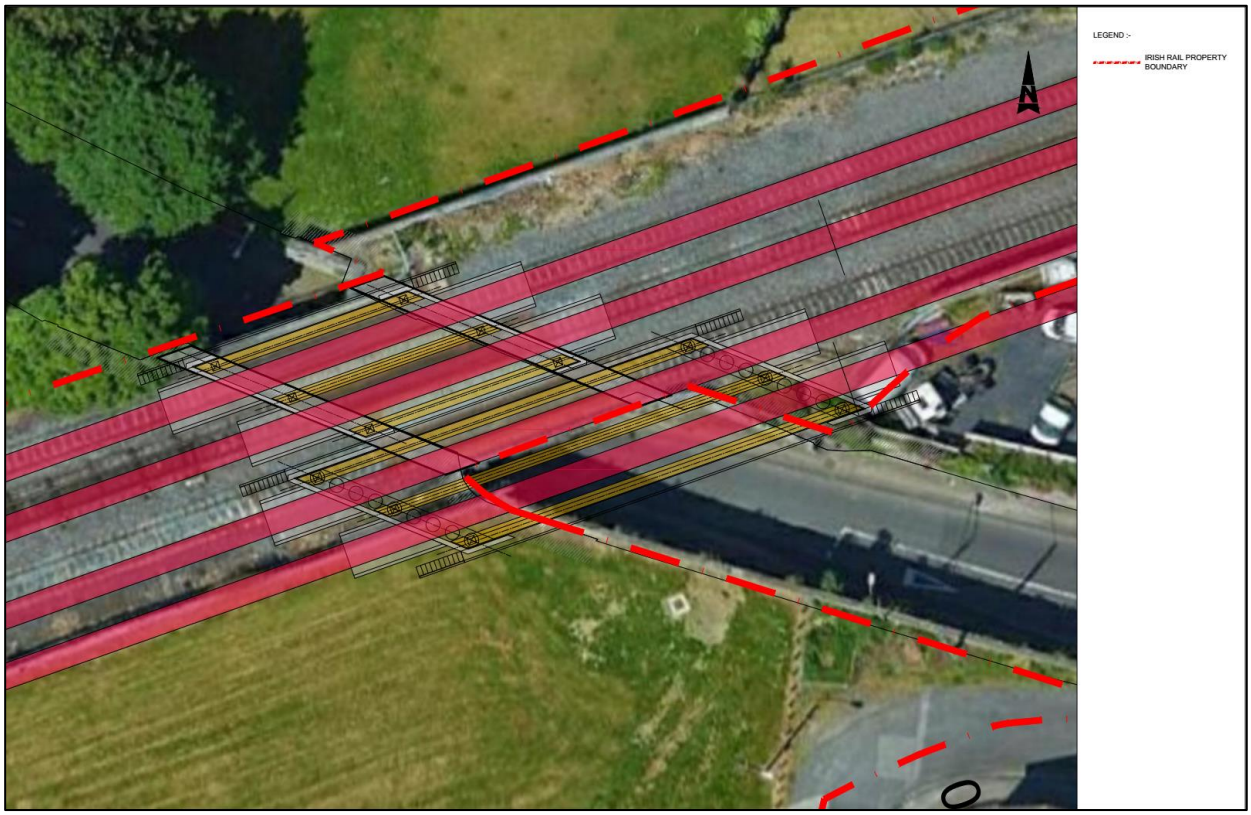


Figure 7-1 Sarsfield Road Bridge (UBC4) General Arrangement

Design development has focused on providing a bridge structure that facilitates (as a minimum) the existing clearance over Sarsfield Road, safe operational access across the bridge. Summary of the proposed bridge details:

- Proposed Bridge Type = Steel Portal Frame and with permanent formwork for in-situ concrete (slab track) Deck. With associated transition zones from ballasted track.
- Proposed Bridge Deck North Span (incl. Abutment) Length = 15.5m (Approx.)
    - Northern Deck seated on set of bearings located on new raised plinths doweled into existing seating beam and existing abutment
- Proposed Bridge Deck South Span (incl. Abutment) Length = 26.51m
    - Southern Deck seated on set of bearings located on new seating/capping beam for the new piled wall abutment located behind existing masonry stone wall abutment,
- Proposed Bridge Northern Deck Width (incl. steel portal frame and inspection walkway) = 8.52m
- Proposed Bridge Southern Deck Width (incl. steel portal frame and inspection walkway) = 9.32m
- Proposed Bridge Slab Depth = 0.55m
- Proposed Parapet Height = 1.5m

See **Figure 7-2** for a Bridge Longitudinal Section of Sarsfield Road Bridge.

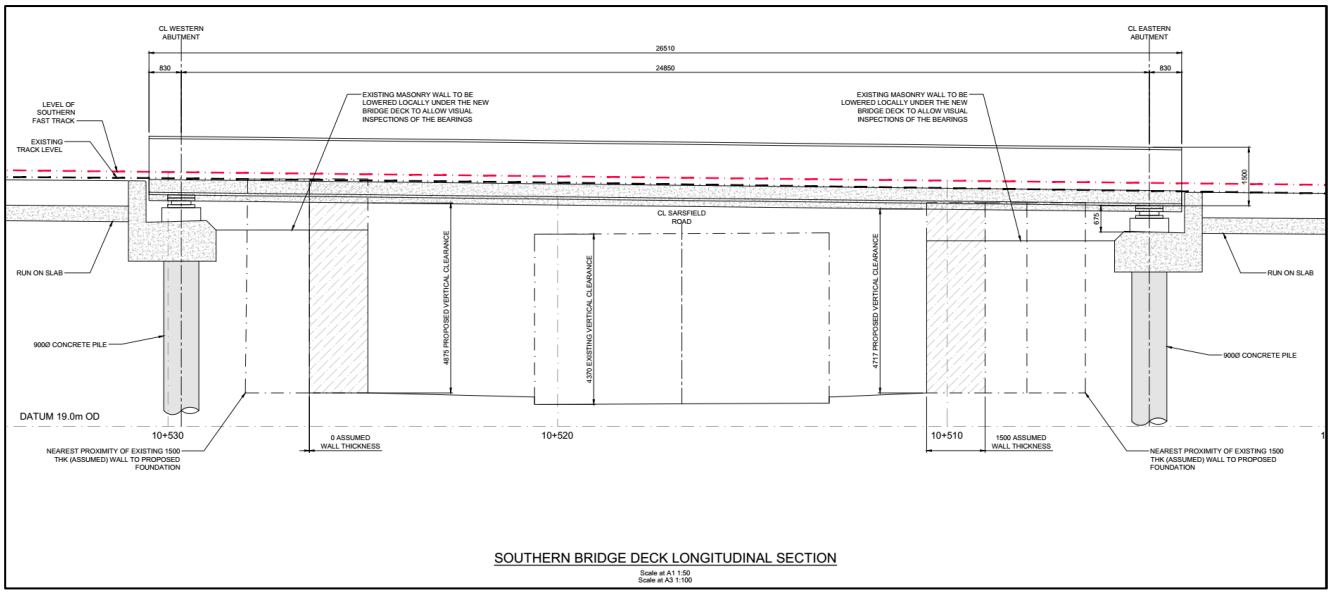


Figure 7-2 Sarsfield Road Bridge (UBC4) Bridge Deck Longitudinal Section - Facing North West

There are currently a number of options being evaluated for replacing walls at the top of the existing road stone masonry retaining walls; in the immediate vicinity of the south eastern bridge deck. This would be to reinstate and tie the existing walls back into the bridge deck parapets.

As the aesthetic character of this wall is an important factor, a number of finishes are being considered. These include introducing patterned concrete formers to replicate the existing masonry parapets currently in place, see **Figure 7-3**. There a many different finishes available to use and the panels can be coloured. See below some examples.

Figure 7-3 Abutment, Retaining Wall, 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 7-4**, or to retain and repurpose the existing masonry.


Figure 7-4 Precast panels fully cladded with masonry

7.3.1.2. Retaining Walls

The over steepened nature of the existing cutting slopes, proximity of the adjacent domestic and agricultural properties and height of the cutting slopes to be retained, necessitates a piled wall solution with the inclusion of soil nails or ground anchors, and cantilever walls along both the north and south sides of the rail corridor east of Sarsfield Bridge towards Memorial Bridge.

To facilitate the widening along the northern and southern perimeters to form the northern (slow) and southern (fast) track cess edges and retain the slopes of the cutting, bored secant pile wall and cantilever wall solutions will be adopted for this section of retaining wall. The average retaining wall heights for the cantilever walls will be approximately 2.5 m, with the average height of the secant piled wall section close to Memorial Bridge being approximately 6 m.

An example of a typical section of the wall and finished wall are shown in **Figure 7-5**, **Figure 7-6** and **Figure 7-7**.

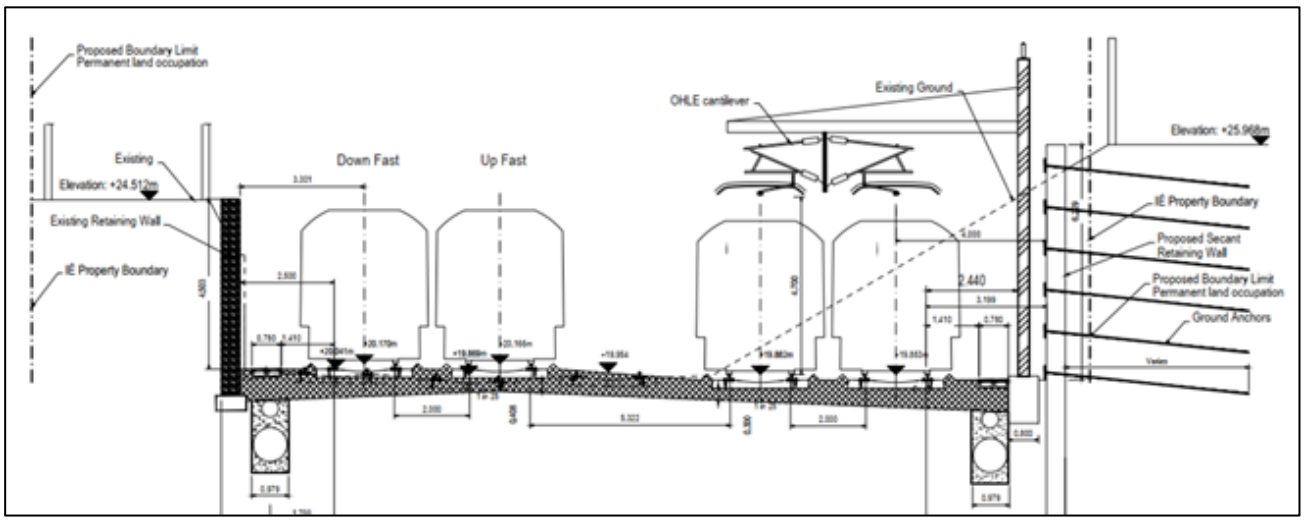


Figure 7-5 Con Colbert Road Retaining Wall & Ground Anchors – Facing West

Figure 7-6 Example of a Secant Wall

Figure 7-7 Examples of Retaining Walls

7.3.1.3. Signalling Cantilevers

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

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

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.

7.3.1.4. Track Bed Design

A new track bed design is required along this section. Bedrock has been indicated west of Sarsfield Road Bridge near elevation 9 m AOD, and to facilitate the track lowering, the new track bed formation shall be constructed consisting of subgrade, sub ballast and ballast.

7.3.2. Permanent Way

The proposed 4-track layout comprises 3 existing tracks that are being realigned along the corridor, plus the addition of 1 new track, resulting in the electrified Slow tracks (north) and non-electrified Fast tracks (south) layout shown in **Figure 7-8**. This is achieved by widening the corridor to the south to enable movement of the existing tracks to the south at the start of the section, with the additional fourth track also being situated on the south side

over Sarsfield Road Bridge (UBC4). This affects properties to the south of the corridor here, including Dan Ryan Truck Rental.

As we head 300m to the east, the new 4 track layout occupies the existing footprint of the 3 southernmost tracks, with the fourth track now occupying the north side – this continues on eastward until we reach Memorial Road Bridge (OBC3). As the new 4 track corridor widens to the north side here it cuts into the existing embankment.

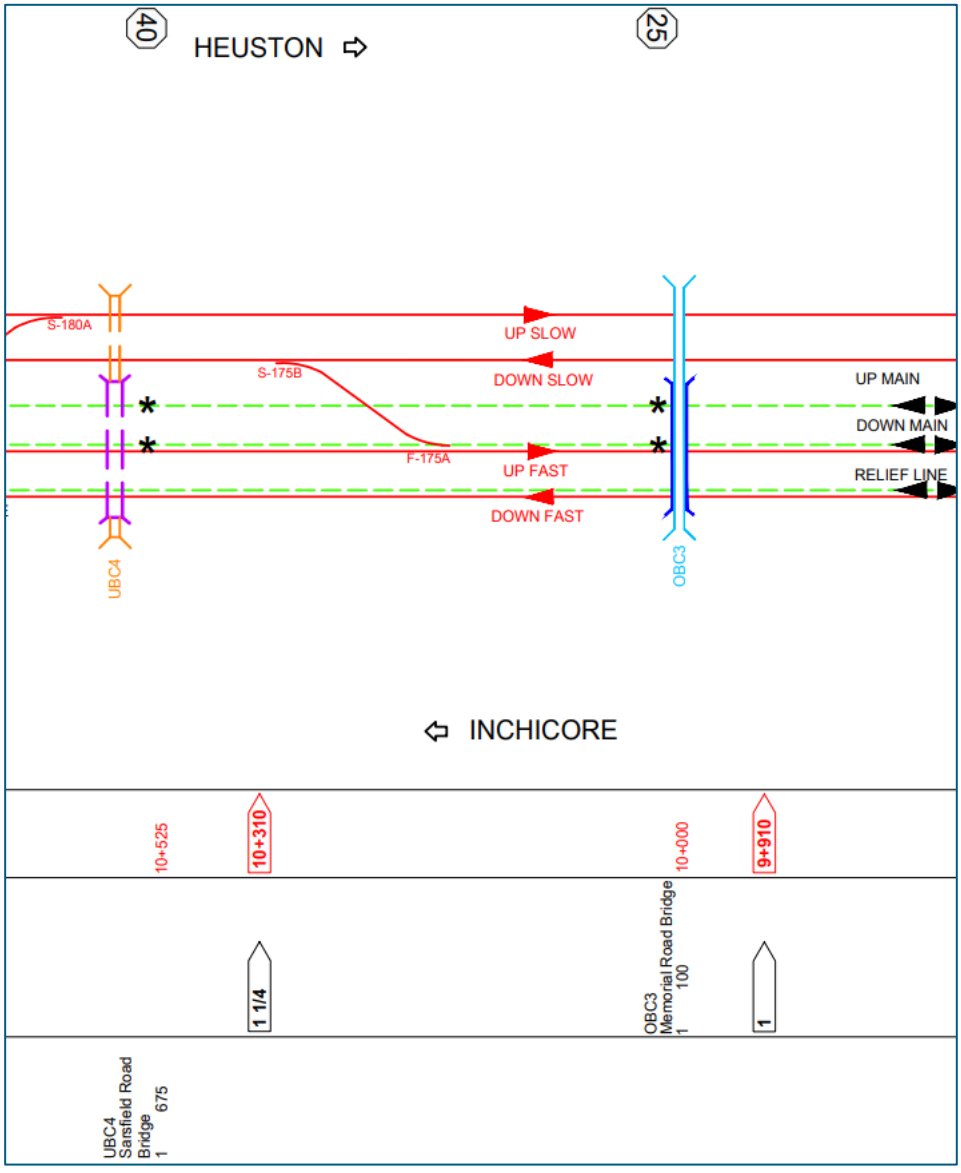


Figure 7-8 Sarsfield Road Bridge (UBC4) to Memorial Road Bridge (OBC3) – Track Plan Layout (new tracks = red, removed tracks = dashed green, structures = blue)

The horizontal layout of the tracks is set at a standard clearance interval of 3.58m between the Up Fast track and Down Slow track over Sarsfield Road Bridge (UBC4) that is maintained through the Down Slow to Up Fast crossover situated immediately to the east, before gradually widening on the approach to Memorial Road Bridge (OBC3) to an increased interval of 5.400m. This widening is to accommodate an intermediate retaining wall, needed due to the progressive difference in level between the Slow and Fast lines as we head further east towards South Circular Road Bridge (OBC1), described below.

Vertically, the Slow and Fast tracks are co-planar (at the same level and gradient) at the west end of this section, in order to accommodate the crossover spanning the Up Fast to Down Slow track interval immediately east of

Sarsfield Road Bridge (UBC4). This co-planarity also ensures that all 4 tracks are at the same level over the bridge; the gradient is 1.108% with nominal lifts of 200mm over Sarsfield Road Bridge (UBC4). As we head further east towards Memorial Road Bridge (OBC3) the Slow lines diverge vertically from the Fast lines, lowering in order to achieve the compliant contact wire height required for the Slow tracks.

Retaining walls are required to both the north and south sides of the rail corridor, which is in cutting to the east of Sarsfield Road Bridge (UBC4), as shown in **Figure 7-9** with a cross section of the corridor within the extents of the section covered by this report.

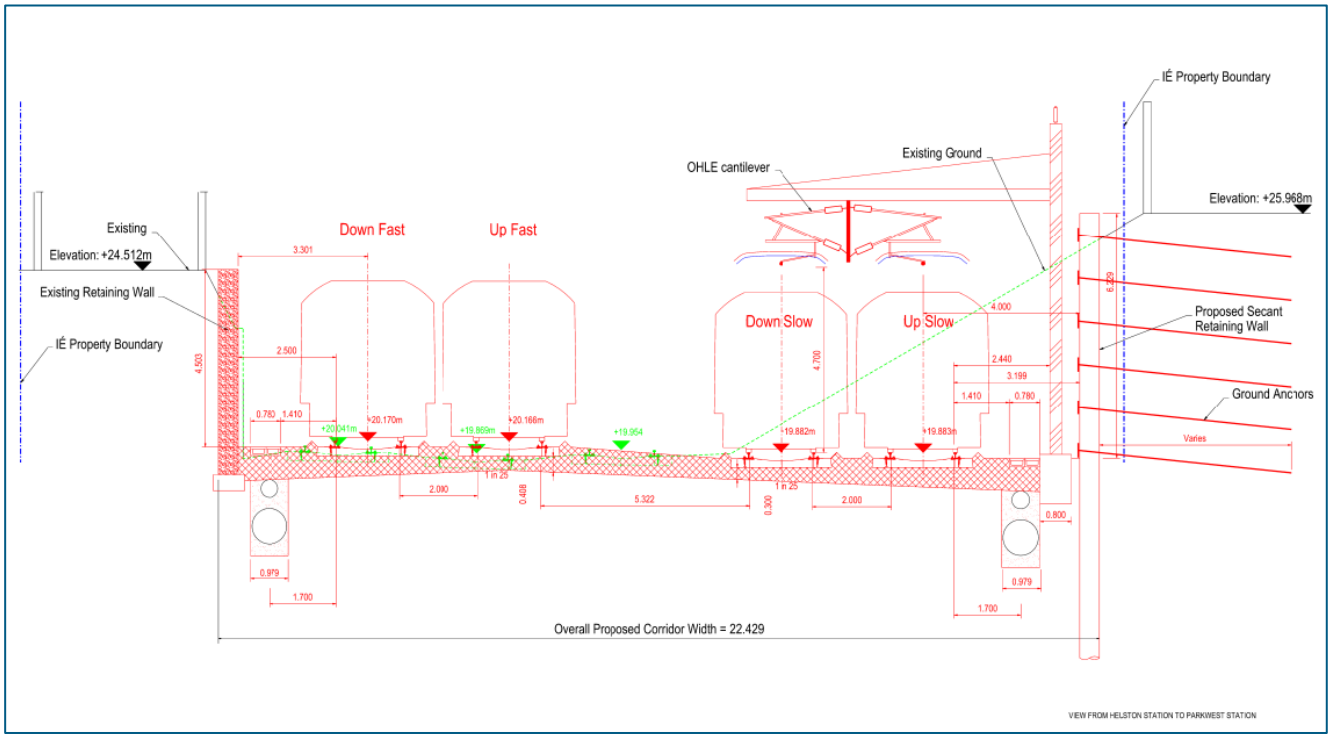


Figure 7-9 Cross Section between Sarsfield Road Bridge (UBC4) and Memorial Road Bridge (OBC3) looking West at CH 10+103 (400m to the east of UBC4)

7.3.3. 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**.

7.3.3.1. 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 proposed 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.

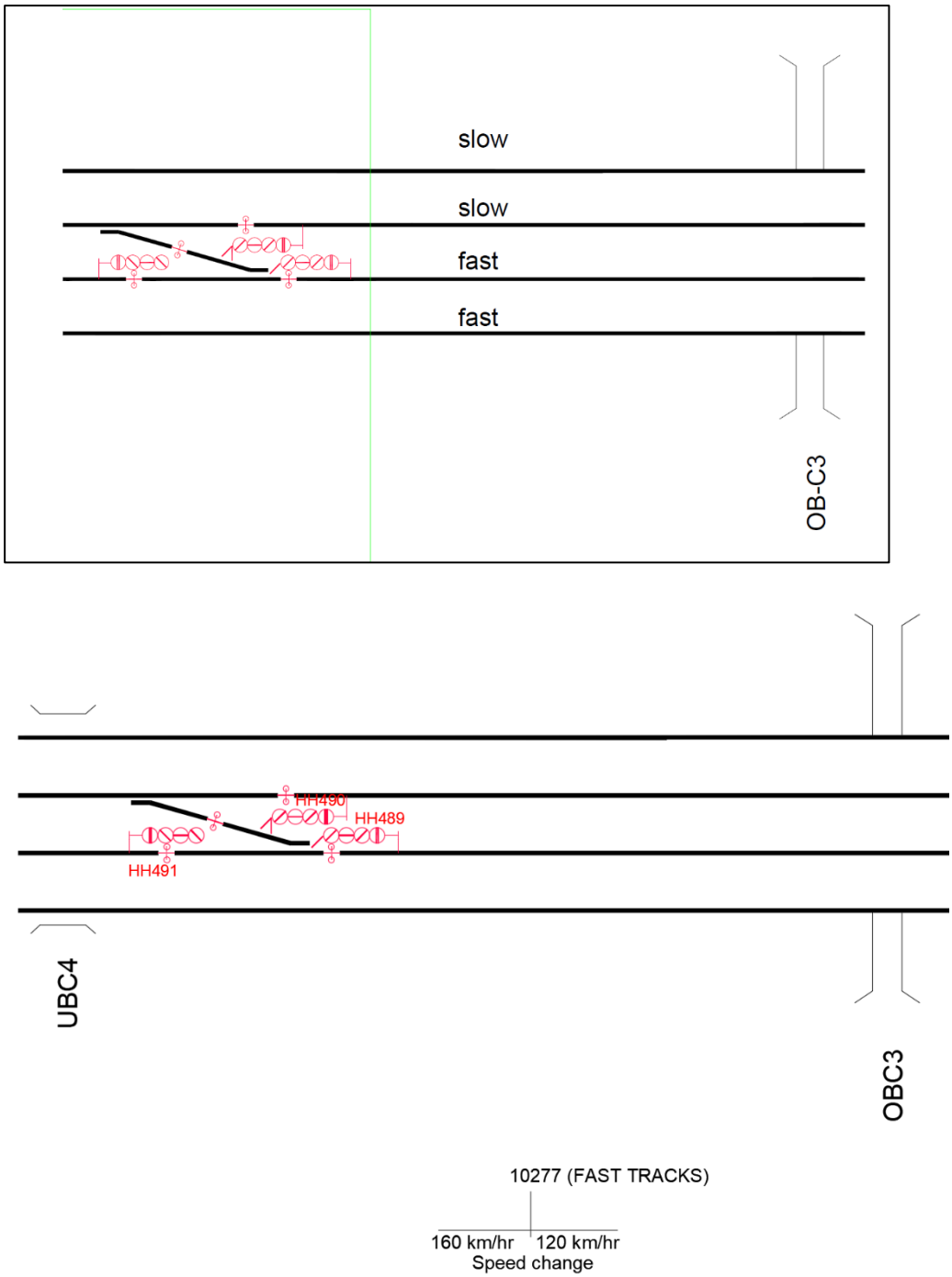


Figure 7-10 Signalling Scheme Plan (Sarsfield Road – Memorial Road)

Legend:

- 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 that no signalling distribution equipment is expected to be located within the existing IE land boundary to minimise the impact to the public. There will be trackside signal posts only locations being on finalisation of design schematic.

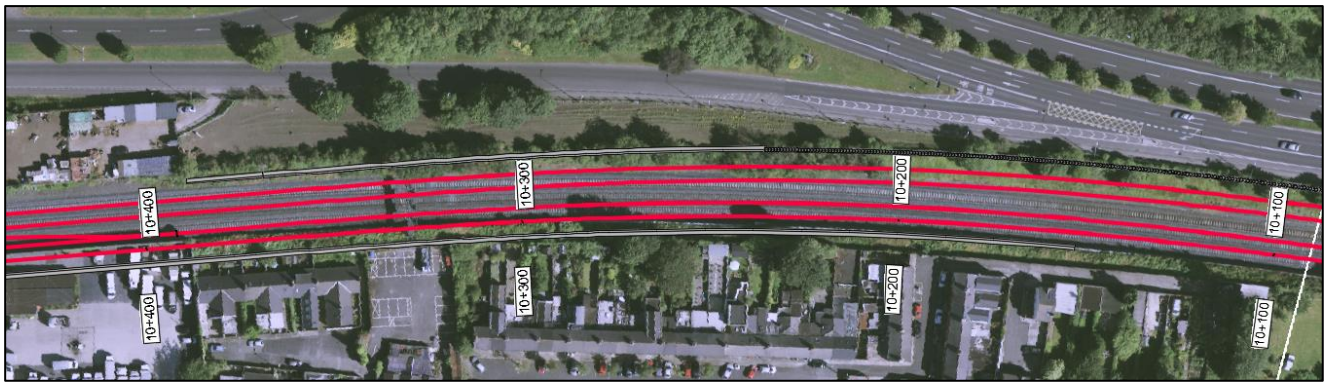


Figure 7-11 Signalling Infrastructure (Sarsfield Road – Memorial Road)

7.3.3.2. 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 Signal Post

7.3.3.3. Object Controller Cabinet (OBJ)

In the railway system, the movement of the train is controlled by an interlocking system. Such an interlocking system consists of different parts. From a logical perspective, there is a central device (computer) that controls and senses the condition of important equipment such as switches, signals, track circuits, etc. This equipment is collectively referred to as an object or rail side object. The equipment that handles the interface between the central device and the object is referred to as an object controller. A typical Object Controller Cabinet is shown in **Figure 7-13**. There are no Object Controller Cabinets planned for this section of the route.

Figure 7-13 Typical Object Controller Cabinet (OBJ)

7.3.3.4. 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 7-14**. There are no Location Cases planned for this section of the route.

Figure 7-14 Typical Location Cases

7.3.3.5. 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 7-15**), 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 7-15 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.**

7.3.3.6. Telecommunications

According to the current design, no Telecom Equipment Building (TER) is required for this area.

7.3.3.7. Electrification

Open route

The electrification equipment, in 4 track area between Sarsfield Road Bridge (UBC4) and Memorial Road, will be supported by TTC structures and STC structures where the OHLE to be terminated with anchor arrangement required in limited space, as detailed in **Section 3.2.1 Electrification System.**

Underbridges

The length of the Sarsfield underbridge is 21m in skew orientation, and less than 30m in orthogonal orientation, and so OHLE structures can be positioned clear of the bridge structure to remove any requirement for OHLE fixings to the bridge.

The proposed bridge deck options include walkways, and for some options, a central girder. These will form standing surfaces which will need assessment for electrical safety clearances. These are expected to be compliant since the contact wire height at this location will be 4.7m.

The metallic elements of the reconstructed bridge are likely to require bonding in accordance with the project earthing and bonding strategy, which will be developed during the detailed design stage.

7.3.4. Roads

The existing footpath to be reinstated due to localised utility diversion works, a number of utilites to temporarily diverted due the proximity of piling works associated the bridge abutment works. As a consequence of these temporary diversions, it is anticipated that a section of kerb and road surfacing reinstatement will be required in order to leave a uniform vehicular running surface and a pedestrian surface. (see **Figure 7-16**). Other works

associated with bridge replacement include the replacement of the existing underbridge lighting, with appropriate new lighting to the relevant standards.

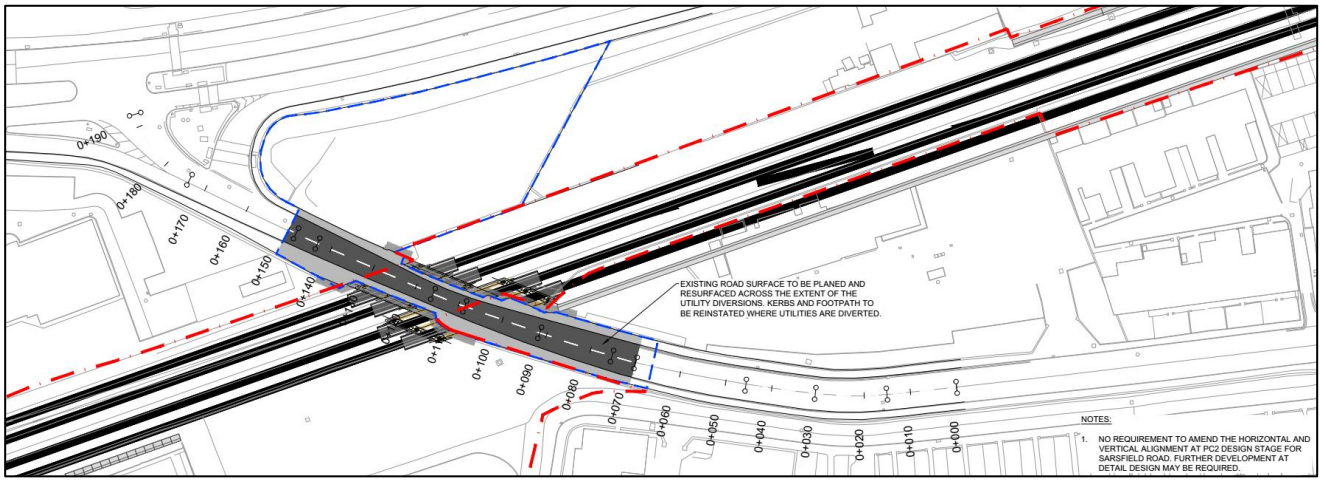


Figure 7-16 Sarsfield Road - Potential Area of Road and Footpath Resurfacing

7.3.5. Drainage Requirements

7.3.5.1. Road Drainage

As the majority of proposed road and footpath works is limited to resurfacing associated with utility diversion, there is no proposed change to the existing road drainage system. Where existing storm water ponding is associated with inconsistencies in the current surface grading, the anticipated resurfacing works associated with utility diversions may aid on resolving some of the drainage path inconsistencies that may exist. The existing gullies will be cleaned of all bridge and/or track related construction debris prior to road reopening but must be noted that it is not the remit of this project to improve the road drainage system if there are currently network flooding issues.

There are areas of the existing bridge that would currently drain through to the road, however the proposed bridge slab track is not currently proposed to discharge to the road level but rather discharge into the new track drainage system.

7.3.5.2. Track Drainage

The proposed track drainage system includes filter drains to collect runoff waters from the ballast and surrounding areas, and carrier pipes to convey collected runoffs to the proposed attenuation structure and discharge point, located at Liffey River. The proposed filter drains discharge into the collector pipes through manholes, which are to be spaced between 30 to 50 metres.

The drainage system for this track section consists of two main branches running parallel to the track beneath the ballast layer.

No track drainage attenuation structures are proposed in this section between Sarsfield Road Bridge and Memorial Road; as the retention tank and outfall point for the network draining this track length are located in the open area by Heuston West Station.

8. Construction

This section of the report sets out the approach in relation to the construction methodology for the works in the area between the west of Sarsfield Road Bridge (UBC4) and the next section 50m (approx.) west of the Memorial Road Bridge (OBC3).

8.1. Summary of the Proposed Works

This section of the railway corridor has to be widened to accommodate an additional track for the new DART+ service. However this too includes the relaying of the existing 3no. tracks in this area to improve horizontal track geometry. In addition, the 2No. northern tracks through this area (Slow Tracks) will be electrified. The cross section varies through this area but is predominantly in cutting, with property boundaries close to the top of the cut slopes to the south; while to the north it includes public open space, private greenfield livestock grazing and paddocks as well as a boundary with Con Colbert Road. Much like the adjacent section to the west, the proposed track levels are almost at grade in order to tie into the Inchicore works and to further limit the impact on private land.

8.2. Retaining Structures

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

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

8.2.1. Secant piled walls and contiguous bored piled walls

Secant and contiguous bored piled walls are constructed using a top-down method i.e. they are constructed through the soil and then the soil in front of the walls is removed. Large piling rigs are required to core large diameter holes through the soil using augers through soil and corers through rock. Once the soil is removed a reinforcement cage is lowered into the holes and concrete is poured. New piles are added to the side of the first to create a wall. Secant pile walls have continuous piles interconnected with each other and contiguous piles have gaps between the piles and are infilled between to create continuous support.

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

8.2.2. Cantilever Retaining Walls

Cantilever walls can be constructed by locally steepening the cut slopes. This will create the space for cast in place or precast construction. The working sites will require access for relatively heavy plant (small cranes, concrete trucks, dump trucks etc) and it is anticipated that this will be done by means of a bench at 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.

8.2.3. Soil Nailing

Soil nailing is a top down walling method. From the top, soil is excavated over a short height. The surface of the excavation is spray concreted if needed, with steel mesh placed in position. 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.

8.2.4. Retaining Walls Design

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

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

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

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

Cantilever walls are proposed west of CH10+240, where the 220m (approx.) length of secant pile walls from Memorial Road terminates and continue for a further 150m (approximately). They are also proposed (initially) between Sarsfield Road Bridge (UBC4), CH10+500 and CH10+160 along the southern perimeter of the rail corridor where they would join with the existing stone masonry wall 150m (approx.) west of Memorial Road. The cantilever walls will typically range from 1 to 3.5 m in height. These walls are still subject to further preliminary design review, particularly in locations where the severity of impact to adjacent 3rd party lands is deemed significant and after receipt of further geotechnical survey data.

The section of wall adjacent to the Chapelizod Bypass section of Con Colbert Road, from 10+015 to 10+185 (approx.) will also be designed to mitigate that weight and operational forces associated integrating an H4A containment wall with the retaining wall. To build the retaining wall, in this area, requires the existing road/rail corridor boundary wall to be demolished.

8.3. Bridges

The proposed replacement Sarsfield Road Bridge (UBC4) comprises 2No. independent decks; the construction of which will accordingly be managed independently. The southern deck is proposed to be constructed first; which will require demolition of the southern portion of the existing deck through a 48-72hr possession (assuming a weekend road closure, see **Section 8.6 Temporary Traffic Management**). The existing 2No northernmost tracks are proposed to remain operational during the abutment construction of the southern deck. The abutment piling will be carried out in sequence (one after the other, to the east and west of the road) behind the existing stone masonry retaining walls.

Once the seating beam is constructed and a layer of upper stone masonry removed to provide access to the future bearing shelf, the steel portal frame will be craned into place using cranes located in the proposed

compounds adjacent to the bridge (see **Sections 5.8 Construction Support Sites (All Do-Something Options)** and **8.5 Construction Compounds** for compound locations). The portal frame will essentially include a permanent formwork and parapets allowing the remaining steel works and concrete preparatory works to continue while road traffic is unhindered. Further cranage of materials would only be carried out after risk assessment of the contractors' proposed methodology is approved and supervised. It is assumed that temporary short duration (30mins to 2hrs) closures should suffice for the latter and would typically be during off peak periods and at off-peak times, taking cognisance of the anticipated noise levels for a specific task.

The removal and installation of the northern deck will only commence once the northern tracks are diverted to the proposed new southern deck and brought into operation under a temporary track configuration to the east and west of the bridge. After the track diversion is brought into operation the remainder of the existing deck (to the north) would be demolished. Thereafter the existing bearings would be removed and the decks new bearing plinths with bearing arrangements installed followed by the same cranage and operations associated with the southern steel portal frame deck. This northern deck requires no new abutment or reconstruction. No road closure longer than a 72hours should be necessary. The duration of the construction associate with the bridge itself is anticipated be 4-5months (approx.) however the work in the locality of the bridge will be substantially longer owing to the temporary track arrangements and retaining wall construction required both east and west of the bridge. This would include the utility diversions at road level in order to facilitate the phased construction and limit impact to road, rail and public utility users.

8.4. Permanent Way

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

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

8.5. OHLE Infrastructure

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

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

It is envisaged that the OHLE will be constructed in safe zones adjacent to the live railway or in night-time possessions. The phasing of the works will endevour to keep a minimum of 2No. working railway tracks through the Cork line. it is envisaged that a safe zone will be possible for construction in this area.

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 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.

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 requires minimal modification, if any, over the duration of the construction programme. The compound will consist of areas of hardstanding for vehicles and materials and therefore the water runoff with be managed and treated as required.

Section 5 Options outlines the preferred locations for the construction compound required for this area; **Section 6 Options Selection Process** provides a detail of the option selection methodology. A construction compound (Split into 3 discrete sites) is required at the vicinity of Sarsfield Road Bridge to facilitate the bridge reconstruction, underground attenuation tank installation, and localised works in the rail corridor. **Figure 8-1** shows the proposed construction compound locations at Sarsfield Road.

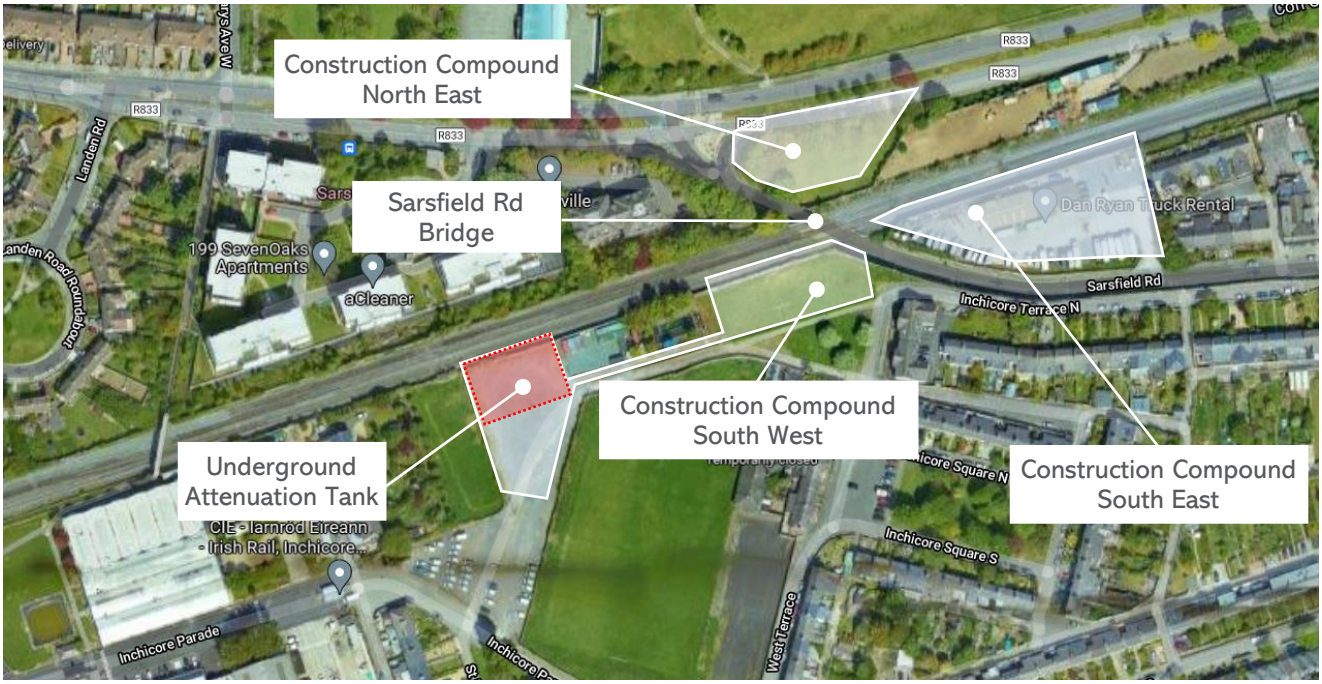


Figure 8-1 Sarsfield Proposed Construction Compound Locations

The section between Memorial Road and Sarsfield Road is generally geographically constrained, with options limited for materials handling. Large sections of the westbound Con Colbert Road bus lane will require closure to

facilitate access and egress to construction compounds as well as the works itself. Shorter sections have the potential to pose a greater hazard.

8.7. Temporary Traffic Management

Temporary utility diversions within 30-50m of the bridge will require localised traffic management that keeps the existing single lane yield system but likely requiring automated or manual control to improve the flow of traffic and give priority to public transport. The same will be used for the construction of the southern deck abutments to accommodate scaffold and shoring protection to the existing wall on the side of the abutment being constructed. Sarsfield Road Bridge (UBC4) reconstruction itself requires 2 no. main types of closure of Sarsfield Road underpass and are described further below;

- 24-72hr for existing deck demolition and portal frame installation. Restricted to off-peak periods e.g. weekends.
- 30mins-2hrs for material cranage or concrete pours. Restricted to off-peak hours e.g. 10am-2:30pm or late night subject to other noted considerations. Half day closures may be considered more manageable/practical; this would be subject to review of a specific method statement by the Project Team and DCC. In all cases adequate forewarning will be given to local residents and industry; through road closure licensing notice criteria.

A number of proposed temporary traffic management solutions for the noted road closures are set out below:

8.7.1. Private and Commercial Vehicles

The typical route for south/east bound traffic (using the Sarsfield Road underpass) would generally turn into Grattan Crescent and then either turn into Emmet or continue along Tyrconnell (R810) Roads; both of which direct the vehicle towards the Grand Canal and/or the City Centre, and even onwards to the N7/Naas Road.

It is anticipated that vehicle users would have to pre-plan their own diversion routes either back to M50 via N4/Chapelizod Bypass or west via Kylemore or Le Fanu or Park West crossings or east along Con Colbert Chapelizod Bypass and turn into South Circular Road (among many other alternative subject to their destination of choice. As the longest closures would only be anticipated to be over a weekend, it is assumed that users would be distributed onto the surrounding network over the limited period.

Sarsfield Road's (westbound lane) currently is designated for bus use only, but traffic counts suggest it is already used regularly by other forms of transport (see **Table 8-1**). The current users that ignore its existing public transport 'only' designation would have to revert to routes available; these routes would be those similar to the diversion routes as noted Public Transport (and/or potentially for Emergency Services), in the **Section 8.6.3 Public Transport.**

Table 8-1 Traffic Volumes over Kylemore Rd Bridge (Count data 29/11/2019)

Traffic Type	Northbound	Southbound
Daily Traffic (07h00 – 19h00)	909	6 000

Many Heavy Vehicles (HVs) are already restricted from using Sarsfield Road due to the existing 4.37m constrained bridge clearance. Further reviews may consider whether a full restriction on HV's is prudent during abutment piling works.

8.7.2. Vulnerable Users (Pedestrians, Wheelchair users and Cyclists)

Cyclists currently use vehicular lanes and this is not intended to change during construction works associated with the abutments. The intention would be to divert pedestrians well in advance of the bridge to the opposite side of the road to which the abutment piling is taking place; because of the additional retaining wall safety bracing that will be in place on the works side of the road. The footpath along the eastern abutment is particularly narrow and may well need a stop/go control, as would the vehicles.

As noted earlier in this Chapter the number and duration of full road closures will be limited and then only to a few days and half days at a time, over a period of 6 months (approx.). These short duration closures will be planned and communicated in advanced and require the necessary lane closure approvals. They will typically be off-peak closures and where alternative arrangements could not be made by regular users the pedestrian diversion route would add an additional 550-900m to a pedestrian or cyclists' journey (subject to their final destination)

For pedestrians this would require them using footpaths along Con Colbert Road and then re-joining their route via Memorial Road Bridge (OBC3). This would add an additional 6-15 mins (approx.); subject to their walking speed. The proposed temporary bridge at Memorial Road may already be installed and in use (see **Figure 8-2** and **Figure 8-3**), if pedestrian access to the existing bridge is closed. Vehicular closure of the same, as previously stated, is not planned concurrently with Sarsfield Road.

The cyclist diversion for eastbound route would be nominally longer than the westbound route as it would require those from the junction of Con Colbert/Sarsfield Road to proceed to the Con Colbert Road/Inchicore Bypass junction and join the east bound cycle lane, before re-joining their original route via Memorial Road Bridge (OBC3). The longer journey being the signal cycle times for crossing Con Colbert Road/Inchicore Bypass twice. This would add an additional 5-10 mins (approx.); subject to their cycling speed and signal timing but also would be at an easier gradient that Sarsfield Road and will be in designated cycle lanes rather than shared (as is the existing case in Sarsfield Road). See **Figure 8-4** and **8-5** for cycle routes proposed diversion, and **Figure 8-6** for proposed temporary vulnerable users diversion.

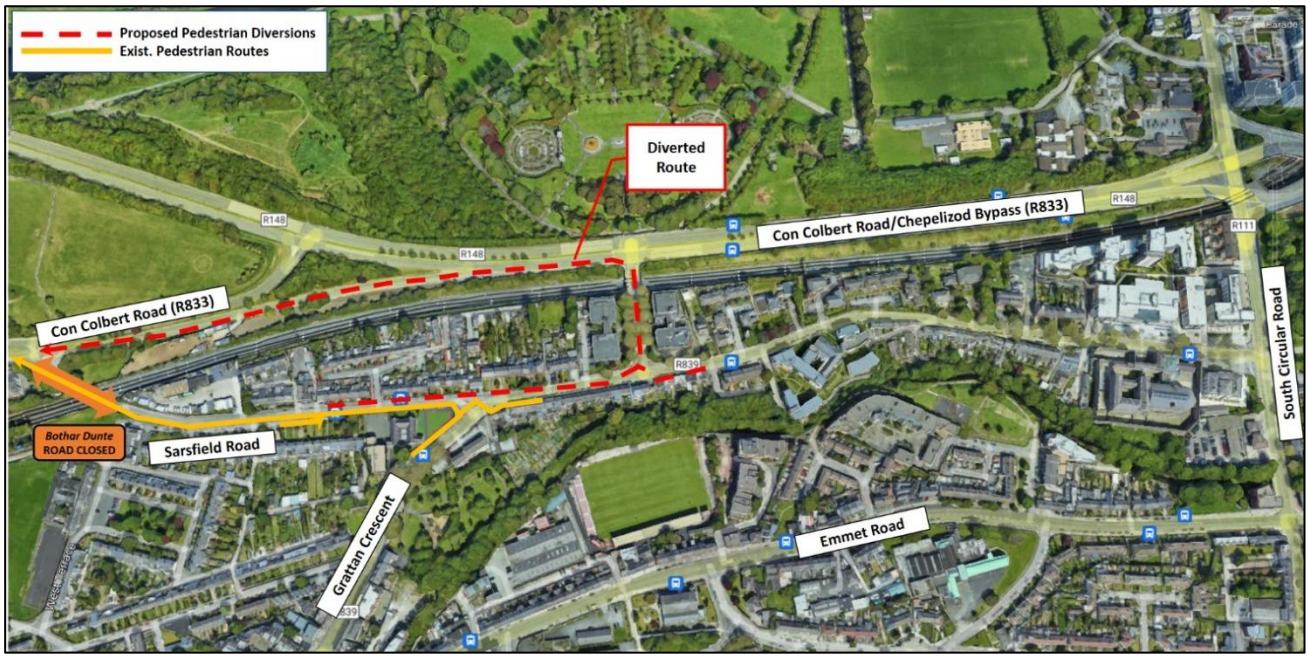


Figure 8-2 Proposed Diversion - Pedestrian (Westbound)

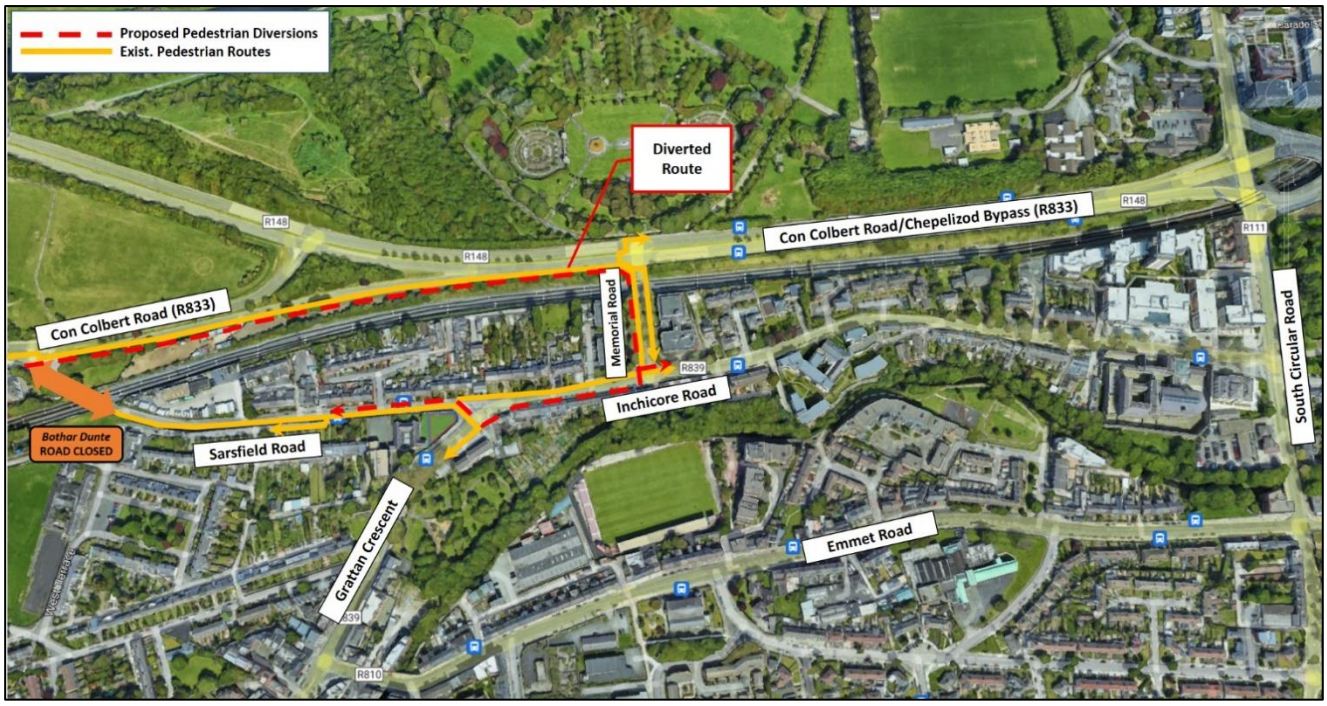


Figure 8-3 Proposed Diversion - Pedestrian (Eastbound)

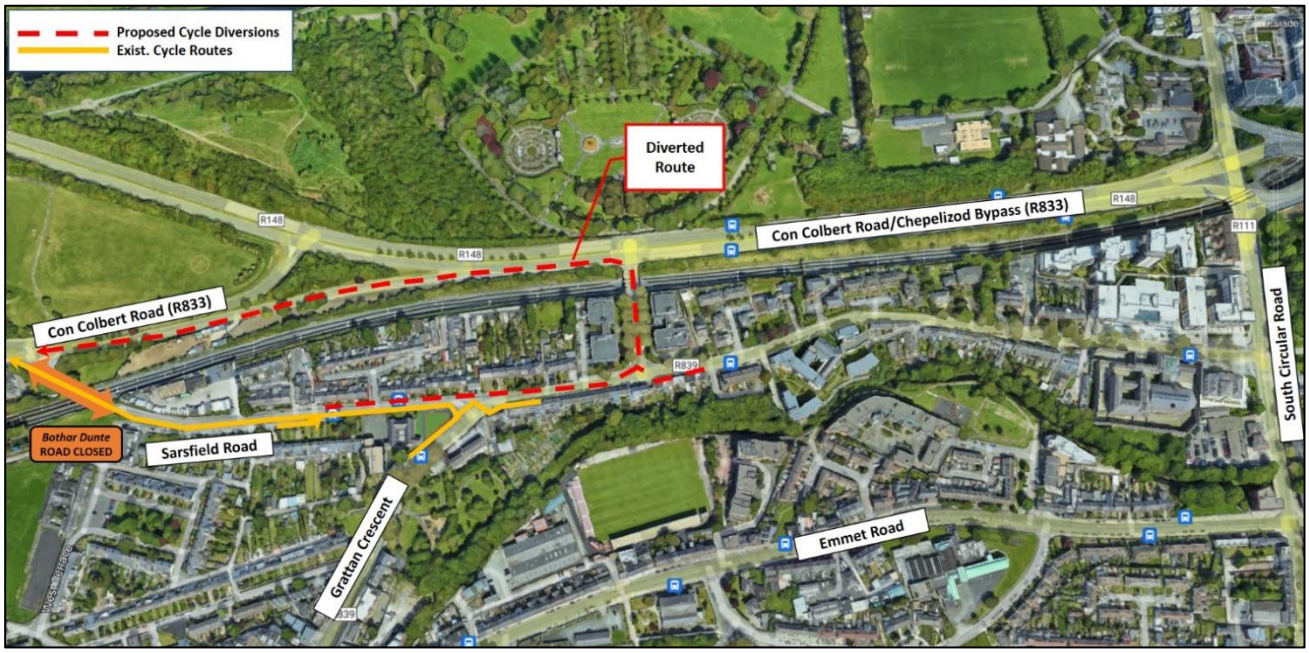


Figure 8-4 Proposed Diversion - Cycle (Westbound)

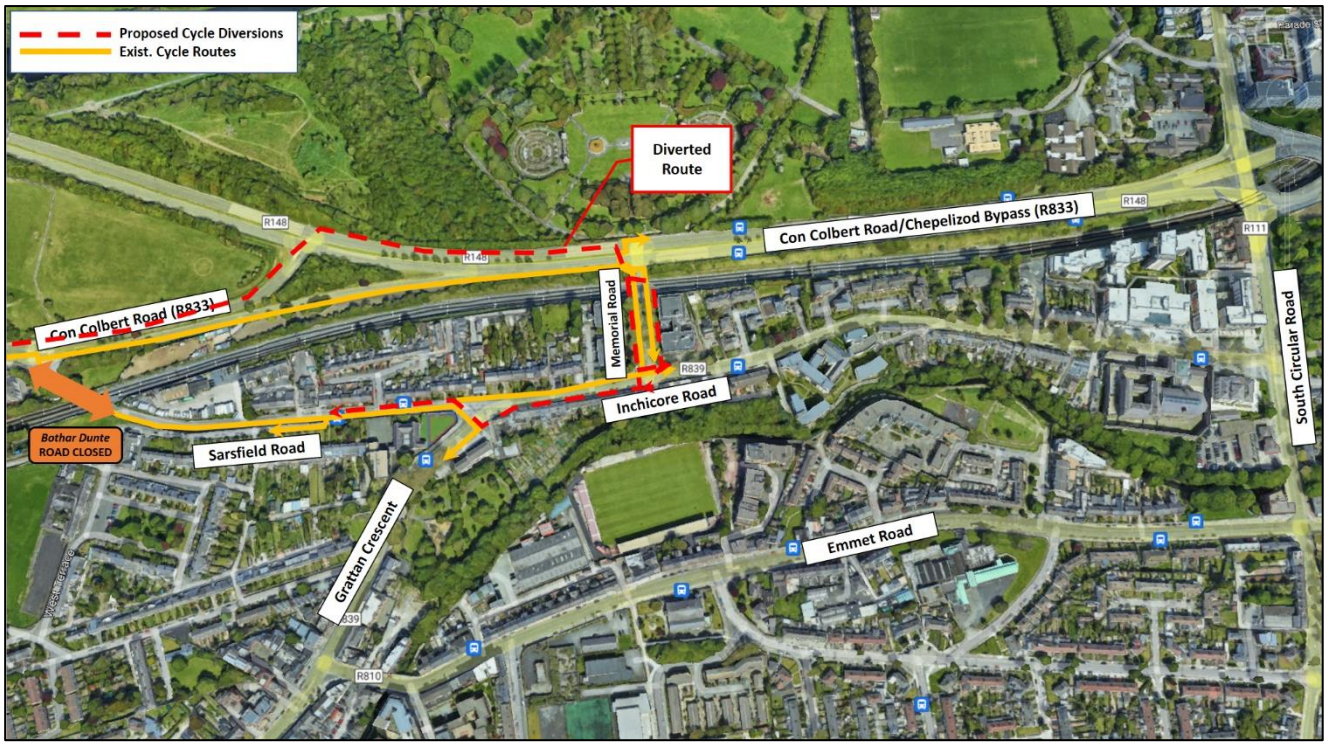


Figure 8-5 Proposed Diversion - Cycle (Eastbound)

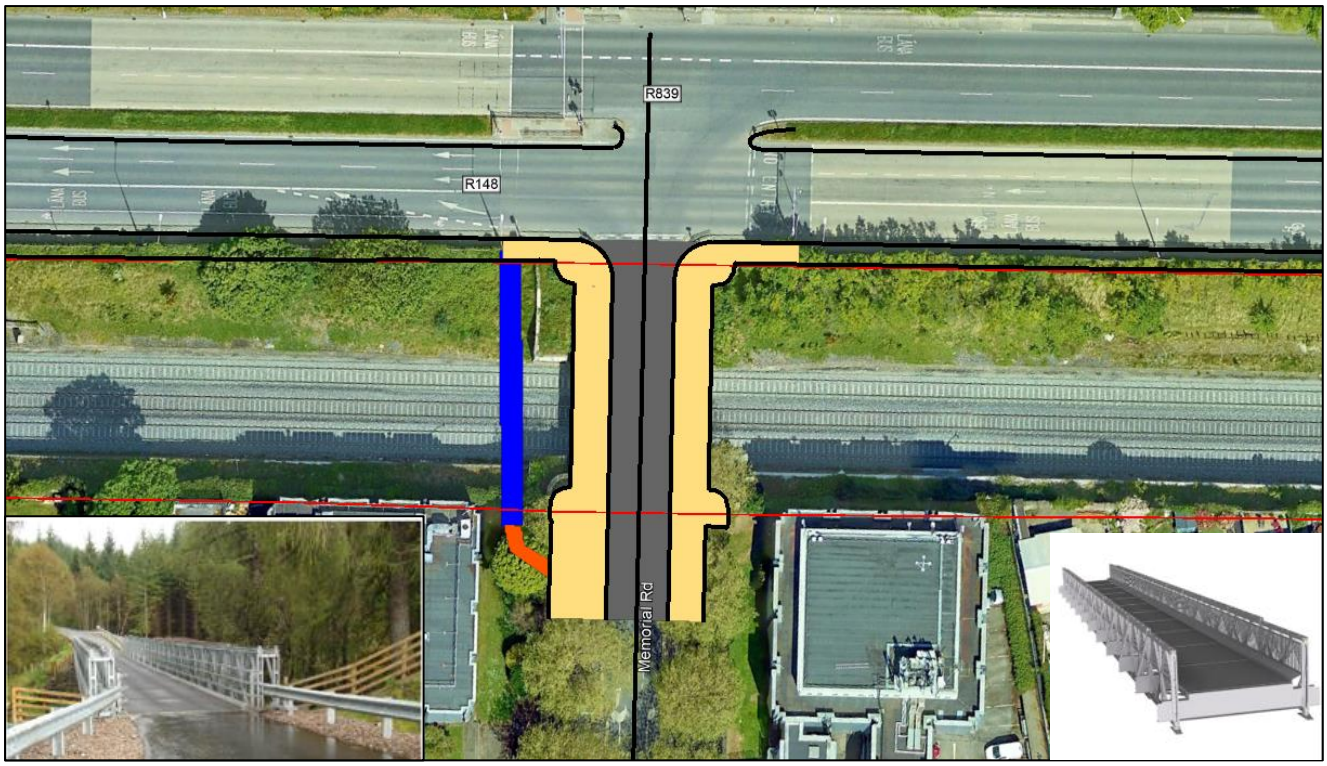


Figure 8-6 Proposed temporary vulnerable user diversion (incl. bridge)

8.7.3. Public Transport

Sarsfield Road (westbound lane) currently is designated for bus use only, but traffic counts suggest it is already used regularly by other forms of transport. As Sarsfield Road and Memorial Roads are not planned to be closed at the same time during the project.

Dublin Buses (Routes 40 & 79), that typically use the westbound lane of Sarsfield Road, before using the underpass, would be diverted, as shown in **Figures 8-7 & 8-9**. This would be via Inchicore and Memorial Roads and on to Con Colbert Road/Chapelizod Bypass (R148), before taking the Con Colbert Slip Road and re-joining Ballyfermot Road (R833).

The same Dublin Bus Routes (noted above) that use the eastbound lane of Sarsfield Road Bridge (UBC4) would be diverted, as shown in **Figures 8-8 & 8-10**. With Route 79 missing out on the Woodfield Place (Stop 2719) bus users wishing to access or exit the Inchicore area could use Memorial Gardens (Stop 7435) at an additional pedestrian journey time of 5-10minutes for the 420-490m (approx.) additional distance. The Route 40 would also miss Woodfield Place (Stop 2719). And all its eastbound stops in Emmet Road between Sarsfield Road and South Circular Road. Unless alternative arrangements could be made this could result in additional walking time for those with a destination in this section of Emmet road of 1-15mins. Those leaving from Emmet Road would need to consider walking to just east of South Circular Road to board the next Route 40 bus or alternatively take the 13 or 68 subject to their destination of choice.

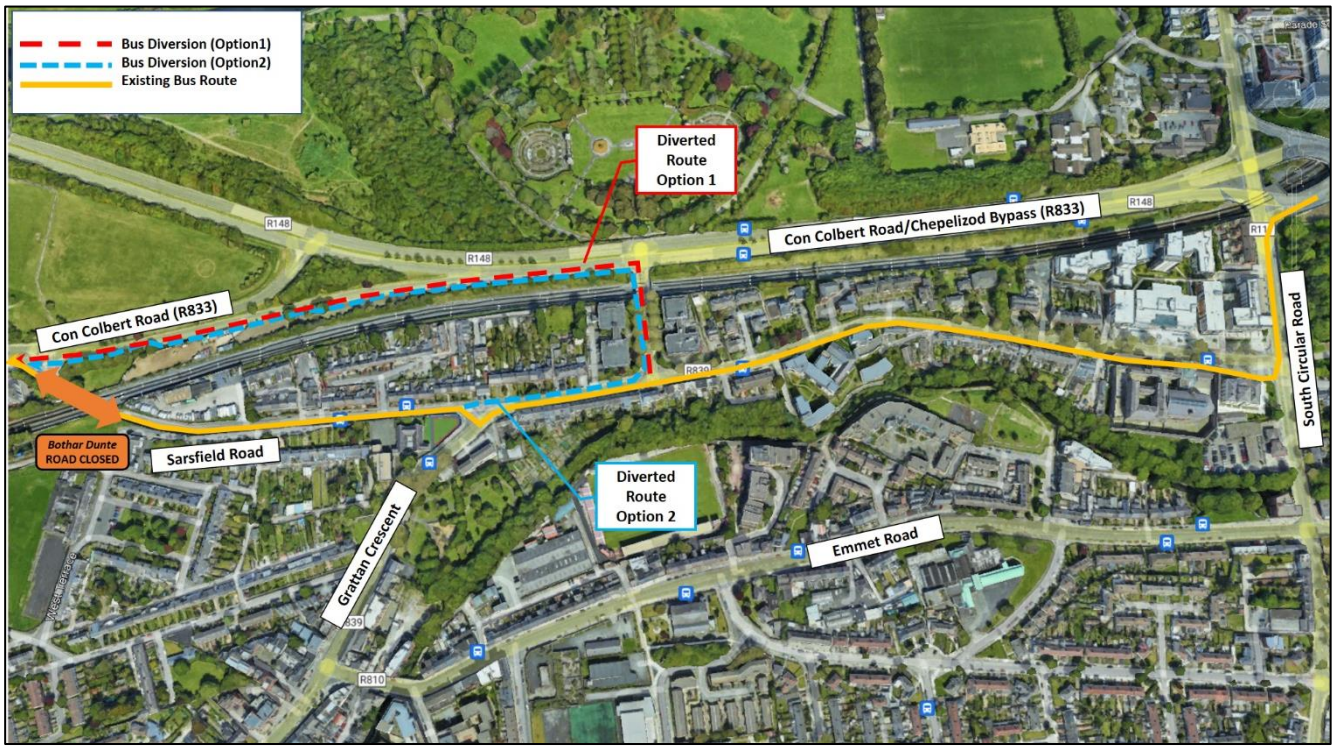


Figure 8-7 Proposed Diversion - Dublin Bus Route 79 (Westbound)

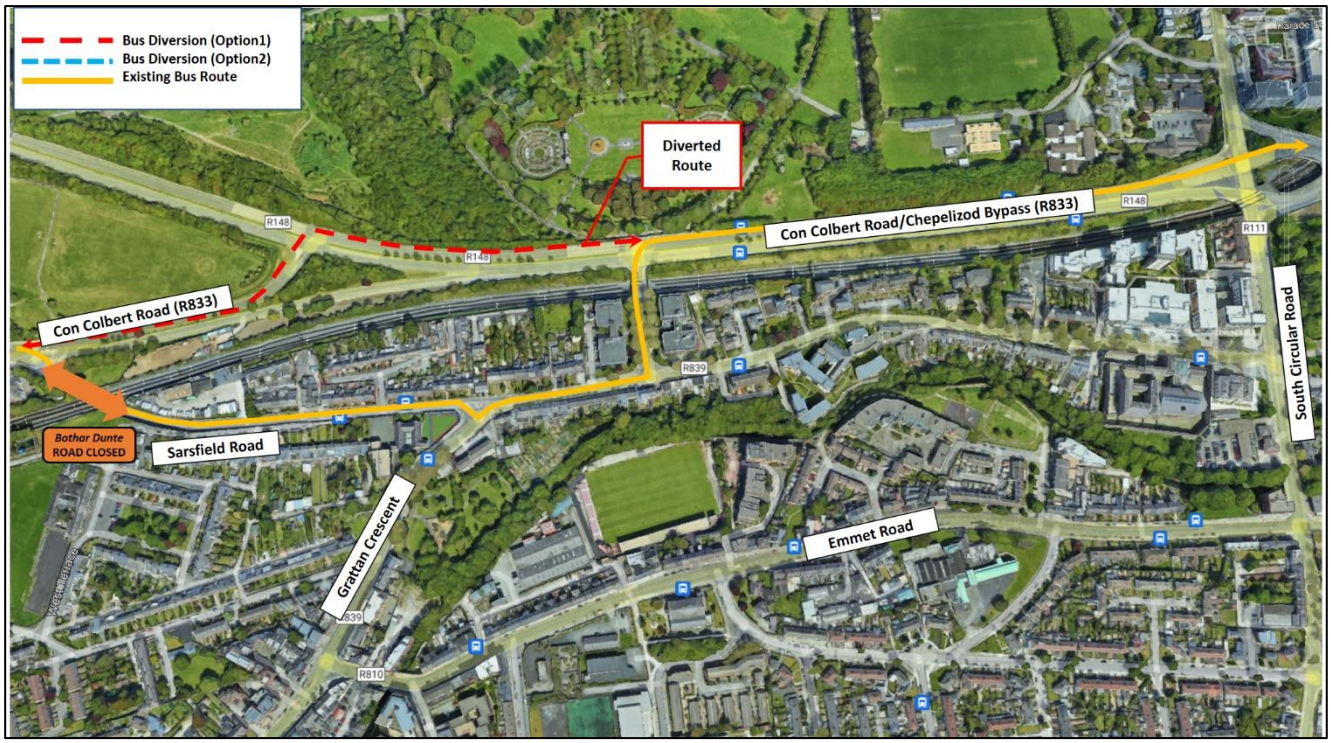


Figure 8-8 Proposed Diversion - Dublin Bus Route 79 (Eastbound)

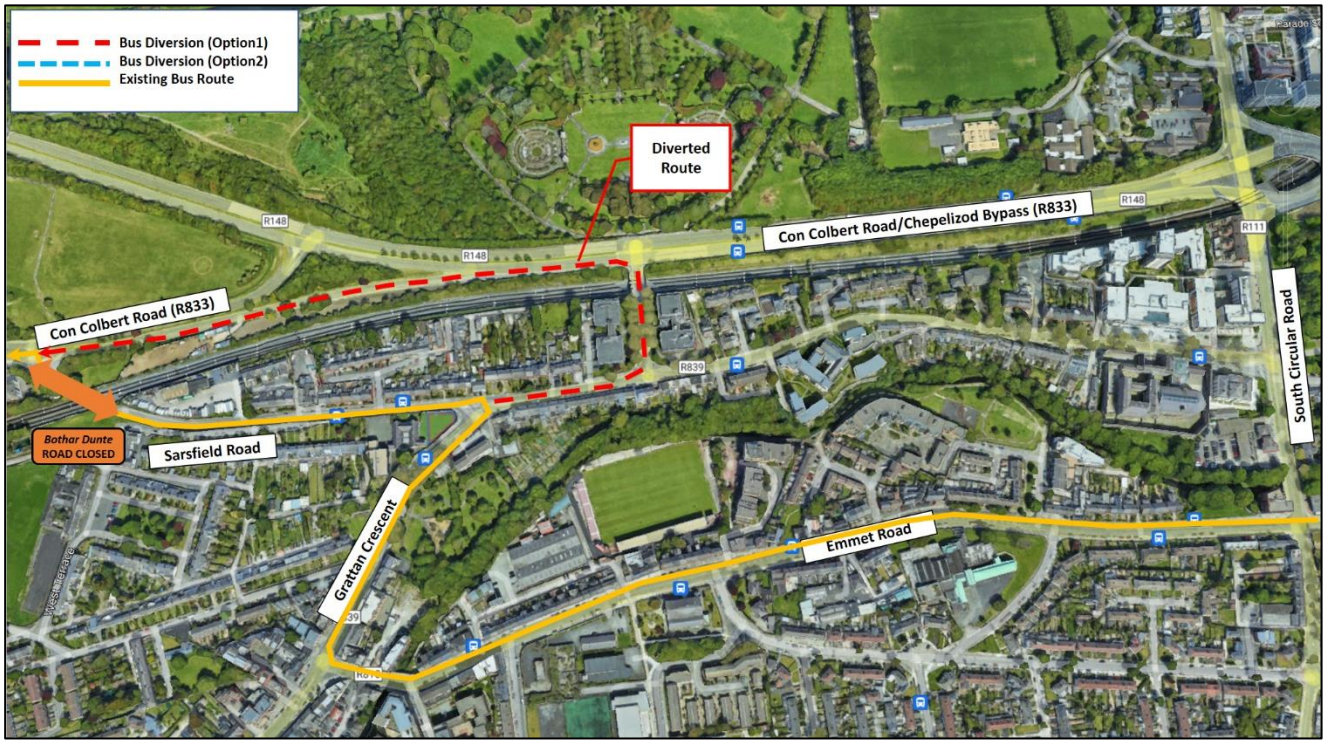


Figure 8-9 Proposed Diversion - Dublin Bus Route 40 (Westbound)

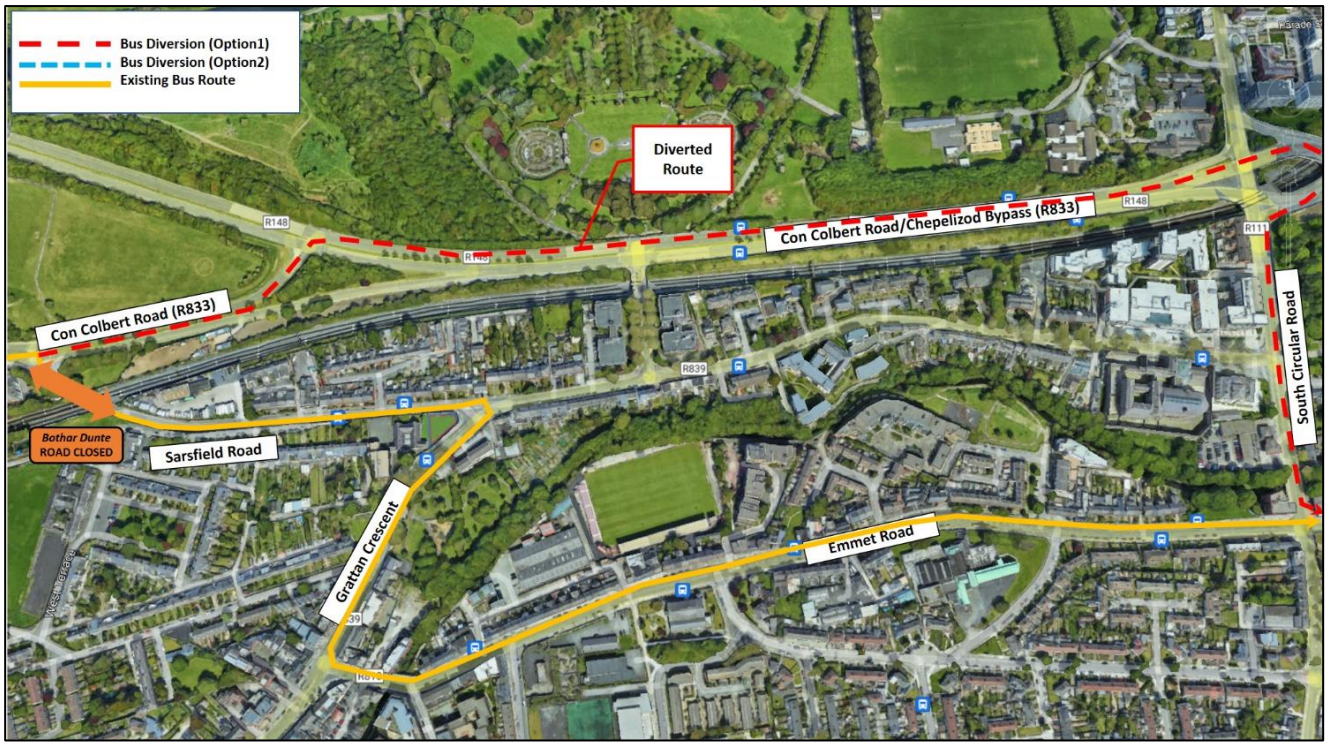


Figure 8-10 Proposed Diversion - Dublin Bus Route 40 (Eastbound)

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).

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

A full methodology of the setup and construction methods will need to be sympathetic to both the railway operations, 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 – Sarsfield Road Bridge

Appendix B – Drawings

The following drawings accompany this Technical Report:

Bridge Drawings

DP-04-23-DWG-ST-TTA-57140: Sarsfield Road Bridge (UBC4) – General Arrangement

DP-04-23-DWG-ST-TTA-57141: Sarsfield Road Bridge (UBC4) – Bridge Deck Plan

DP-04-23-DWG-ST-TTA-57142: Sarsfield Road Bridge (UBC4) – Southern Bridge Deck Longitudinal Section

DP-04-23-DWG-ST-TTA-57143: Sarsfield Road Bridge (UBC4) – Northern Bridge Deck Longitudinal Section

DP-04-23-DWG-ST-TTA-57144: Sarsfield Road Bridge (UBC4) – Bridge Deck Cross-Section

Roads Drawings

DP-04-23-DWG-CV-TTA-56511: Sarsfield Road Bridge (UBC4) – Road – Plan and Profile

Permanent Way Drawings

DP-04-23-DWG-PW-TTA-56995: Sarsfield Road Bridge (UBC4) to Memorial Road Bridge (OBC3) – Track Plan Layout

DP-04-23-DWG-PW-TTA-56996: Sarsfield Road Bridge (UBC4) to Memorial Road Bridge (OBC3) – Cross Section CH 10+103