

# DART+ South West

## Volume 3D – Technical Optioneering Report – Kylemore Bridge to Sarsfield Road Iarnród Éireann

November 2021

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# Glossary of Terms

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

Reference	Description
IA	Independent Assessor
IÉ	Iamród 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
PPT	Phoenix Park Tunnel

Reference	Description
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 safe 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
TPS	Train Protection System

Reference	Description
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 area around Inchicore Works and Khyber Pass Footbridge (OBC5). This report presents the approach to option development, options assessment, and options selection. This optioneering process incorporates assessment by the following Design Workstreams and specialist Project Teams:

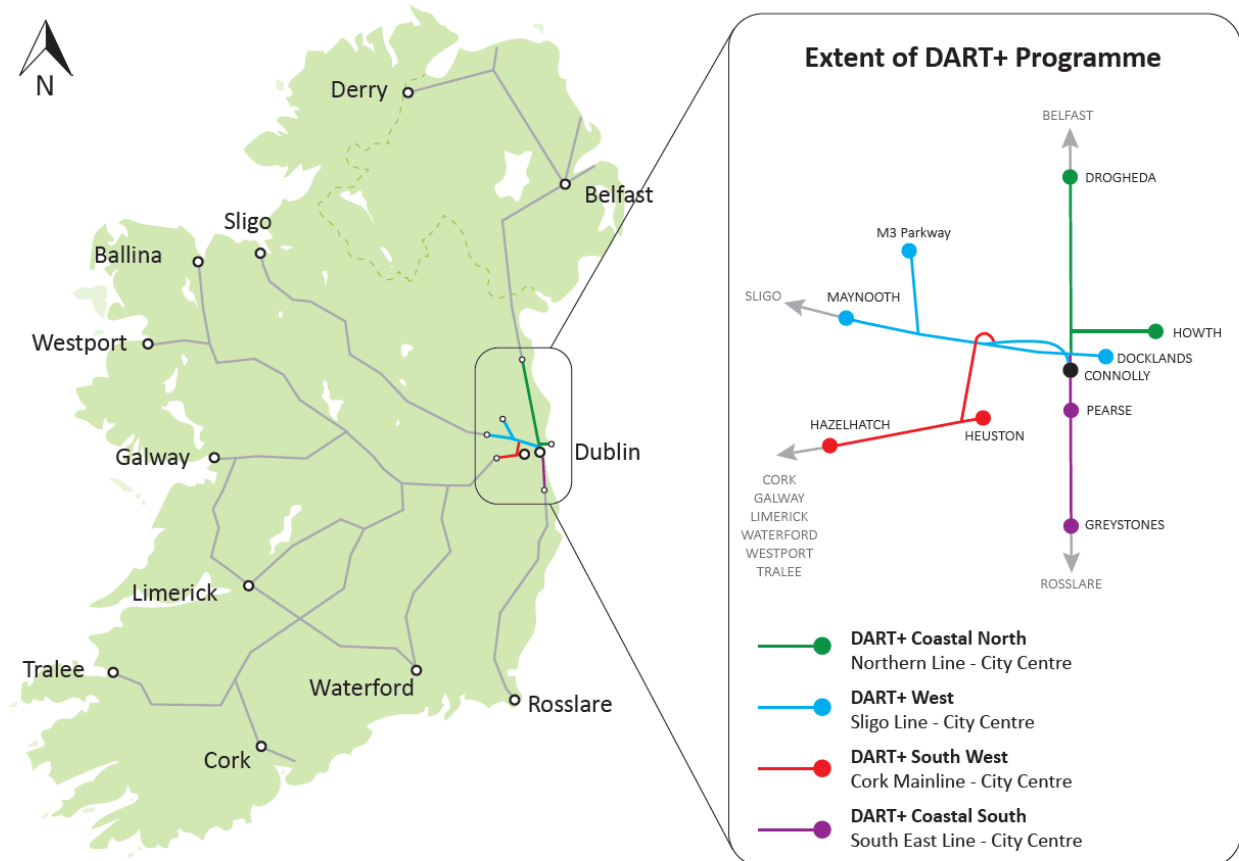
- Permanent Way
- Civils and Structures
- Signalling, Electrification and Telecommunications (SET) and Low Voltage Power
- Overhead Line Equipment (OHLE)
- Environment
- Highways
- Geotechnical
- Construction Compounds

The report provides:

- An area overview and a detailed description of the existing railway infrastructure and challenges.
- The Project Requirements for this area.
- The technical and environmental constraints, including the horizontal and vertical clearances at structures.
- The options considered for this area.
- The option selection process 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/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 electrification of the DART+ South West route, new DART trains will be used on this railway corridor, similar to those currently operating on the Malahide / Howth to Bray / Greystones Line.

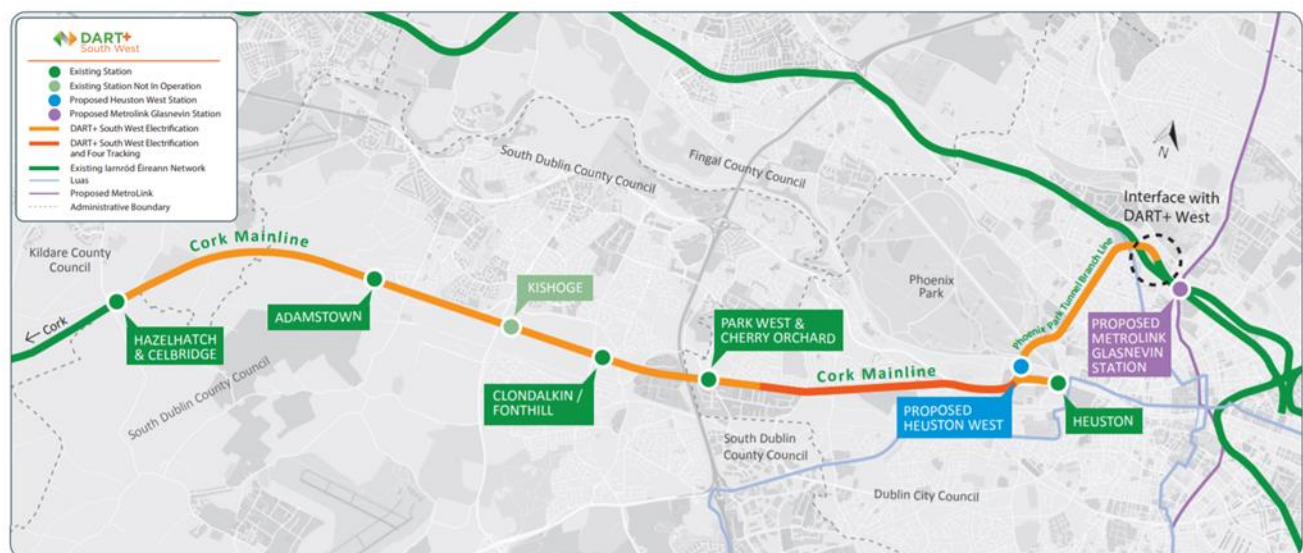


Figure 1-2 DART+ South West Route Map

### 1.4. Capacity Increase Delivered by DART+ South West

DART+ South West will improve performance and increase train and passenger capacity on the route between Hazelhatch & Celbridge Station to Heuston Station and through the Phoenix Park Tunnel Branch Line to the City Centre, covering a distance of circa 20km. It will significantly increase train capacity from the current 12 trains per hour per direction to 23 trains per hour per direction (i.e. maintain the existing 12 services, with an additional 11 train services provided by DART+ South West). This will increase passenger capacity from the current peak capacity of approximately 5,000 passengers per hour per direction to approximately 20,000 passengers per hour

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

## 1.5. Key infrastructure 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 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
<b>Hazelhatch to Park West</b>	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
<b>Park West to Heuston Station</b>	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 Name	Sub-area Description	Extents	Main Features
	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
<b>Heuston West Station</b>	New Heuston West Station (Volume 3I)	Area to the West of Heuston Station, adjacent to Liffey Bridge (UBO1)	Heuston West Station
<b>St John's Road Bridge (Islandbridge) to Glasnevin Junction</b>	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
<b>St John's Road Bridge to Glasnevin Junction</b>	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)

Area Name	Sub-area Description	Extents	Main Features
			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.

Stakeholders expressed concern regarding air pollution. Stakeholders expressed concern that the works and increased train activity will only worsen the situation.

Submissions cited that infrastructure was already in place for a station in Inchicore and to not include a station would be a massive 'over sight'. Stakeholders expressed concerns on how the project will impact traffic around Inchicore and were worried that the project may exacerbate the existing traffic impact on Sarsfield Road.

With regard to traffic impact, a number of submissions had concerns around the Inchicore Area.

Submissions were mixed with regard to Khyber Pass footbridge. Some respondents felt it should be opened to the public and included improved access for wheelchair and cycle access as they believed it could provide good connectivity to the Red Line LUAS and other services on Tyrconnell Road. While other respondent submissions expressed concern at it being used for open public use and the potential for antisocial behavior.

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).

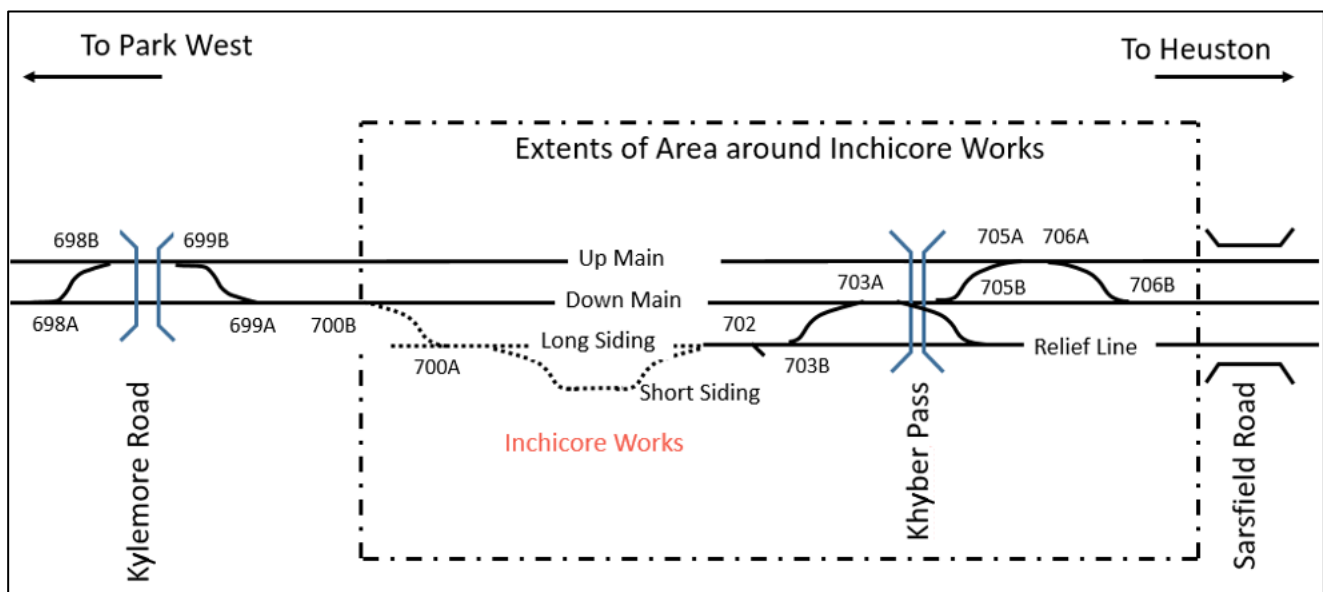
A high-level summary review of the above is also outlined in **Section 7.2 Review of Stakeholder Feedback** of the report.



## 2. Existing Situation

### 2.1. Overview

Currently, the four-track section on the Cork Mainline terminates immediately east of Park West Station where the lines converge into two running lines which continue from Park West Station to Kylemore Road Bridge (OBC5A). East of Kylemore Road Bridge (OBC5A) there is an additional siding track to the south of the mainline that provides the entrances and exits to and from Inchicore Works. Adjacent to Inchicore are two siding tracks, the Long Siding and the Short Siding, which account for a maximum width of up to four tracks running parallel through part of the Inchicore area. Where the sidings end to the east of the Inchicore facility the third line to the south of the mainline becomes the third running line as it heads east. The project requirement is to continue the four tracks from Park West Station to Heuston Station. The existing track layout is shown in **Figure 2-1**.



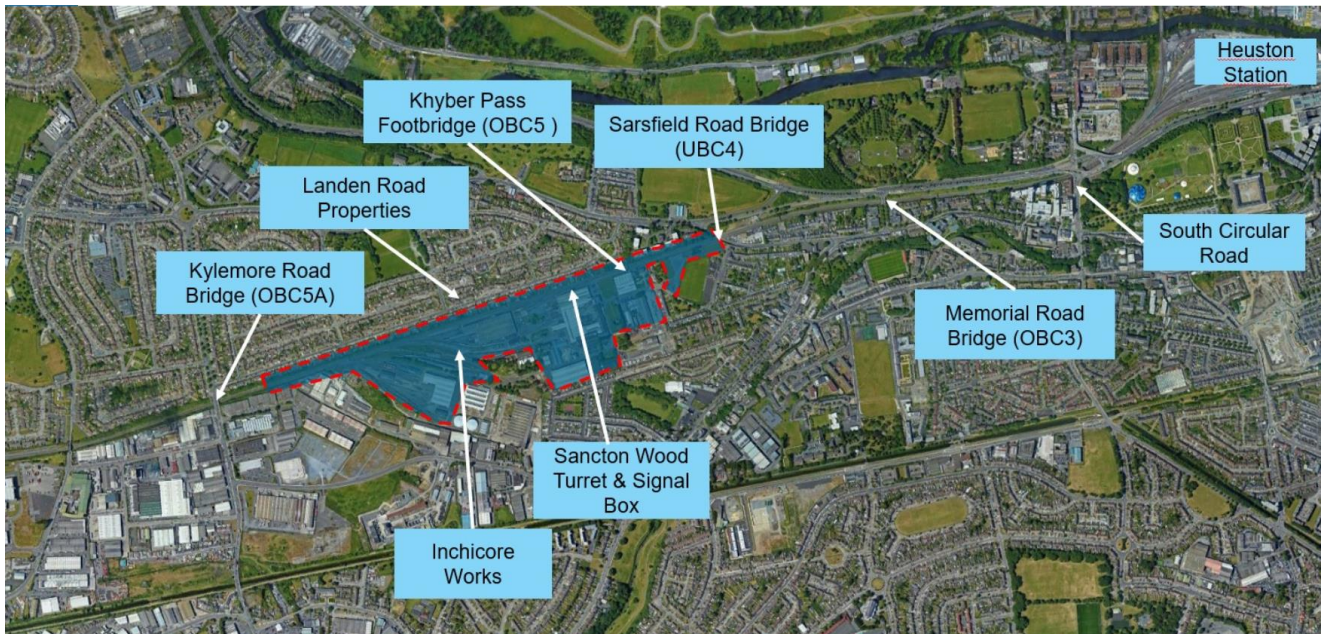
**Figure 2-1 Existing track layout at area around Inchicore Works**

This area starts at Points 700B, located on the east side of Kylemore Road Bridge (OBC5A). Here, the track is in a cutting and the two main lines run parallel to the Inchicore Works sidings. On the north side of the corridor the back gardens of the houses at Landen Road limit the rail corridor, and, on the south side, Inchicore Works can be found.

The Maintenance Shed in Inchicore Works is located 900m east of Kylemore Road Bridge (OBC5A). Here, the railway is at grade, and the tracks run between the Old Signal Box and the Turret (a Heritage building). The Track and Signal building and Khyber Pass Footbridge (OBC5) are located immediately to the east of Inchicore Works.

On the east side of the Works the tracks are on an embankment. The Seven Oaks apartment building and Floraville apartment building are located to the north side at a lower level than the track. On the south side, St George's Villas and existing drainage attenuation facilities can be found. The demarcation between this area, around Inchicore Works, and the area around Sarsfield Road Bridge (UBC4) is the east side of Sarsfield Road Bridge (UBC4). The general view of the area is demonstrated in **Figure 2-2**.

The project scope in this area is to increase the number of running lines up to a four-tracking section and electrify the two tracks at the North (Slow tracks) for the DART services. The existing depot functionality must be maintained. The depot is for the maintenance and refurbishment of railway activities.



**Figure 2-2 General view of the study area around Inchicore Works.**

Inchicore Works is the main feature that is found in this area. The depot contains several facilities for the maintenance of the intercity rolling stock, for infrastructure maintenance and other buildings that Irish Rail employs as offices and training rooms.

This report also covers the localized area at the existing Khyber Pass Footbridge (OBC5). This is a private footbridge for IÉ employees to access the depot from the north of the railway. The Permanent Way in this area currently consists of 3 No. tracks. The rail is at grade and approximately the same level as the surrounding ground. There is a masonry boundary wall along the north side of the rail corridor at this location.

The major infrastructure features of the area are illustrated in **Figure 2-3**.



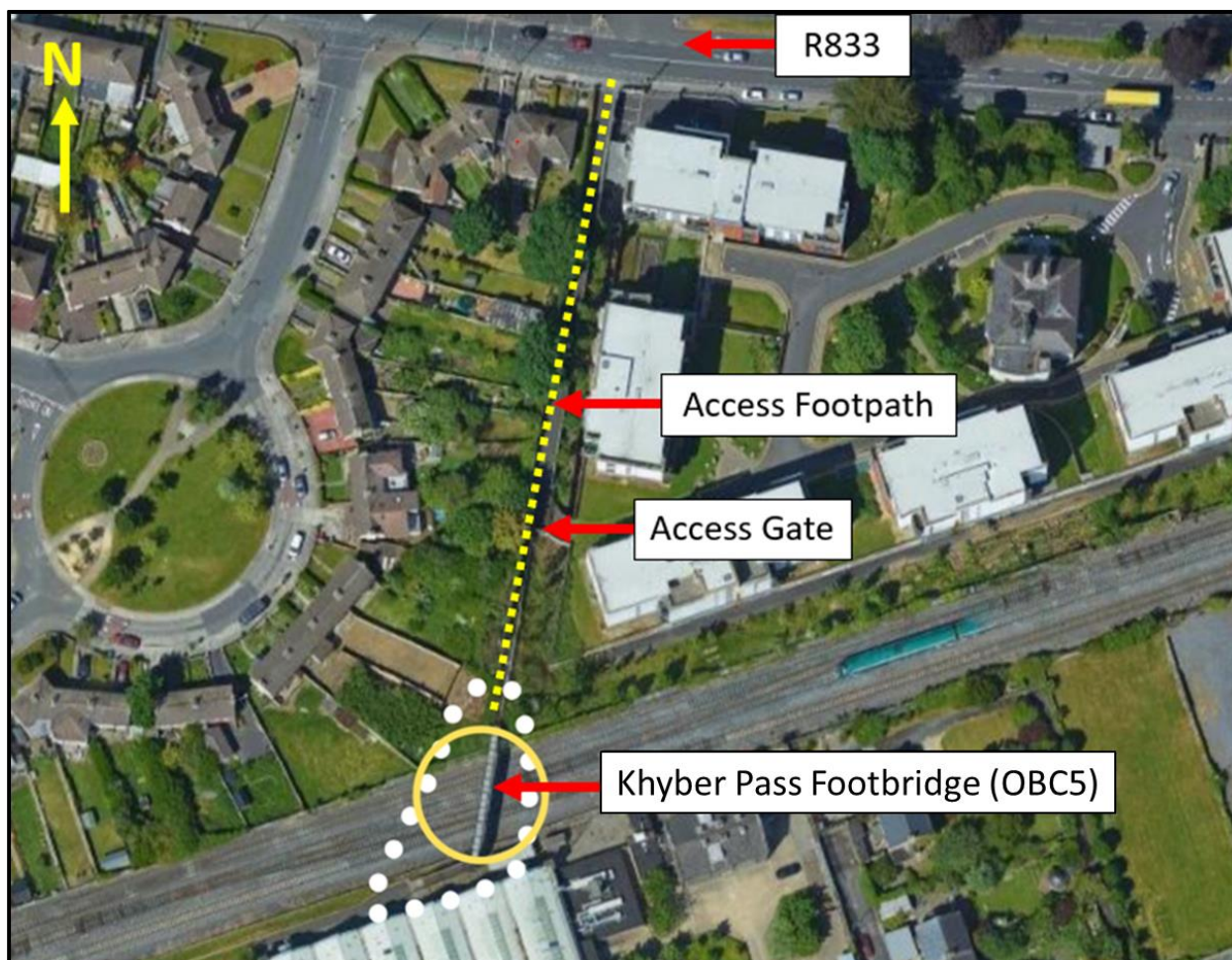


Figure 2-3 Extent of Area associated with Khyber Pass Reconstruction (white dotted outline)

## 2.2. Challenges

The main challenge to provide the two additional running lines while maintaining the depot functionality is to increase the area of the existing rail corridor.

There are two possibilities: widen the corridor to the North or to the South of the existing tracks. Each alternative would have to consider the elements along the area. In **Figure 2-4**, the main elements that constrain the track alignment are shown.

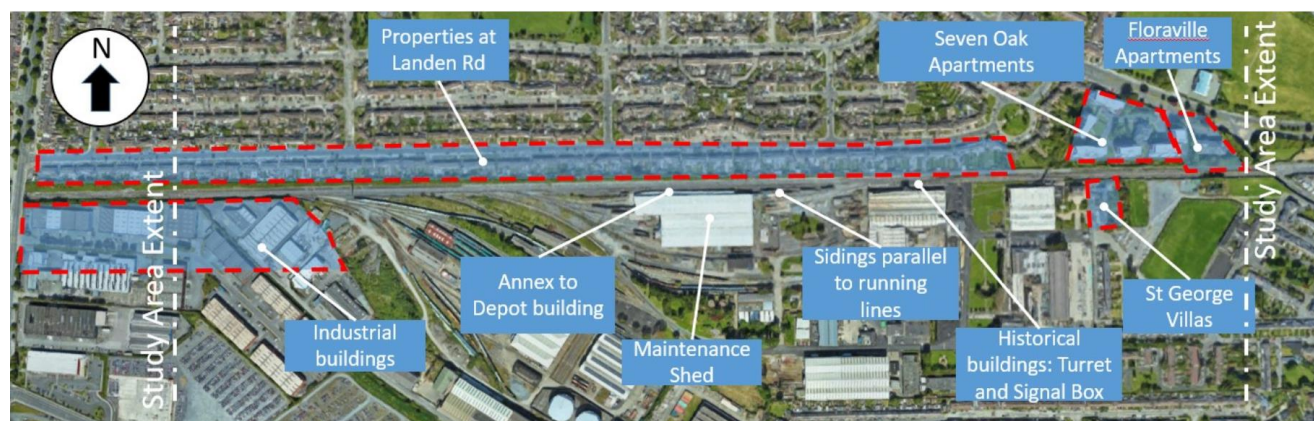


Figure 2-4 Main Challenges to the widening of the railway corridor.

The increased railway corridor area would be used for the installation of four new running lines. In the new configuration, the tracks will be paired by speed, with the Slow tracks for the slower services (DART services that would stop at each intermediate station) and the Fast tracks for the faster services (Intercity trains or freight trains that would not stop in most of the intermediate stations). This configuration is set to maximise rail capacity. The name of the tracks in the new configuration will be, from North to south, Up Slow, Down Slow, Up Fast and Down Fast. The resulting track configuration, with a continuous four-track section from Hazelhatch through to Heuston, will remove the existing bottleneck from Park West station to Heuston caused by the existing two or three track sections.

The Slow tracks, the tracks on the North, will be electrified and used by the DART services. The Intercity service trains will use the Fast lines that will not be electrified. The functionality of the Inchicore depot must be maintained to ensure continued operational railway function.

The new corridor area would have to consider the installation of the OHLE equipment for the electrification of the Slow lines.

Suitable and safe access for the rail maintenance teams is also important. The railway corridor must include the access strategy in the area.

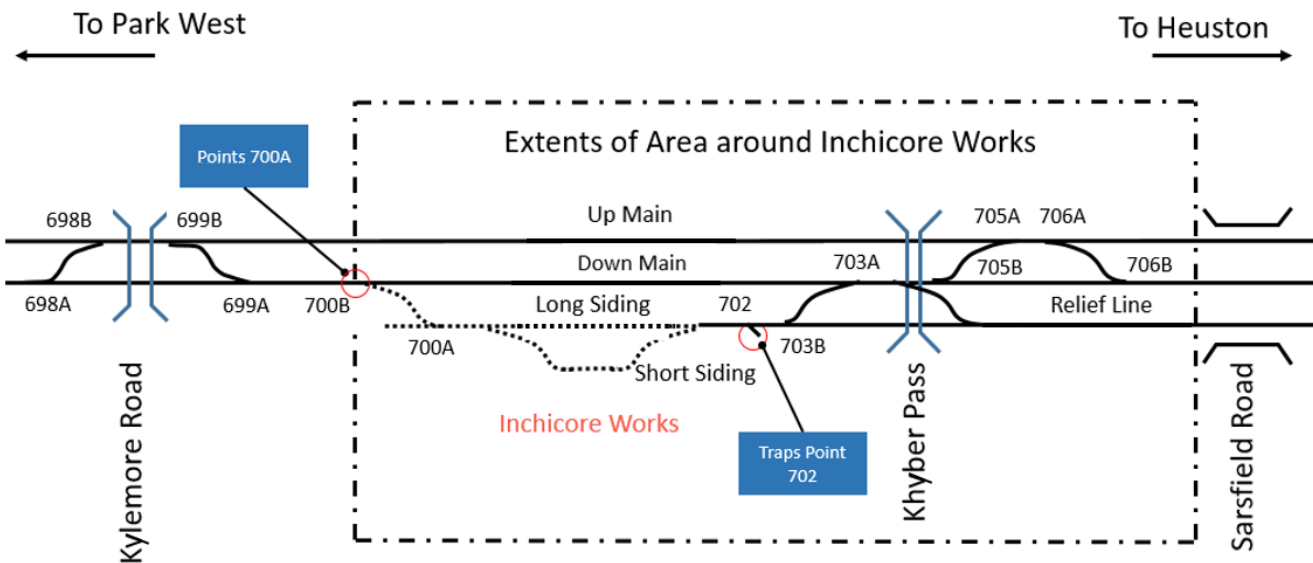
The challenge in the Khyber Pass Footbridge (OBC5) area is the constraint that is posed by the existing Khyber Pass Footbridge (OBC5) structure. It has insufficient horizontal clearance to facilitate 4 No. tracks to IÉ design standards without a structural intervention.

## 2.3. Permanent Way and Tracks

The area around Inchicore Works commences at the connection of the Down Main line to the Long Siding at Points 700B. From there the rail corridor comprises three tracks: two running lines (Up Main and Down Main) and a siding (Long Siding). A fourth siding, the Short Siding, parallel to the mainline extends past the Maintenance Shed of Inchicore Works. The Long Siding is connected to the various tracks leading into the depot, whilst the Short Siding is used for train stabling. The Long Siding ends at trap points 702 to the west of Inchicore depot, and from there the track is designated as the Relief Line. The Relief Line completes the three tracks that run east to Heuston Station. The track layout is shown in **Figure 2-5**.

There is an existing speed limit in front of the maintenance shed, with line speed increasing from 40mph (60km/h) to 60mph and 70mph (100km/h and 110 km/h) as we move east towards Heuston along the Up Main and Down Main tracks respectively. The speed restriction is related to the constraint that is imposed by the Old Signal Cabin that prevents the track from having an optimal alignment in this area.





**Figure 2-5 Track layout in the vicinity of Inchicore Works.**

From Park West the track gradient falls towards Heuston at an approximate slope of 1%. Similarly, this is the gradient of the two sidings parallel to the running line (Long and Short sidings).

The connection between the Down Main and the Long siding on the west side is protected by trap points, with a fixed buffer stop as an arresting device (refer to **Figure 2-6**). The level difference between the siding and the main tracks can be observed in the picture.



**Figure 2-6 Connection of Down Main track (centre) with the Inchicore Long Siding (right).**

The sidings are at a lower level than the running lines. The level difference varies from around 400mm at the west connection to zero at the east end and a proprietary retaining system is used to support the level difference.

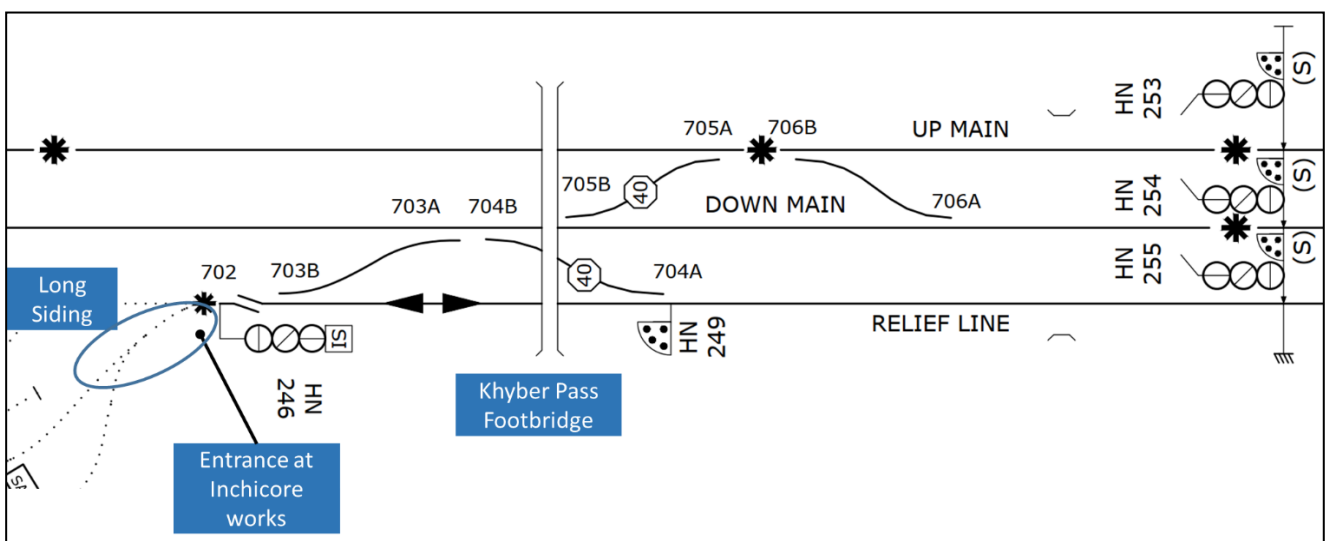
To the east, the Inchicore siding ends in trap points without any element to arrest a train overrun as shown in **Figure 2-7**. After this, the Long Siding becomes the Relief Line.



**Figure 2-7 Existing trap points at the East of Long Siding (Points 702).**

The trackform is comprised of a ballasted track with 54E1 rail and concrete sleepers. The P&C layouts are normally on timber bearers (some of the units are on concrete bearers), protected from the thermal forces by adjustment or breather switches.

Currently at Khyber Pass Footbridge (OBC5) there are 3 no. tracks beneath the bridge, they are named from north to south: Up Main, Down Main and Relief Line. The connection to the Inchicore Works depot, where the Relief Line becomes the Long Siding is 180m to the west. At the bridge there are several crossovers to provide access to the depots from the three main lines. See **Figure 2-8** for a track layout in the vicinity of Khyber Pass Footbridge.



**Figure 2-8 Track layout in the vicinity of Khyber Pass Footbridge (OBC5)**



## 2.4. Other railway Facilities

Inchicore Works contains several facilities for the maintenance of rolling stock (intercity trains), the maintenance of the track infrastructure and offices for IÉ. In **Figure 2-9**, the location of some of the main buildings is represented. A Warehouse for the maintenance of rolling stock, offices, a training centre and fuel tanks is found within the area.



**Figure 2-9** Inchicore Works; technical buildings and offices.

The access to the depot is through the Long siding where all the depot tracks are connected to  
Refer to **Section 4.1 Environment** the description of the level of protection of the buildings in this area.

## 2.5. Structures

The Khyber Pass Footbridge (OBC5) is an existing pedestrian bridge at Inchicore Works. The steel structure was manufactured and installed by Iarnród Éireann in the early '00s. The bridge crosses the existing tracks at a high skew.

The single-span structure is supported on steel abutment supports and shallow foundations. The existing north and south abutments have horizontal clearances greater than 4.5m (a minimum distance for which abutment need not be designed for railway impact loading). The north abutment is positioned outside the north CIE boundary wall (i.e. to the North of the boundary wall). The south abutment is located on the north side of the Iarnród Éireann Infrastructure building.

The internal width of the structure is 1.1m. A stairway on the north and south sides of the bridge facilitates access to deck level for the users. The edge of stairways incorporates a bicycle ledge that allows users to more easily manoeuvre bicycles to and from deck level. The bridge deck is fully enclosed. The height of the enclosed deck is 2.7m.

Access to the R833 road on the north side is secured by means of a keypad locked steel access gate. The bridge is exclusively for use by Iarnród Éireann staff and does not form part of a public footway. See **Figures 2-10** and **2-11**.





Figure 2-10 Khyber Pass Footbridge (OBC5), west elevation



Figure 2-11 North boundary wall

## 2.6. Ground Conditions

The western extents of the Inchicore Works area are located within a steep cutting on both sides that are partially covered by vegetation.

The northern cutting appears to gradually decrease in height in an easterly direction. A retaining wall covered by vegetation exists along the northern boundary of the railway for the entire study area providing separation between the railway and the residential properties. A retaining wall sits behind the cutting slope on the southern

boundary between Kylemore and Inchicore Works and terminates at the sidings where the railway becomes at grade. Further to the east, the south of the railway is bound by the sidings, maintenance sheds, car park and other buildings owned by Iarnród Éireann at the Inchicore Railway Works.

Close to the Khyber Pass Footbridge (OBC5), the railway transitions on both sides from a minor cutting to an at-grade section, then onto an embankment section on the approach to Sarsfield Road Bridge (UBC4) - with boundary walls on either side of the tracks.

Industrial units and the Inchicore Works generally form the southern boundary of the railway, and residential properties form the entire northern boundary. Further, towards the east, apartment complexes are located north of the railway line between the Khyber Pass Footbridge (OBC5) and Sarsfield Road Bridge (UBC4). Between the Inchicore Railway Works and Sarsfield Road Bridge (UBC4), there are residential properties, vacant land covered by grass and hardstanding, and an existing attenuation tank.

A review of the available geological maps suggests that the site is underlain entirely by till overlying bedrock. The bedrock is described as limestone and shale.

A large amount of historical ground investigation is available within this area and has been summarised below.

Historical boreholes in the western extents of the site undertaken at road level close to Kylemore Road Bridge (OBC5A) indicate the ground conditions to comprise clay underlain by limestone bedrock at 35.69m AOD. No groundwater conditions were recorded.

In the centre of the site adjacent to the Inchicore Railway Works, the ground conditions typically consisted of made ground underlain by soft to stiff clay and limestone bedrock. Historical boreholes completed west of the Track and Signal Building encountered a thin layer of topsoil over the made ground to a depth of 1.40m bgl (28.24m AOD). Drillers described the made ground as slag and stony clay. The made ground was underlain by very soft to soft clay. Below the soft clay, stiff black clay was encountered that became very stiff with depth. The borehole was terminated at 9.50m bgl (20.14m AOD). The hole would be continued using the rotary techniques in BHRC02 with bedrock encountered at 9.50m bgl (20.16m AOD) and was described as very strong limestone and moderately strong mudstone and shale. Water strikes (recorded as seepage) was encountered during drilling at 0.70m bgl and 5.30m bgl.

In the east, adjacent to Sarsfield Road Bridge (UBC4), historical boreholes report the ground conditions to comprise made ground, underlain by a firm to stiff clay and gravel with limestone bedrock encountered at depths ranging from 9.54m AOD and 12.73m AOD. No groundwater conditions were recorded.

Topographically the ground slopes gently towards the River Liffey east to west and the railway is at grade at Khyber Pass Footbridge (OBC5).

The general superficial geology in the Khyber Pass Footbridge (OBC5) area is anticipated to comprise till overlying bedrock (limestone and shale). A previous ground investigation completed 70m west of Khyber Pass Footbridge (OBC5) recorded a thin layer of topsoil overlying made ground to depth of 1.40m below ground level (bgl) (28.24m AOD). This was described as slag and stony clay. The made ground was underlain by very soft to soft clay becoming stiff to very stiff with depth. The borehole was terminated at 9.50m bgl (20.14m AOD). Water strikes recorded as seepage during drilling were noted at 0.70m bgl and 5.30m bgl.

The borehole was re-drilled from ground level using rotary coring techniques. The ground conditions recorded were clayey gravel and gravelly clay between ground level and 8.50m bgl (21.14m AOD). There was no recovery of this material. Firm clay was recorded from 8.50m bgl (21.14m AOD) overlying a thin layer of limestone gravel. Rock comprising strong to very strong limestone and moderately weak mudstone and shale was encountered at 10.50m bgl (19.14m AOD).



It is not envisaged that the development of options in this area will be governed by existing ground conditions as the ground conditions noted will facilitate all likely options. Nevertheless a Ground Investigation is currently ongoing to verify the ground conditions encountered in the historical investigations.

## 2.7. Environment

There is a significant residential development in close proximity to the north of the rail corridor at Landen Road, in many cases within 50m of the existing rail centreline. There are also a number of residential apartment blocks located to the north as the corridor approaches Sarsfield Road. There are also residential dwellings to the south associated with Inchicore Road, Inchicore Parade (including St. Georges Villas) and St. Patrick's Terrace.

Community facilities in this area include Markievicz Park, which is north of the Inchicore Works.

To the south, the lands are predominantly associated with the Inchicore Works and the functional railway sidings for the cleaning and maintenance of the carriages. There is also significant built and industrial heritage value associated with the Inchicore Works with a number of the buildings and features in the works listed on the National Inventory of Architectural Heritage (NIAH), as well as the Record of Protected Structures (RPS).

Key features include a signal box to the North of the rail line (Regional Rating Reg No. 50080417) and a turret associated with a locomotive shed to the south of the line (Regional Rating Reg. No. 50080418). There are also two offices, several workshops, a warehouse, a turntable and a water pump also listed as NIAH.

The entire circuit boundary wall of the Inchicore Works is afforded statutory protection under the Dublin City Development Plan [RPS Ref:8744, which reads 'CIE Railway Estate: boundary wall dating from the 1850s (including 20th-century reconstructions but excluding modern additions)'. In addition, specific sections of the boundary wall of the Inchicore Works are also protected under RPS Ref:3300, RPS Ref:3992 and RPS Ref:7476. The former Dispensary & Reading Rooms & Dining Hall, now Inchicore Sports & Social Club, within the estate are also identified on the RPS.

The boundary circuit has been surveyed by the National Inventory of Architectural Heritage (NIAH) who have assigned these a 'Regional' rating (NIAH Ref: 50080055).

The general works area is considered to have industrial heritage value associated with the historic rail line.

Biodiversity constraints to highlight within this area are noted as invasive alien species and bat roost potential, which were identified previously.

## 2.8. Utilities

As there are no public roads directly impacted within this area, existing utilities networks are primarily limited to trackside items and underground services crossing under the railway. 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)
- Private water supply pipe (Irish Rail owned)

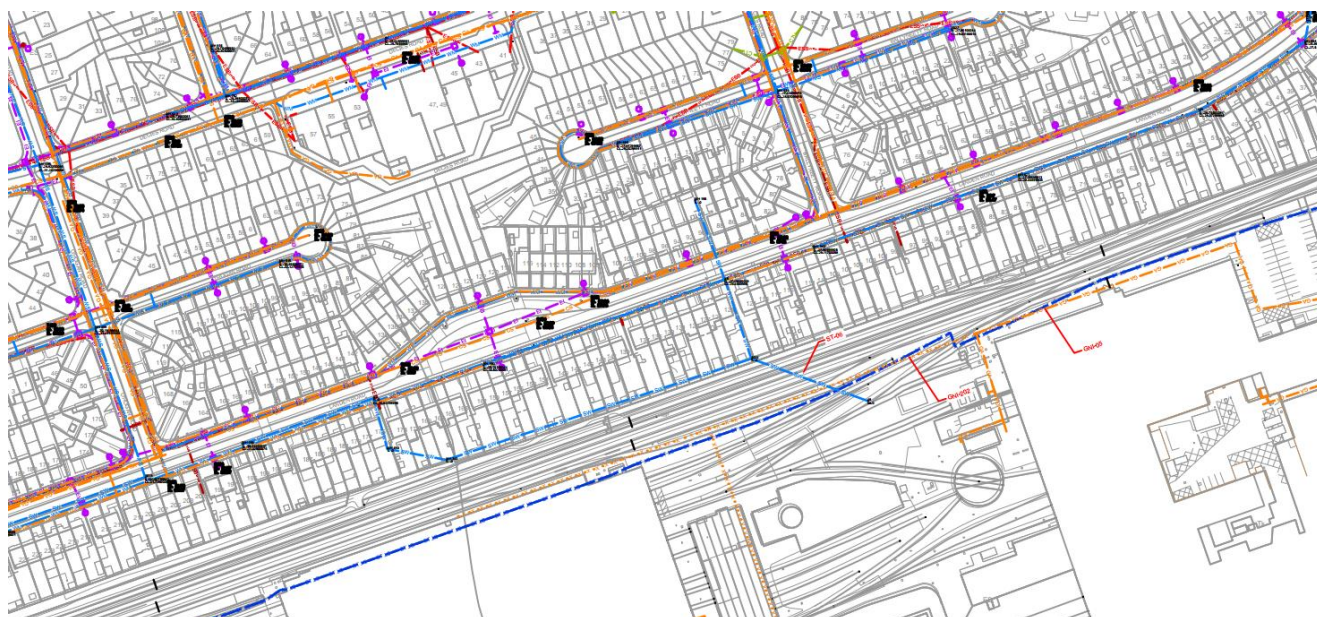
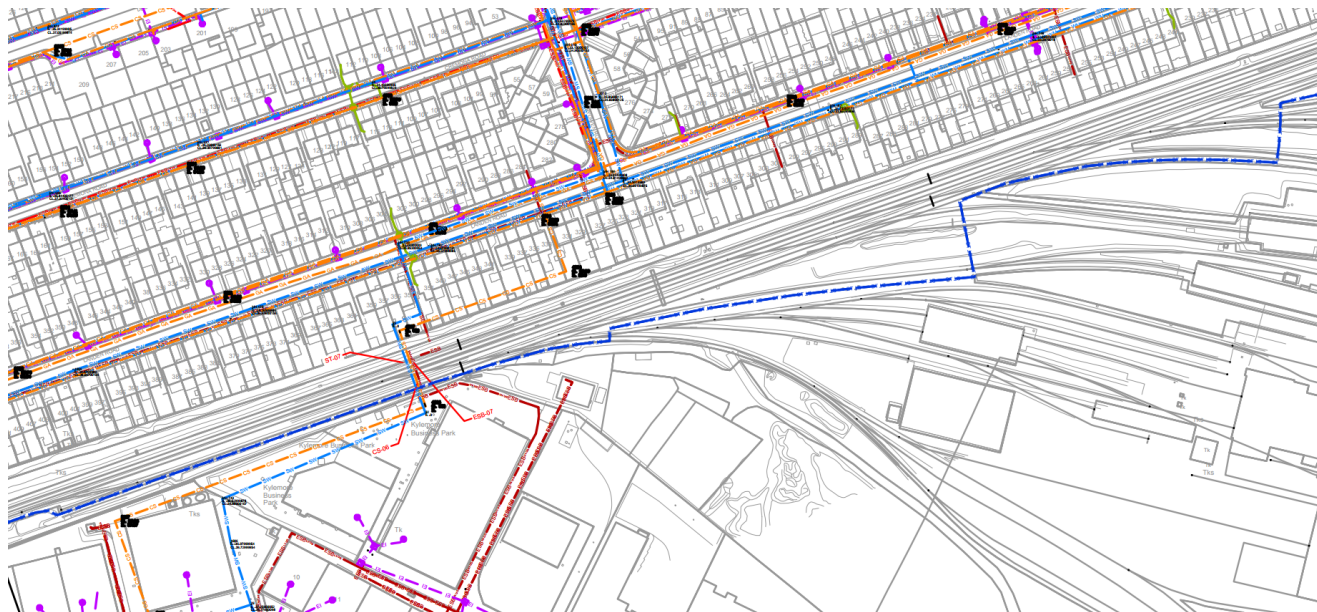
Data in the form of utility service records have been gathered from all providers in the area. The majority of services are present at the track level, most of which are crossing the railway corridor below the tracks. Where track lowering is proposed, consideration of the impacts on these services will be necessary.

There are a number of combined sewers and stormwater sewers crossing the tracks. In general, these services provide linkage to public sewers located along Landon Road to the north. The Creosote Stream is located to the



eastern extent of the study area. It flows in a general west-to-east direction before crossing under the railway and Sarsfield Road at Sarsfield Road Bridge (UBC4) in a culvert. This culvert is located at a significant depth compared to the railway surface level.

At the Khyber Pass Footbridge (OBC5) the only services that cross beneath are IÉ owned services that run along the rail corridor. There are no other services that are above, below or in close proximity to the bridge.



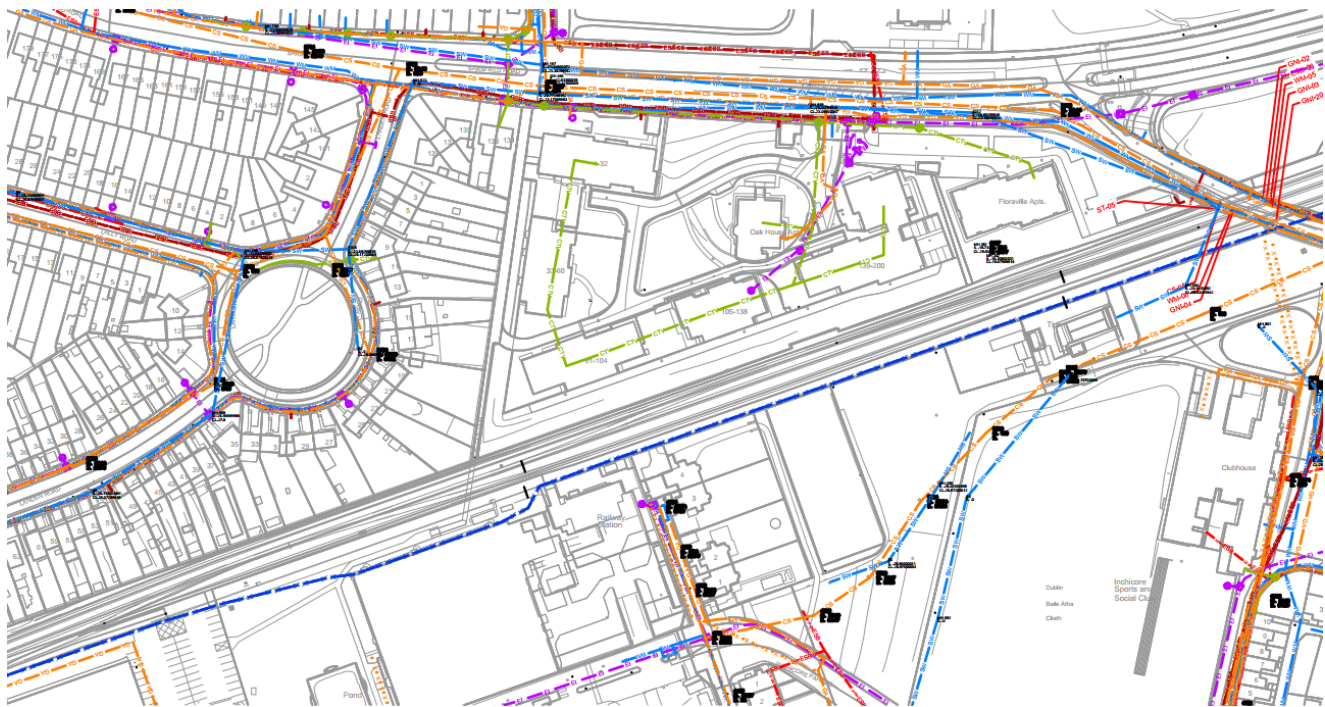


Figure 2-12 - Existing Utilities Kylemore to Sarsfield

## 2.9. Drainage

There are no known track drainage elements present in the area where the four tracking is to be implemented. The only drainage asset that is identified in the area is within Inchicore Works. Inchicore Works has its own drainage systems, with an outfall into the existing culvert under Sarsfield Road where the existing attenuation tank, located north of the CIE Sports Ground, is thought to discharge. This existing attenuation tank holds the runoff volumes drained from the Inchicore Works Depot.



## 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 with associated electrical substations
- Electrical clearance to structures
- Keep current functionality of railway (including Inchicore Works).
- Keep current functionality of footbridge (Khyber Pass)
- Replacement bridge options to be ambulant disabled accessible and incorporate a bicycle ledge
- 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 envisaged 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 of Relocatable Equipment Buildings (REB) 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

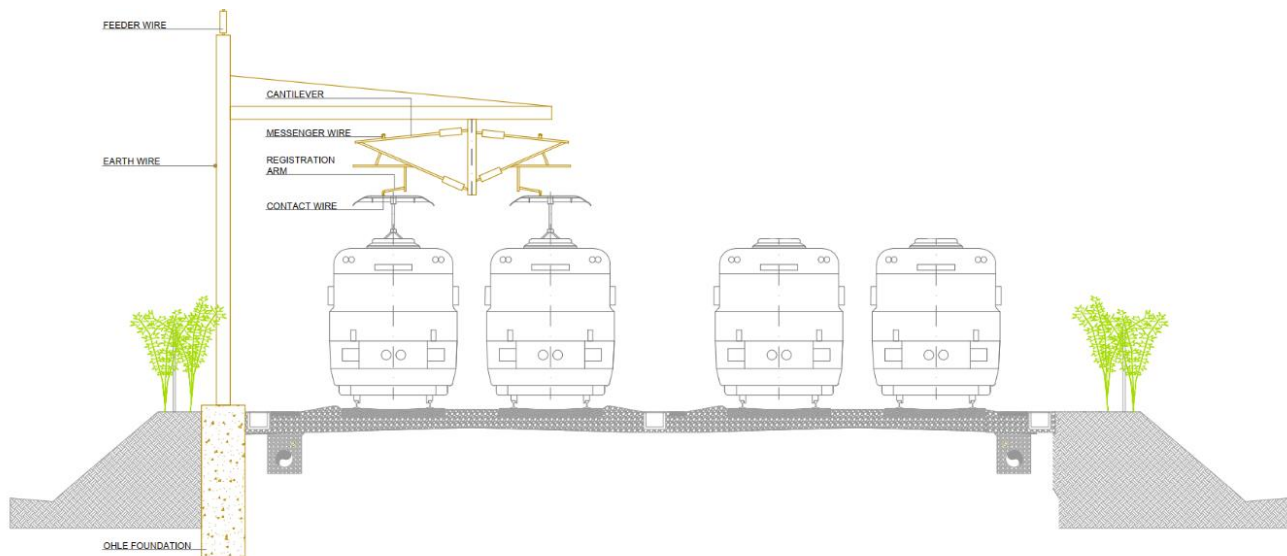
The OHLE system architecture is currently being developed. The Dart wide programme will adopt a 1500V Direct Current (DC) OHLE system to provide electrical power to the network's new electric train fleet.

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

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

In the four track areas, Two Track Cantilevers (TTCs) will generally 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.



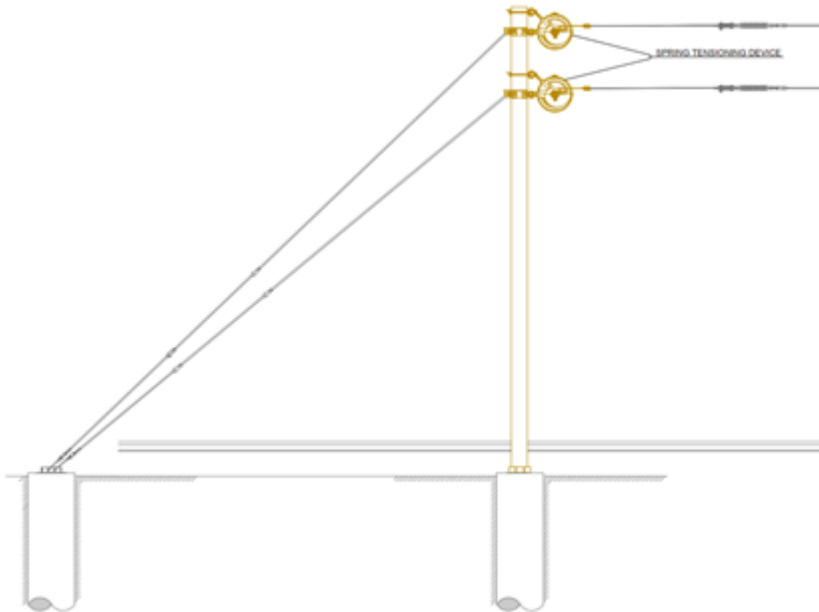
**Figure 3-1 Typical OHLE arrangement in four track open route – Facing East**

For contact wire details under Khyber Pass Footbridge see **Section 7.3.3. Signalling, Electrical and Telecommunications.**

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

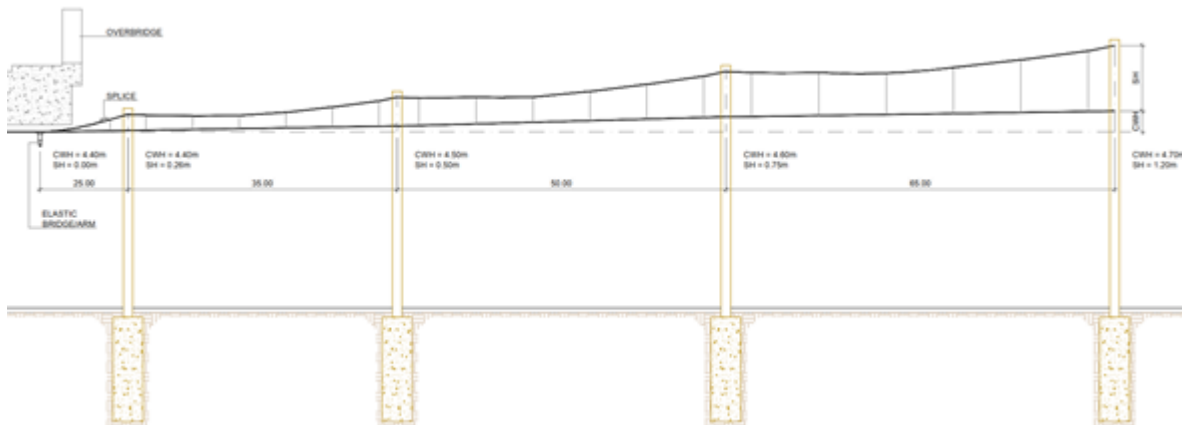
Maximum tension length is 1600m. Overlaps will comprise three spans, with spring tensioners used throughout. Midpoint Anchors (MPAs) will generally be of the tie-wire type, although the portal type may be needed in some locations.

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



**Figure 3-2 Typical anchor structure**

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



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

### 3.3. Design Standards

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

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

## 4. Constraints

### 4.1. Environment

The key environmental constraints in this area relate to proximity to residential properties, heritage assets associated with Inchicore Works and material assets associated with existing rail infrastructure. 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. Bat dusk emergence and dawn re-entry surveys have been carried out to characterise and identify bat roosting at the old signal box and the turret associated with a locomotive shed at Inchicore Works.

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 highlighted the Irish Rail Inchicore Works Estate as a particularly important area, given the various protected structures on the grounds, including the estate boundary wall which is protected under Dublin City Council's Record of Protected Structures (RPS) Ref: 8744. Aside from the statutory protection afforded to the wall under its inclusion on the DCC RPS, the boundary wall is also listed on the National Inventory of Architectural Heritage (NIAH). A meeting with Dublin City Council noted that a new City Development Plan for 2022-2028 is being prepared and that it is proposed to designate the whole Inchicore Works complex as an Architectural Heritage Area (ACA) as part of the review of the development plan. 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 noted local community features of importance in the area – a community orchard and walled garden within the CIE works estate boundary, a community garden located at the back of the Seven Oaks Apartment complex and a sports and social club in Inchicore. Further issues or concerns raised during PC1 are described in the **Public Consultation No. 1 Findings Report, Volume 4.1**.

### 4.2. Property

The existing Khyber Pass Footbridge (OBC5) is fully within IE lands. Options that propose a replacement bridge would be constrained by the narrow pedestrian walkway on the north side of the structure. A replacement structure designed to ambulant disabled standards would require a minimum width of 2m (i.e. more than the existing width). The lands to the east and west of the north access steps are not in IE ownership.

The building on the south side of the bridge poses a geometric constraint for replace bridge options with increased span lengths. Replacement bridge options with higher deck levels would require longer stairs in plan. See **Figure 4-1** and **Figure 4-2**.





Figure 4-1 Existing pathway not sufficiently wide to provide ambulant disabled access



Figure 4-2 Land to the west (LHS) and east (RHS) of the existing north access steps




This section of the railway corridor has to be widened to accommodate the additional two tracks for the new DART service. The cross section varies through this area but is predominantly at grade, with property boundaries close to the rail corridor on both sides. Where possible the extension will be contained within CIÉ's land ownership, however in specific locations it will affect adjoining property owners. There may also be temporary interference of other property rights during construction along the rail corridor and works, however technical and construction related solutions will seek to minimise the impacts.


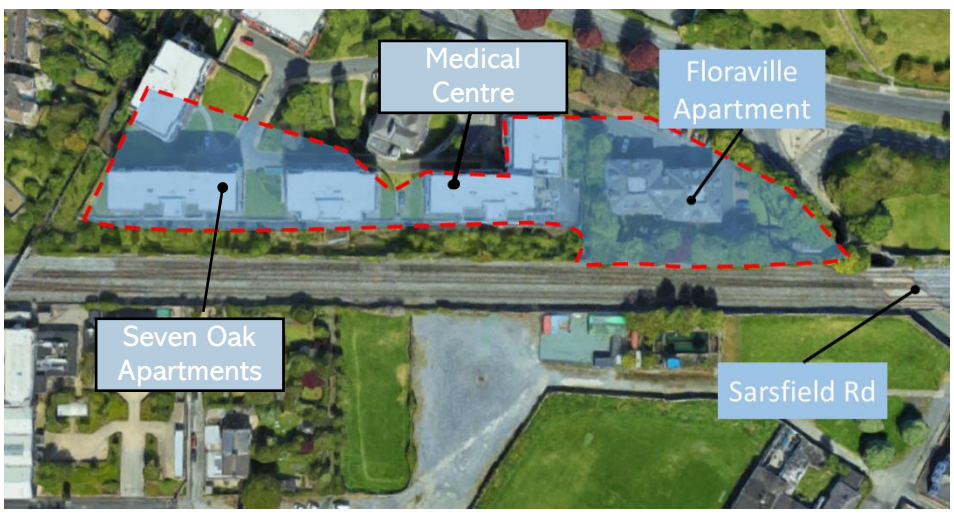
### 4.3. Permanent Way


In **Table 4-1** details of each of the features that would constrain the widening of the rail corridor are demonstrated.

**Table 4-1 Details of the constraints to install the four tracks**

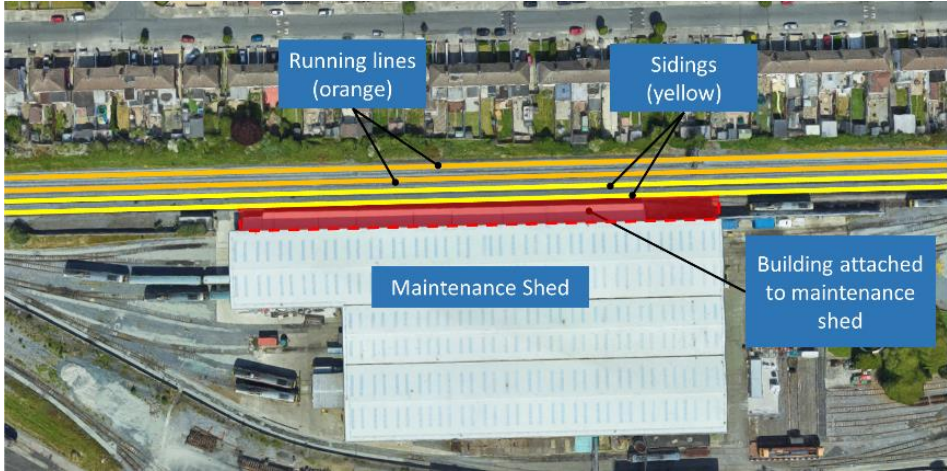

Location	Name	Description of Constraints to four-tracking
North Side	Properties at Landen Road	<p>The back garden of the properties at Landen Road are close to the existing tracks. The distance between the property wall varies from 10m on the West to 1.8m on the East side (refer to <b>Figure 4-3</b>) to the nearest rail.</p>  <p><b>Figure 4-3 Minimum distance of 1.8m from property wall on the north to nearest track.</b></p>




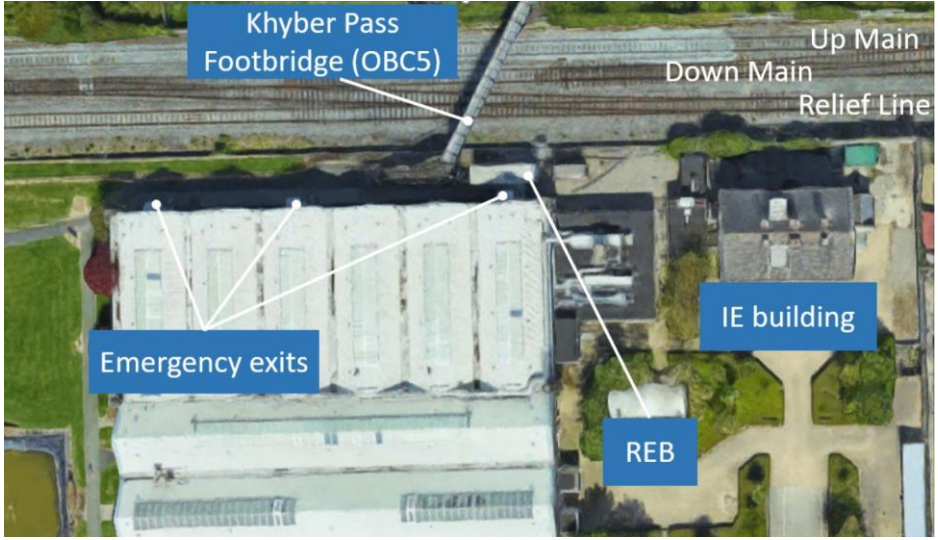

Location	Name	Description of Constraints to four-tracking
North Side	Old Signal Box	<p>The signal box is a historical building currently located 1.6m to the nearest rail.</p>  <p><b>Figure 4-4 Old Signal box, located at 1. 6m to the nearest rail.</b></p>
North Side	Apartment building and Sarsfield Medical Centre	<p>The property boundary of the Apartment building at Sarsfield Road is located at 2.4m from the nearest track. This property is at the same level as the railway corridor.</p> <p>The property boundary of the Sarsfield Medical Centre is at 10.5m from the nearest track. The building is at a lower level; the track is on an embankment of 3m high.</p>  <p><b>Figure 4-5 Medical Centre and Apartment buildings in the north.</b></p>

Location	Name	Description of Constraints to four-tracking
South Side	Industrial Properties	<p>Property boundary of the Industrial properties east of Kylemore Rd is located at 6.5m to the nearest rail.</p>  <p>The aerial photograph shows a large industrial complex with several large blue-roofed buildings. A red dashed line outlines the property boundary. Labels with leader lines point to 'Kylemore Road' on the left, 'West Depot Connection' at the top, and 'Industrial properties' within the complex. A white line indicates the 6.5m distance from the rail line to the property boundary.</p> <p><b>Figure 4-6 Industrial properties West of Inchicore Works.</b></p>




Location	Name	Description of Constraints to four-tracking
South Side	Depot Maintenance Shed	<p>The maintenance shed at Inchicore is where the regular maintenance of rail vehicles is carried out. An extension on the north side has been added to the building. In the attachment are offices, toilets, lockers and plant rooms which houses tanks and pumps for the train wash.</p> <p>There is a limited clearance area between the building and the Long Siding (circa 1.8m interval). This is an area where the standard distance between the track and the structure is not achieved, and the passing of the maintenance personnel is prohibited during the rail operation time.</p>  <p><b>Figure 4-7 Location of the maintenance shed, the attached building and the sidings.</b></p>  <p><b>Figure 4-8 Attachment to the maintenance shed</b></p> <p>Close to the adjacent siding. Limited clearance area between the Long Siding and the building.</p>

Location	Name	Description of Constraints to four-tracking
South Side	Turret	<p>The Turret is part of the overall architectural heritage building. It currently accommodates offices and electrical services. It is at 5.5m to the nearest siding. The area between the Turret and the nearest siding is used for road vehicle access to the track maintenance area.</p>  <p><b>Figure 4-9 View of the Turret.</b></p> <p>View of the Turret on the right, and the Old Signal Box on the left. The Turret is on the south of the tracks. Vehicular access to the track maintenance area.</p>

Location	Name	Description of Constraints to four-tracking
South Side	Track and Signal HQ	<p>The Track and signal building is on the south side of the tracks. At this point, there are three running lines (Up &amp; Down Main and Relief Line). The Long siding becomes the Relief Line after the trap points. On this side of the buildings, there are some emergency exits. The Khyber Pass Footbridge (OBC5) provides access to the depot from Sarsfield Road.</p> <p>A signalling Relocatable Equipment Building (REB) is found between the building and the tracks.</p>  <p><b>Figure 4-10 Track and Signal building. Three Tracks at this section.</b></p> <p>From North to South: Up Main, Down Main &amp; Relief Line</p>  <p><b>Figure 4-11 HQ Signalling building.</b></p> <p>Emergency exits on this side of the building. Khyber Pass Footbridge (OBC5).</p>

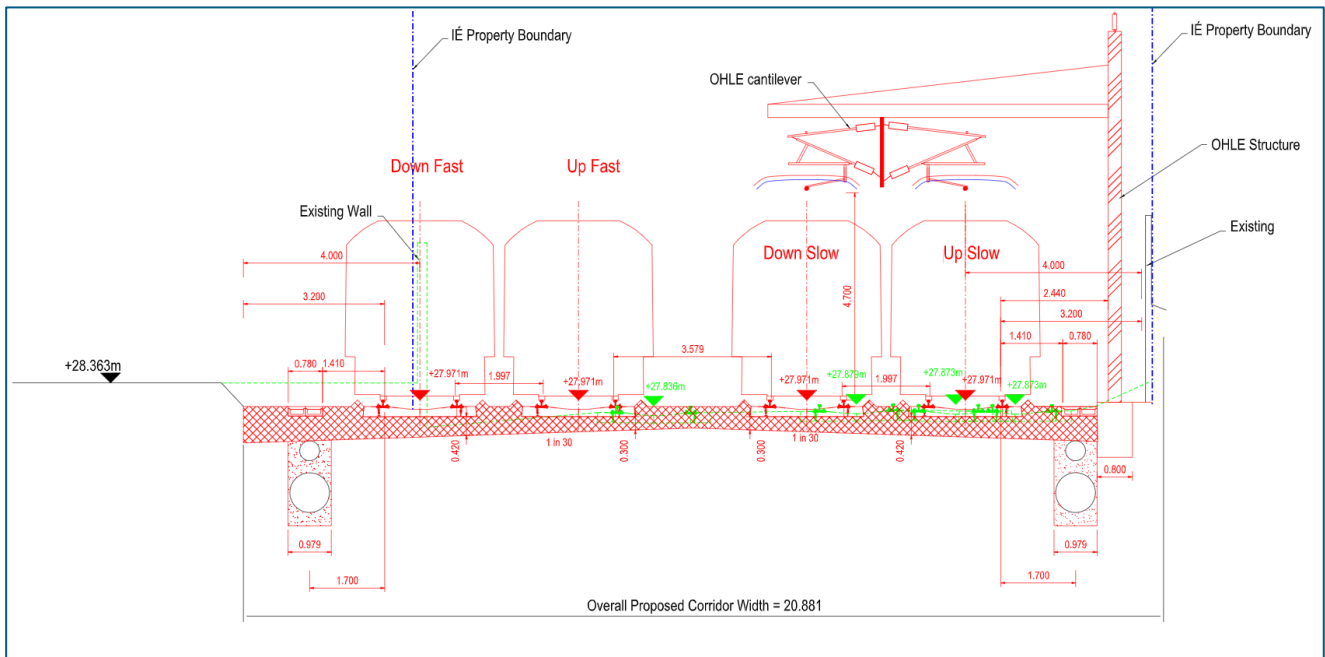


Location	Name	Description of Constraints to four-tracking
South Side	4 St George's Villas	<p>On the south, the boundary wall of the house located at 4 St George's Villas is close to the track, at 4m from the track. In this area towards the East, the existing drainage attenuation facilities of the depot and the Sarsfield Road Bridge (UBC4) are located.</p>  <p>The aerial photograph shows a railway track running horizontally across the top. Below the track, on the left, is a residential area with a house labeled '4 St George's Villas' highlighted by a red dashed rectangle. To the right of the house is a large, irregularly shaped area labeled 'Attenuation Facilities'. Further to the right is a bridge structure labeled 'UBC4 Sarsfield Road overbridge'. The area between the house and the bridge is mostly green grass.</p>

**Figure 4-12 St George Villas, attenuation Facilities and UBC4.**

In addition to the features described in **Table 4-1**, the vertical alignment will be constrained by the level of the existing sidings in Inchicore and the level of the resulting deck of Sarsfield Road Bridge (UBC4).

The criteria to set the new property boundary are shown in **Figure 4-13**. Room for the installation of the new property walls, the OHLE mast and the walkway is considered.



**Figure 4-13 Minimum distance from property boundary to the nearest track.**

Regarding the Khyber Pass Footbridge (OBC5) area the main constraints there are related to the resulting railway corridor width after the installation of the four-tracking. On the north the wall of the back gardens of private properties and in the south the Track & Signal HQ building.

## 4.4. Existing Structures

The span and clearance of the existing Khyber Pass Footbridge (OBC5) presents a challenge in terms of achieving the project requirements of four-tracking and electrification.

There is insufficient horizontal clearance to install 4 No. tracks beneath the structure without an intervention. This is primarily due to the current location of the abutments relative to feasible Permanent Way design Options and also that the reduced horizontal clearance to the supports would not be in accordance with bridge design standards (even when derogated).

An initial bridge electrical clearance assessment has been carried out to determine whether an Overhead Line Equipment (OHLE) solution is possible without structural or track intervention. The assessment found that minimum normal clearance can be achieved with a 4.7m contact wire height with no structural or track intervention required. The skew of the bridge presents a constraint in terms of positioning OHLE masts on either side (i.e., the bridge would be crossing the OLE above each track at unequal distances from the support gantries on either side).

Sarsfield Road Bridge (UBC4) is located at the western boundary of the study area. It is in close proximity to the subject area (i.e. immediately beyond its boundary) and influences the proposed Options within the area around Inchicore Works. Please refer to **Volume 3E Technical Optioneering Report – Sarsfield Road Bridge to Memorial Road** for details of UBC4 and the proposed treatment options. Similarly, Kylemore Road Bridge (OBC5A) is in close proximity to the west boundary of the study area and has a major influence on the Options for this subject area. Please refer to **Volume 3C Technical Optioneering Report – Le Fanu to Kylemore Bridge** for details of Kylemore Road Bridge (OBC5A).

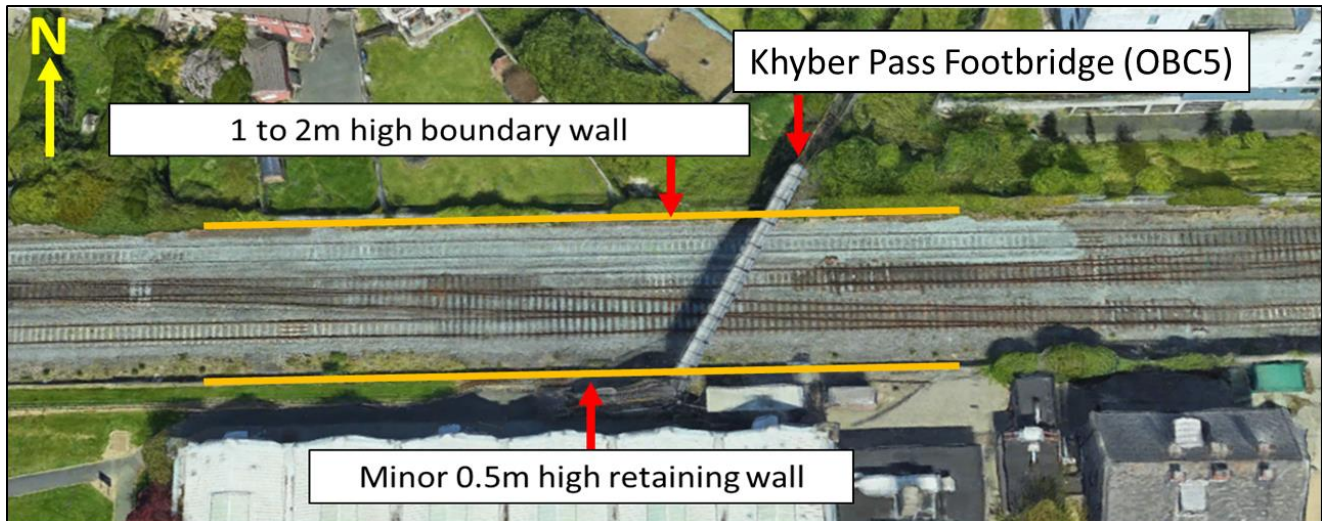
## 4.5. Geotechnical

Based on the existing information, onerous ground or groundwater conditions are not anticipated.

One of the main geotechnical constraints is the retaining walls and existing buildings to the north and south of the railway boundary which restricts the potential permanent way alignments for widening.

As described earlier, a retaining wall covered by vegetation exists along the northern boundary of the railway for the entire study area providing separation between the railway and the residential properties. A retaining wall sits behind the cutting slope on the southern boundary between Kylemore and Inchicore Works and terminates at the sidings where the railway becomes at grade. Boundary walls exist on either side of the tracks at the Khyber Pass Footbridge (OBC5) and onwards to the eastern extents of the study area (see **Figure 4-14**). Widening proposals are constrained to the south by the existing 0.5m high retaining wall on the southern boundary of the railway and the approximately 1m to 2m high masonry boundary wall to the north of the railway.





**Figure 4-14 Boundary wall constraints at Khyber Pass Footbridge (OBC5)**

Depending on the widening details, it is likely that some existing retaining structures will be removed, and new retaining structures will be required. Embankment widening will be required to the east of the Khyber Pass Footbridge (OBC5). At this stage, bored pile walls, gabions or kingpost walls are considered to be suitable and conservative sizing will be used until such stage that detailed ground investigation data becomes available.

Some temporary and permanent acquisitions of land are likely to be required for permanent way widening options to facilitate construction of the track alignment and new permanent boundary retaining structures. This is not uniform across the section because not all the existing properties are aligned parallel to the track; while some sections are bounded by high cutting embankments and others are at grade.

Existing nearby walls, buildings, structures and earthworks may also require monitoring (e.g. vibration monitoring) during piling of any new retaining structures to ensure no structural damage is caused during construction to existing buildings and listed structures. Consent for works close to sensitive, listed or historic structures will be required.

## 4.6. Existing Utilities

The combined sewers and storm water sewers present at various locations where they cross under the tracks will require careful consideration. These sewers provide linkage to existing public sewer networks along Landon Road to the North. In some cases, the sewers also run within private gardens (parallel to the railway) for a distance before utilising a 'gap' in the buildings to access the street beyond. Any proposal to lower the track level or to construct new boundary / retaining walls to the rear of existing private properties will need to consider the potential impact on these services.

Other utilities include ESB infrastructure, private water supply mains and gas mains. ESB infrastructure is limited to a single crossing at the western extent of the study area. Where track lowering is proposed, impact on this service may require local service lowering or localised diversion works.

There is a Irish rail water supply main running located between Inchicore and Heuston that will need to be diverted for track widening works.

Located on the eastern side of Inchicore Depot are a live gas main and a redundant gas main, both parallel to the tracks on the southern side of the rail corridor. Track widening works in the area will require a diversion of the live main due to access availability requirements for Gas Networks Ireland. A 3m lateral clearance is required from any structure satisfies all utility provider requirements. The redundant gas main can be removed during works.

Discussions are ongoing with utility providers to address potential treatment options.

## 4.7. Drainage

The existing track does not have any specific track drainage and the water flows and infiltrates into the terrain naturally. If a complete renewal of the tracks is required, the installation of a new positive track drainage system is advisable to improve the track performance. The main constraint for the design of a new track drainage system is the location of a suitable outfall in the area. There are two potential outfalls for the new track drainage in this area. The existing storm water sewer that crosses the track at chainage 11+820 and the culvert under Sarsfield road located at chainage 10+570. The attenuation of the peak flow of the resulting drainage system would require a significant facility, in terms of land take requirement and civils works.

## 5. Options

This section presents the options associated with the following elements between Kylemore to Sarsfield Road:

- Civil and OHLE infrastructure solutions
- Construction Compounds

Options for the corridor at the area around Inchicore Works and around Khyber Pass Footbridge have been discussed separately.

Options for the proposed substation at Kylemore are covered under **Volume 3C – Technical Optioneering Report – Le Fanu to Kylemore Bridge**. The preferred option for Kylemore substation site location following the optioneering process detailed in Vol 3C is located within the area covered by this report. This is taken into consideration in the overall design development for this section of the project.

### 5.1. Civil and OHLE

This section describes the Main Options that have been considered for the corridor at the Inchicore Works area and at the Khyber Pass Footbridge area. 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 (e.g. ground conditions or drainage). To remove repetition among the Option descriptions, these issues are addressed at the end of the Option Description section.

#### 5.1.1. Corridor Area around Inchicore Works

The existing tracks through the area would not provide the required four tracking while maintaining the functionality of the depot. Therefore, the relaying of additional tracks must be considered. This would require the realignment of the existing tracks. The railway corridor width would be increased in some areas for the additional tracks and for the location of the infrastructure for the electrification of the Slow tracks that will be used for the DART services.

A total of five options have been developed for the area and were presented at PC1, including a ‘Do-Nothing’ Option and a ‘Do-Minimum’ Option.

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

A summary of the Options presented at PC1 as part of the Emerging Preferred Option Selection process is presented in **Table 5-1**. Please refer to **Section 5.1.2 Khyber Pass Footbridge** for the description of options near Khyber Pass Footbridge.

**Table 5-1 Main Options Summary for corridor area around Inchicore Works.**

Option	Description
Option 0: Do Nothing	The existing infrastructure remains unchanged. There are no interventions.
Option 1: Do Minimum	Four Tracking (use of existing four tracks). Electrification of the north tracks. Tie-in of the southern track (current siding) with four tracking of adjacent study areas.
Option 2	Additional tracks in a tunnel
Option 3	Addition of fourth track to the north, electrification, keeping Inchicore siding operational.
Option 4	Addition of fourth track to the south, Electrification, Permanent Way enhanced to the south. No permanent land occupation at the north.

#### 5.1.1.1. Option 0: Do-Nothing

The Do-Nothing Option proposes no changes to the existing rail infrastructure. The rail corridor would not be widened. There would be no continuous four tracking through the study area. As such, this option would not facilitate the inclusion of the 4<sup>th</sup> track or the installation of an OHLE system on 2 separate tracks from the intercity lines. The project requirements would not be achieved.

#### 5.1.1.2. Option 1: Do-Minimum

This Option seeks to achieve the 4-tracking and electrification by means of minor interventions only. A review of the constraints has concluded that there are no minor interventions that by themselves alone could achieve the project requirements. This is because the continuous four tracking section cannot be obtained without major interventions.

#### 5.1.1.3. Option 2

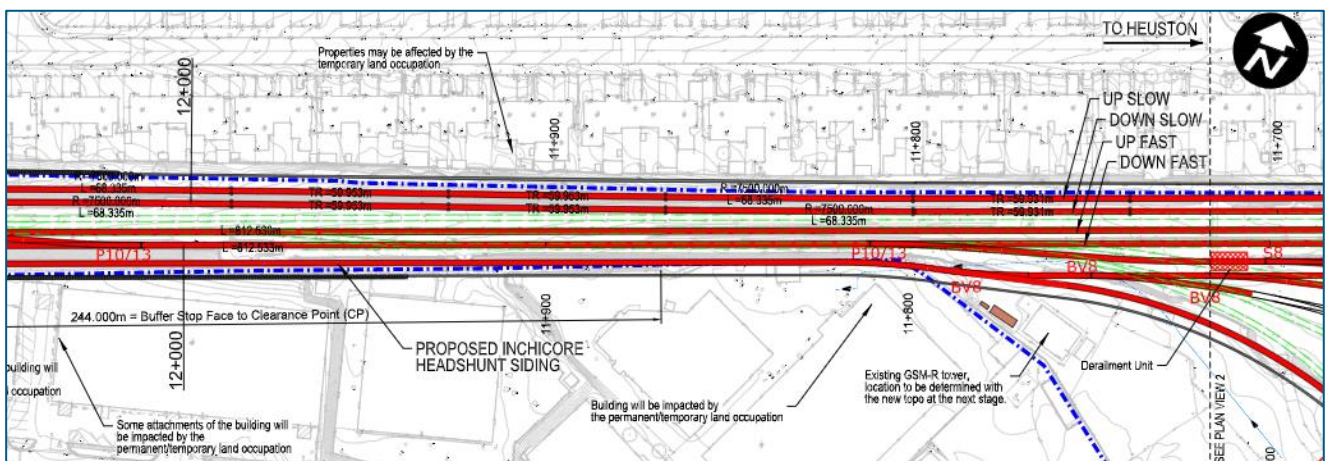
This option assumes that the four tracking is realised by installing a tunnel from the East of Park West station through to the area around Sarsfield Road Bridge (UBC4). This option does not comply with the project requirements because it would not be possible to fit the tunnel portals in the existing railway corridor.

#### 5.1.1.4. Option 3

The widening of the existing rail corridor is realised to the north partially occupying the back garden of the houses at Landen Road.

The study area starts east of Kylemore Road where the position of the tracks will depend on the arrangements at Kylemore Road Bridge (OBC5A). The track alignment links to the design with the area around Kylemore Road Bridge (OBC5A).

At this point, five new tracks will be installed, from north to south: Up Slow, Down Slow, Up Fast, Down Fast and Inchicore Long siding. The Inchicore Long siding would need to be realigned and extended to allow for the shunting movement of a 240m long train to egress or exit from the depot (refer to **Figure 5-1**).



**Figure 5-1 Option 3. Design at the West end of the area around Inchicore Works.**

At the west end of the area around Inchicore Works, the railway corridor will be widened to the south side with significant impact to the industrial buildings. This area is needed to obtain the required length of the sidings. Retaining structures will be installed on either side of the tracks to minimise the land take and contain the resulting slope. The retaining wall on the north would have an approximate height of 3.5m while the retaining wall on the south would have a height of around 4m. In this area permanent land occupation on the north side of the corridor is not required. However temporary occupation of the back garden of those properties (and possible property



wall interventions) may be required. In **Figure 5-2** a view of the existing railway corridor is shown. The rail corridor is in a cutting and retaining walls would be required either side of the corridor to install the additional tracks.



**Figure 5-2 West end of the area around Inchicore Works.**

To the east of the Maintenance Shed the difference in level between the rail levels and the adjacent properties to the north side are less than 1.5m. The northern track will be more than 4m from the existing retaining wall. In this area, no land take is required from the properties to the north. To the south, the internal sidings and connections of Inchicore Works will require a degree of remodelling and will need to be realigned to connect with the proposed location of the Long Siding. There is a GSM-R tower used for the rail communication system that can be retained, whilst the signal gantry in line with the mid-point of the Works will also require replacement – all of these features can be seen in **Figure 5-3** below.



**Figure 5-3 West Entrance to Inchicore Works and GSM-R communication tower.**

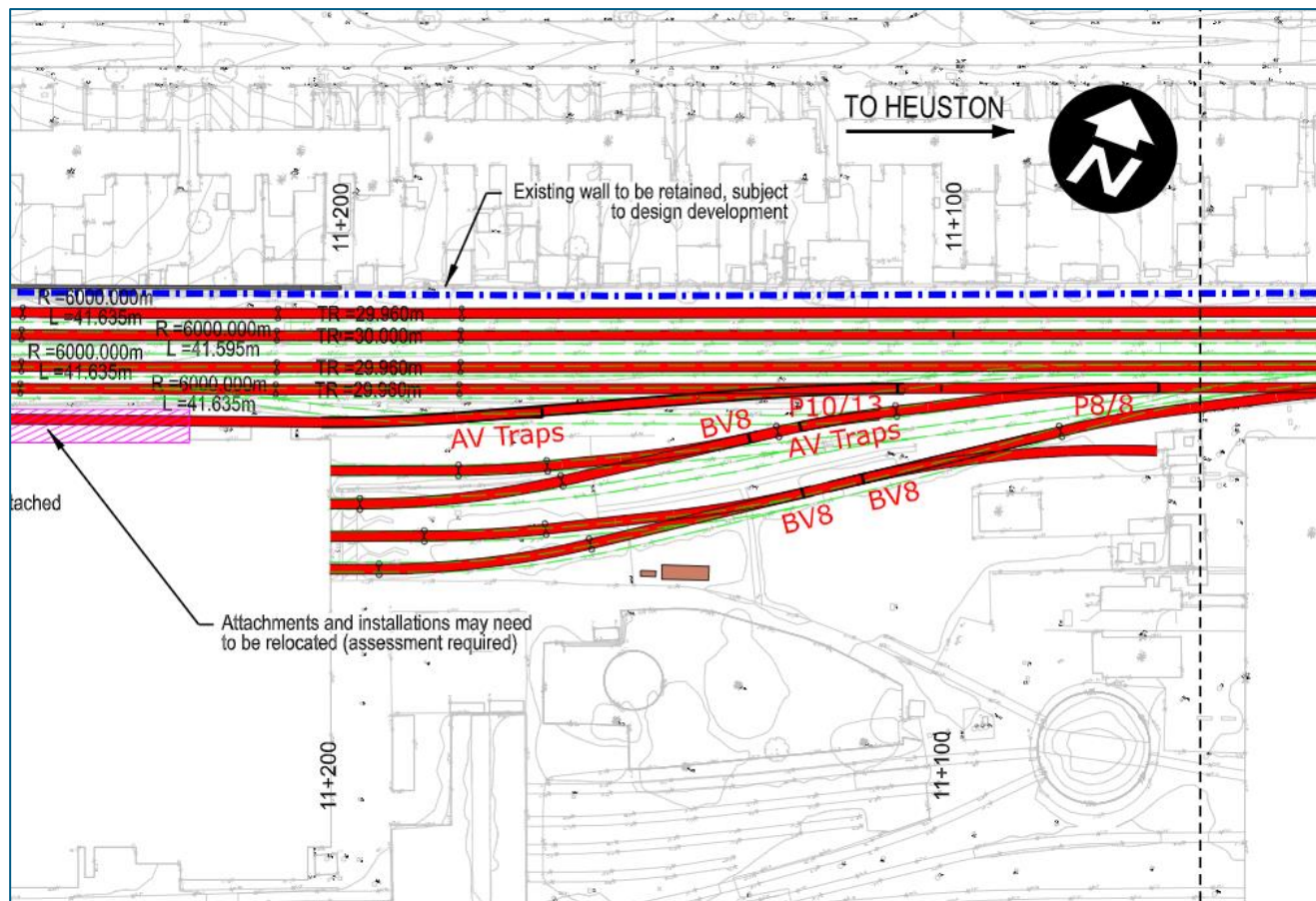
The attached building to the Maintenance Shed must be removed to provide room for the Long Siding (See **Figure 5-4**). This extension has offices, toilets, lockers, and plant rooms which house tanks and pumps for the train wash. All of these elements are to be relocated. Some of the plant equipment is installed outside of the building, between the Maintenance Shed and the tracks. The existing limited clearance area along this building could be removed, and a continuous walkway could be installed to be used by the train drivers and maintainers.



**Figure 5-4 Building attached to the maintenance shed to be removed in all the Options.**



The proposed Long Siding east connection is to the immediate west of the Turret (see **Figure 5-5**). The tracks leading to the Maintenance Shed are to be realigned, with trap points to be included on the east connection to the mainline.



**Figure 5-5 Existing Siding Proposed Realignment.**

Immediately east of Inchicore Works land take would be required to the north side of the railway corridor. Over a length of 600m a total of 45 properties would be affected (Houses at Landen Road and Apartment building at Sarsfield Road). Some land take may also be required at St George's Villas.

The study area finishes at Sarsfield Road, where the design is compatible with the designs that are proposed for the area around Sarsfield Road Bridge (UBC4).

#### 5.1.1.5. Option 4

The Option 4 is equivalent to Option 3 up to the western corner of the Maintenance Shed. From this point, the tracks are realigned further towards the south when compared to the previous Option 3 to avoid any land take from the northern properties.

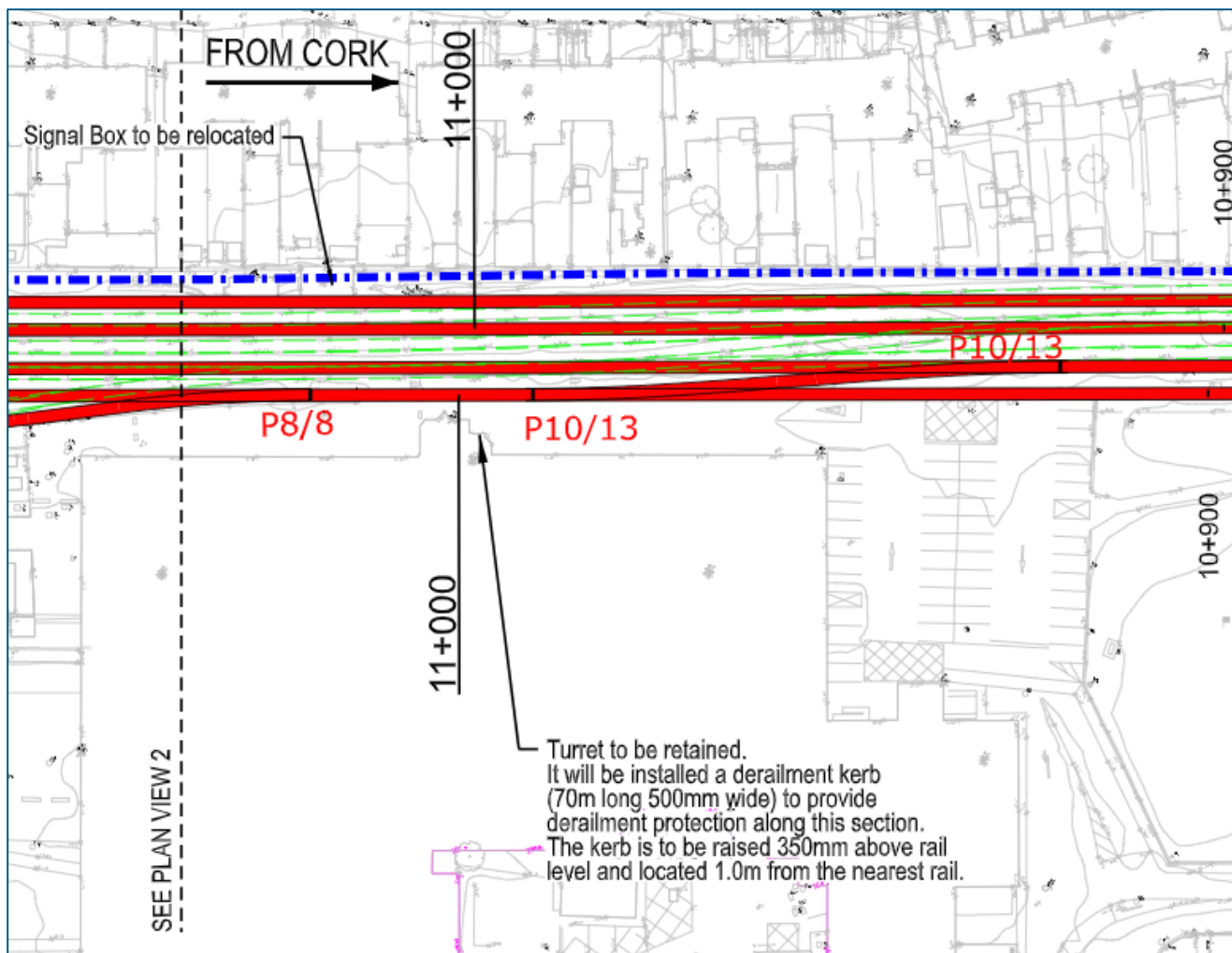
This option concentrates most of the impact of the enhancement on Iarnród Éireann's premises, with a number of railway facilities needing relocation, with the aim of significantly reducing the impact in the properties in Landen Road.

A result of the realignment is that the Long Siding would be closer to the Maintenance Shed. The resulting length would be 2.35m from the nearest rail to the building, enough to provide a walkway between the building and the track.

Again, the sidings need to be realigned to have all the yard tracks connected to the Long Siding and provide trap points and a suitable arresting device.

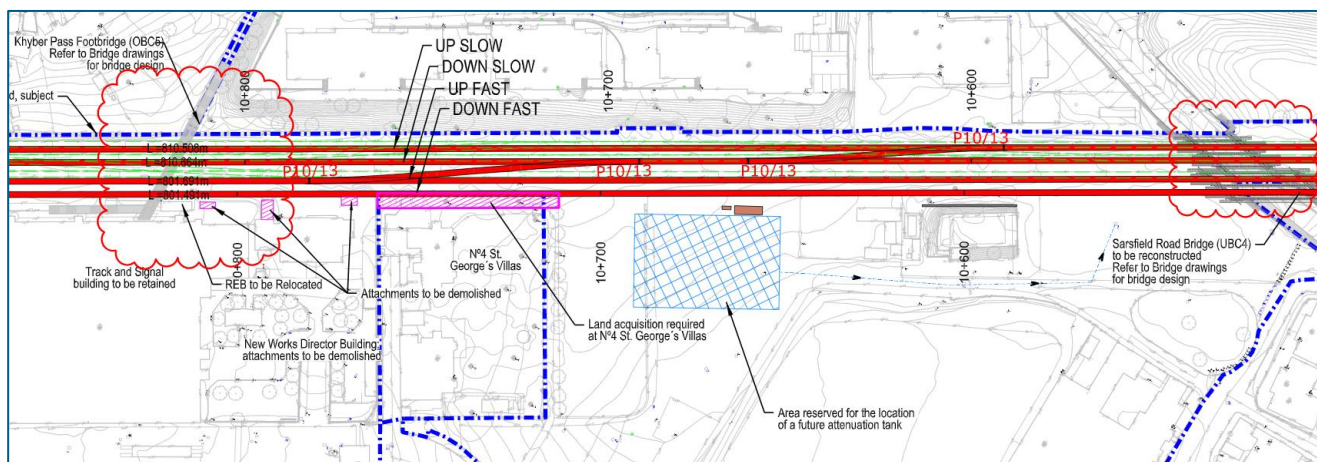
The tracks become quite close to the Turret – which would require the impact on the Turret to be assessed as a result of insufficient clearance to the nearest track.

There would be no impact on the north properties throughout this area. See **Figure 5-6**.



**Figure 5-6** Relative position between the tracks and the Turret in Option 4.

On the south side, the extension of the railway corridor to the south would have an impact on a number of facilities in the depot (Signalling, REB, Attachments to the New Works Director building and the boundaries of the existing drainage attenuation facilities). An area of the garden of 4 St George's Villas would be acquired (see **Figure 5-7** below) and **Appendix C Supporting Drawings**:





**Figure 5-77 Option 4, impact on Irish Rail facilities and St George's Villas in the South.**

### 5.1.2. Khyber Pass Footbridge

The existing Khyber Pass Footbridge (OBC5) structure, which currently has 3 No. tracks beneath it, has insufficient horizontal clearance to safely accommodate 4 No. tracks.

The potential intervention options for the Khyber Pass Footbridge (OBC5) include reconstruction of the bridge with a new bridge that would have sufficient vertical and horizontal clearance to meet the requirements for four-tracking and electrification, retention of the existing bridge and installation of derailment protection blocks to protect the abutments; or its permanent removal and implementation of an alternative (existing) pedestrian access route via Sarsfield Road and Inchicore Terrace North.

A total of 4 No. 'Options' have been developed. The Options include a 'Do-Nothing' Option and a 'Do-Minimum' Option.

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

A summary of the Options presented at PC1 as part of the Emerging Preferred Option Selection process is presented in **Table 5-2**.

**Table 5-2 Options summary**

Option	Description
Option 0: Do Nothing	The existing infrastructure remains unchanged. There are no interventions.
Option 1: Do Minimum	This option endeavours to achieve the 4-tracking and electrification project requirements with the least amount of work to the Khyber Pass Footbridge (OBC5) structure itself.
Option 2	This option proposes to remove the Khyber Pass Footbridge (OBC5) permanently and implement the use of an alternative (existing) pedestrian access route.
Option 3	This option proposes to replace the existing Khyber Pass Footbridge (OBC5) with a new bridge that has increased horizontal and vertical clearance.

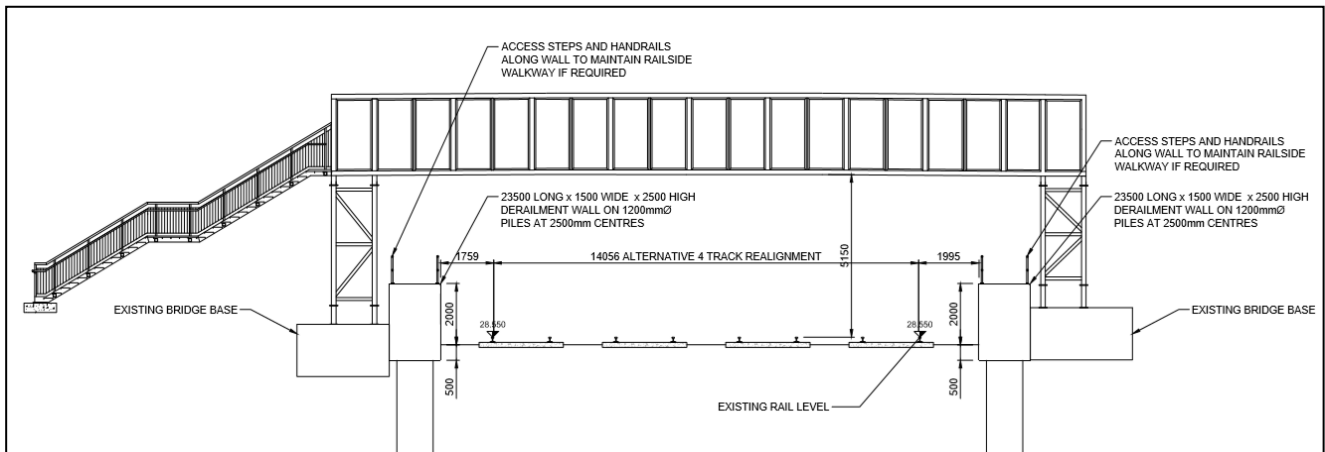
#### 5.1.2.1. Option 0: Do-Nothing

The Do-Nothing Option proposes no changes to the existing Khyber Pass Footbridge (OBC5) or rail infrastructure. The horizontal and vertical constraints at the bridge would not be resolved. This option would not facilitate neither the inclusion of the additional 4<sup>th</sup> track nor the installation of an OHLE system. The project requirements would not be achieved.

#### 5.1.2.2. Option 1: Do-Minimum

This option seeks to achieve the four-tracking and electrification through interventions that would retain the existing Khyber Pass Footbridge (OBC5) structure in its current form. Under this option, four-tracking and electrification would be implemented. The newly placed tracks would be located within less than 4.5m from the existing footbridge supports. As such, derailment protection walls would be constructed in front of the existing bridge supports to withstand derailment impact forces. However, the horizontal clearance to the derailment protection walls would be less than the 2.5m required by standards. The preliminary design indicates that the derailment protection walls would need to be 23.5m long x 1.5m wide x 2.5m high on 1.2m diameter piles at 2.5m

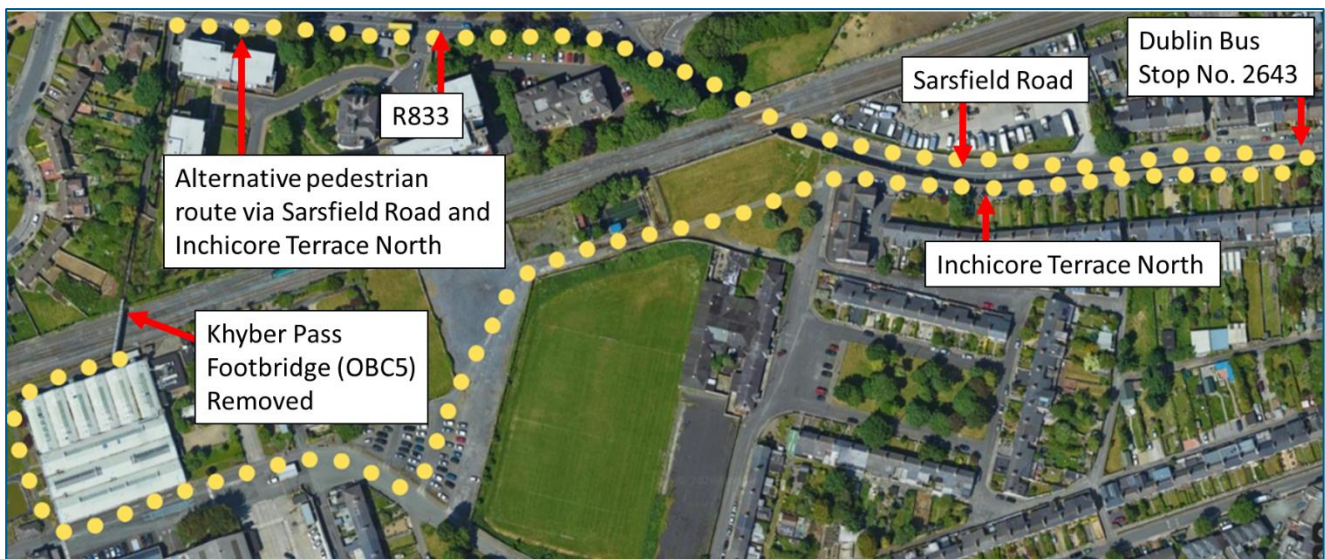
centres. The bridge, which is steel, would require insulating for compatibility with the electrification system. See **Figure 5-8**.



**Figure 5-8 Option 1 - Bridge retained with derailment blocks installed to front of supports – Facing East**

#### 5.1.2.3. Option 2

This option would require significant intervention. The existing Khyber Pass Footbridge (OBC5) would be removed permanently and not replaced. An alternative (existing) pedestrian access route via the R833, Sarsfield Road and Inchicore Terrace North would be implemented. Electrification and 4-tracking would be achieved. The length of the alternative route (shown in **Figure 5-9**) is 1.2 km (10-15 min walking time approximately). Dublin Bus stop (2643) is located on Sarsfield Road at the entrance to Inchicore Terrace North. The distance between stop 2643 and the south side of the existing footbridge is 700m (8 mins walking time approximately). This option would not meet the current requirement to maintain the functionality of the existing footbridge.

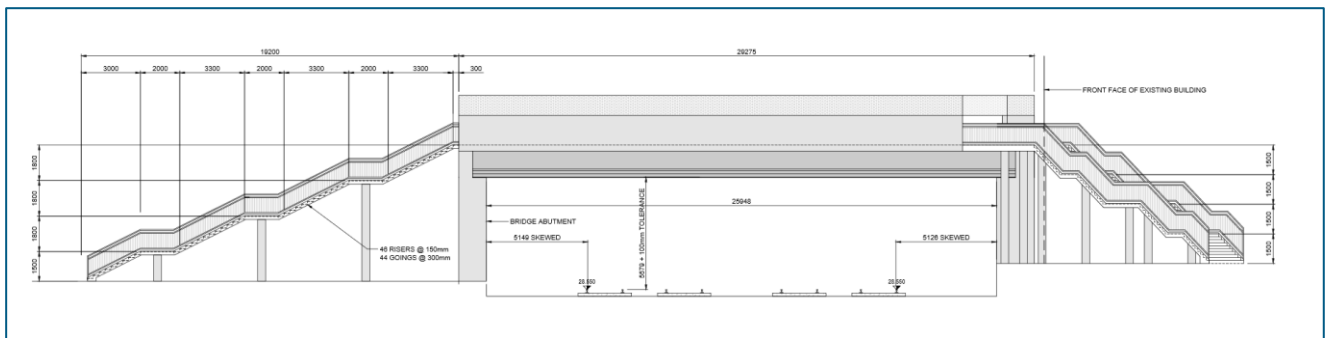


**Figure 5-9 Option 2 - Alternative pedestrian and cycle route**

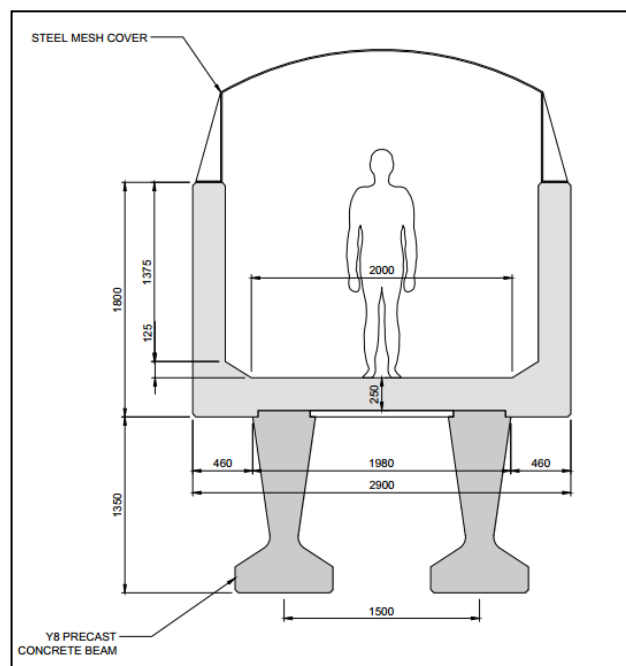
#### 5.1.2.4. Option 3

This option proposes to replace the existing Khyber Pass Footbridge (OBC5) structure. The existing bridge would be replaced with a new structure that has adequate vertical clearance to achieve the required contact wire height and OHLE clearance and a span that facilitates a minimum horizontal clearance to abutments of 4.5m. The additional vertical clearance is to accommodate the constraint posed by the skew of the bridge to the OHLE system. The superstructure would be formed using Y8 beams and an RC deck. The bridge would be enclosed. See **Figure 5-10** and **Figure 5-11**. The bridge stairs would be designed to ambulant disabled standards. The

stairs would incorporate a bicycle ramp ledge (similar to the existing structure). This option is compatible with Perway Option 4 and can be adjusted for compatibility with Perway Option 3. The available space at the south side of the structure is geometrically constrained in Perway Option 4. Where stairs are positioned within 4.5m (horizontally from the edge of the nearest rail), they will be dethatched and not integral with the main structure and supports. An existing spiral staircase fire escape to the building on the south side of the bridge would be removed and replaced with a stair connection to a landing platform on the southern staircase. Please refer to the following drawings in **Appendix C Supporting Drawings**: DE-04-23-DWG-ST-TTA-57150, DE-04-23-DWG-ST-TTA-57151, DE-04-23-DWG-ST-TTA-57152 and DE-04-23-DWG-ST-TTA-57153. An underpass beneath the new tracks may also be considered as an alternative solution.



**Figure 5-10 Option 3 - Bridge replacement, west elevation – Facing East**



**Figure 5-11 Option 3 - Bridge replacement, cross section**

### 5.1.3. OHLE Arrangements

Option 0 does not meet the project requirements and so has not been considered in terms of electrification.

OHLE arrangements will follow the electrification system requirements for DART+ as detailed in **Section 3.2.1 Electrification System**.

Khyber Pass Footbridge (OBC5) is sufficiently high that it can be electrified without any track lowering or structure interventions. The options considered for this bridge include:

- Option 1 (i.e., 'Retain Bridge') provide a soffit height of 5.207m. In this configuration, the OHLE would pass under the bridge without being connected to it. OHLE masts are expected to be positioned around 20m from each outer edge of the bridge. An electrical clearance of 150mm static and 100mm passing would be achieved with a 4.7m contact wire height. The OHLE configuration would be wired using a free-running arrangement. No vertical wire-level grading is required.
- For Option 2, the bridge is permanently removed, and so the OHLE would run through this area with nominal contact wire and system height.
- Option 3 provides a soffit height of 5.579m. In this configuration, the OHLE would use the arrangements described above for Option 1, but the catenary wire heights and mast heights would be increased accordingly.

#### 5.1.4. Permanent Way

The track alignment through Khyber Pass Footbridge (OBC5) is linked to the permanent way solutions in the wider area. At this particular location there are two main alternatives:

1. Area around Inchicore Works Option 3: The rail corridor is widened to the north.
2. Area around Inchicore Works Option 4; The rail corridor is widened to the south.

The differences in plan are related to a different position of around 3m in the north-south direction between the alternatives.

Crossovers need to be installed under the footbridge to maintain the functionality of the depot.

#### 5.1.5. Geotechnical (All Do-Something Options)

##### 5.1.5.1. Corridor at Inchicore Works area

No onerous ground conditions are anticipated that would significantly impact any of the proposed options for permanent way alignment or proposed retaining walls. Therefore, the ground and groundwater conditions currently do not pose any significant concerns from a geotechnical design perspective

New permanent bored pile walls are considered to be suitable at this stage of development for retaining walls greater than 3m in height. Conservative wall types and sizing will be used until such stage that detailed ground investigation data becomes available. For new retaining walls where the retained height is less than 3m, other options may be preferred. The exact type, length and thickness of the proposed retaining walls will be governed by the final permanent way alignment and verticality, topographical information and the ground and groundwater conditions.

##### 5.1.5.2. Corridor at Khyber Pass Footbridge area

All Options (excluding Option 0) propose four-tracking and electrification interventions and will require a detailed geotechnical design for the following elements:

- Earthworks (embankment steepening or widening) and trackbed formation design for new tracks.
- Overhead Line Equipment foundation (preliminary) design.

The geotechnical design will also be required for:

- Derailment blocks (Option 1 only).
- Bridge foundation design.
- Potential replacement of northern boundary wall (1m to 2m in height) and replacement of southern boundary minor retaining walls (Options 1, 2 and 3). Replacement of the concrete walls is considered to be suitable at this stage of development. Intervention on the masonry wall only locally if/where required.



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.

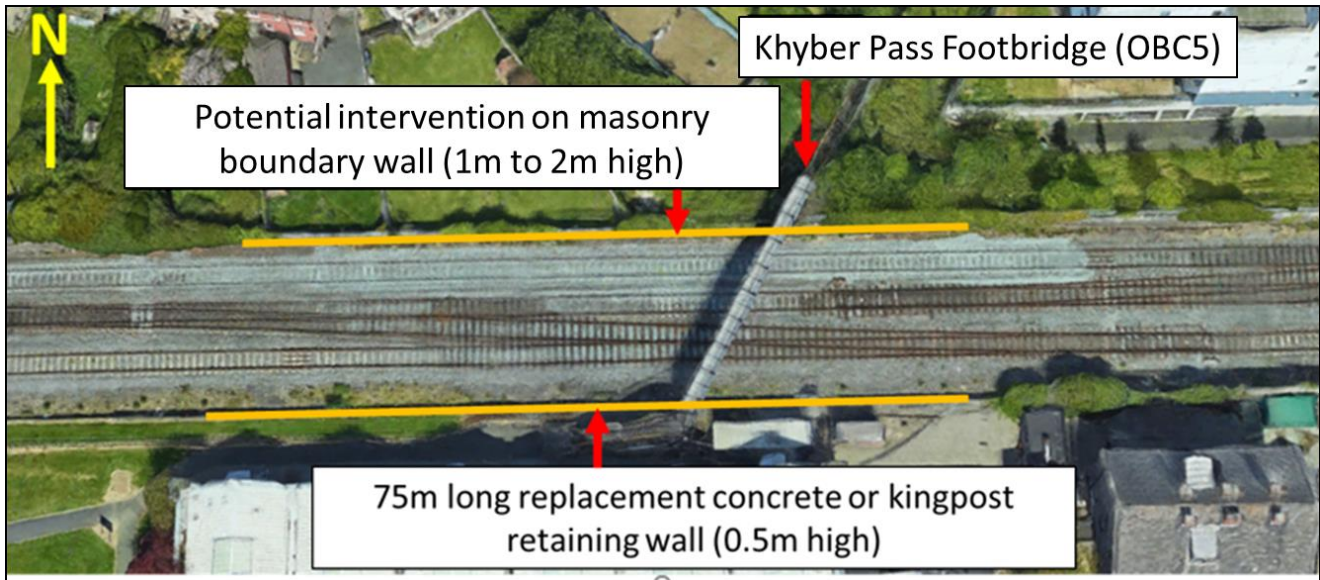


Figure 5-12 Replacement walls locations

#### 5.1.6. Roads and Bridges (All Intervention Options)

All Do-Something Options at the Inchicore Works area will require the re-construction of Khyber Pass Footbridge (OBC5) as well as a track access point to the north east of Kylemore Road Bridge (OBC5A) and the use of the (pan-handle) access road (off Sarsfield Road) to complete northern retaining wall, new electrified slow tracks, as well as the Khyber Pass Footbridge (OBC5) works.

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

All Do-Something Options at the Inchicore Works area will require the relocation of a variety of service cables, utilities and containments and the integration of the existing maintenance routes in Inchicore with the new track arrangement.

#### 5.1.8. Drainage (All Do-Something Options)

The existing attenuation tank facilities (see **Figure 5-13**) are not affected by any of the Main Options. The only impact would be on the fences of the systems that would need to be relocated to allow for a continuous walkway on the cess.

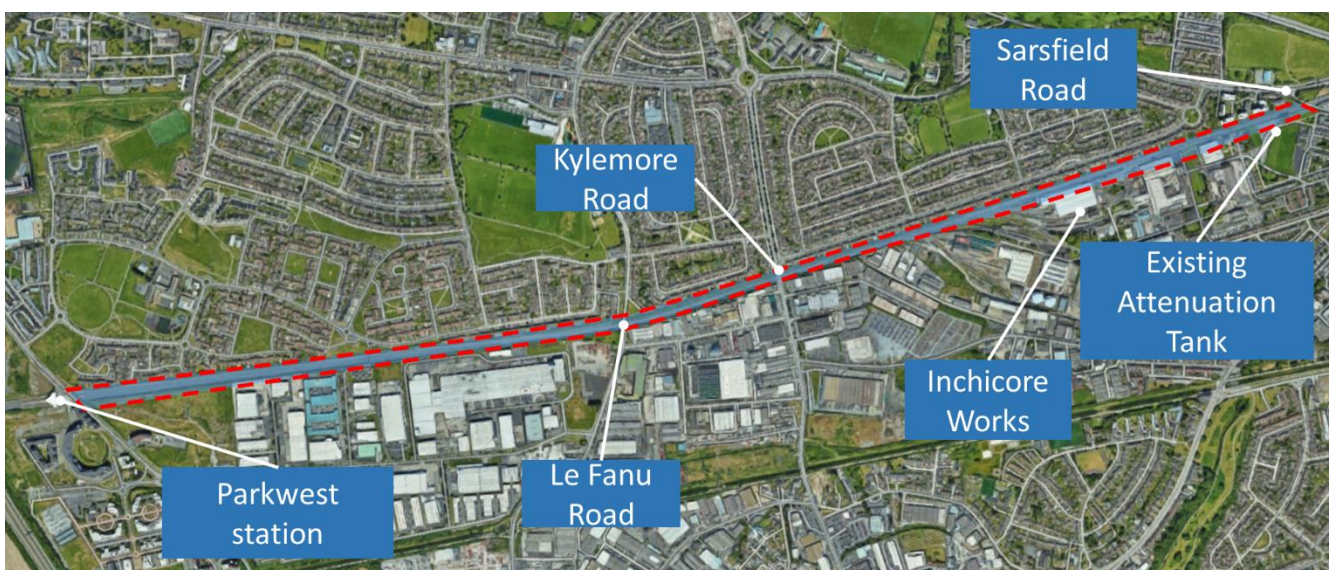




**Figure 5-13 Attenuation tank boundary wall and fence.**

The proposed works in the Main Options involve the renewal of the existing tracks and the addition of new tracks. The track formation would be completely renewed. This new track infrastructure increases the existing impermeable area, and therefore, the generated runoff volumes during storm events. A new drainage system, from the start of the track renewals east of Park West Station, should be put in place as part of the new track arrangement to properly collect and drain all runoff waters either flowing through the ballast or standing on it as a consequence of the ballast saturation during more intense storm events.

**Figure 5-14** shows the extension of the area that needs to be attenuated by a new drainage system. In this area, the track levels are falling towards the east at a gradient of 1%.



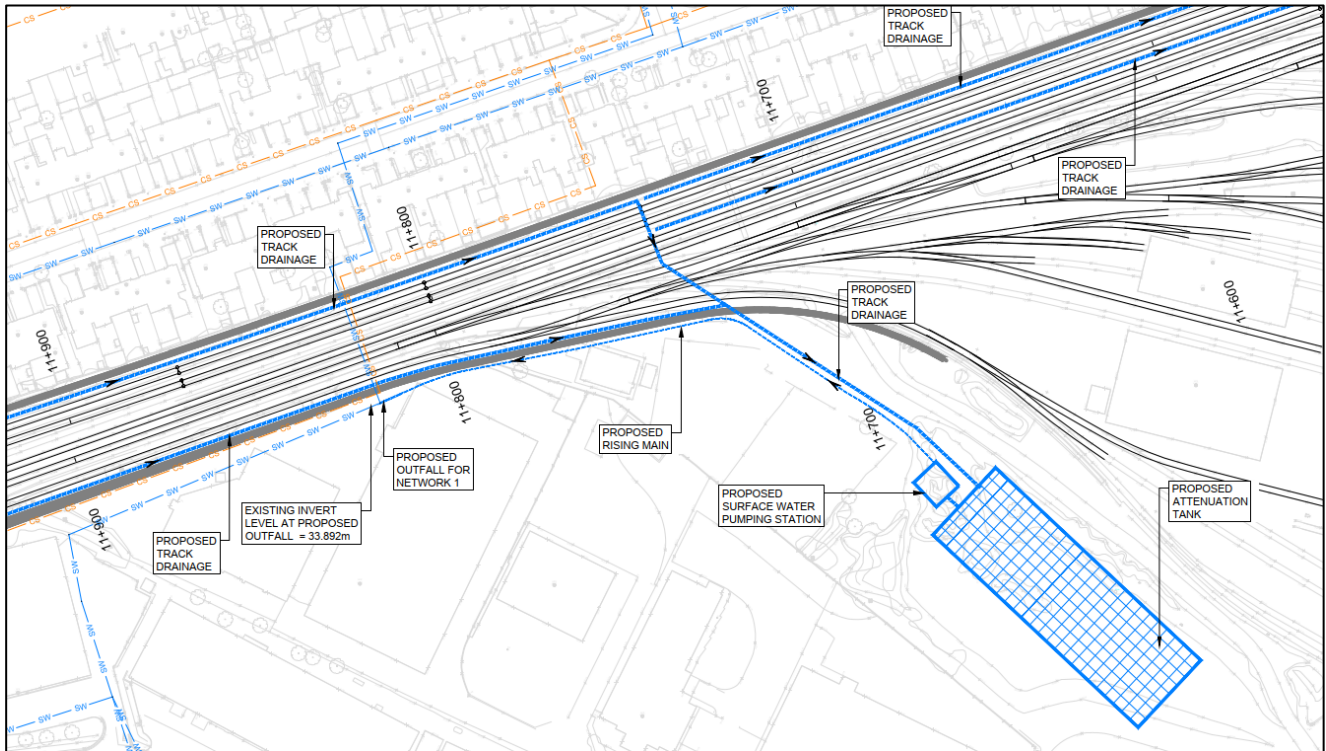
**Figure 5-14 Extension of railway corridor where new track drainage may be installed**

The two potential outfalls identified for the track drainage section from east of Park West Station to Sarsfield Road split the drainage system in two independent networks with its associated attenuation facilities.



The proposed outfall for the first drainage network is located west of Inchicore Depot into the existing storm water sewer that crosses the track at this location. Due to the extension of the area affected by the new track configuration and the catchments generated by this layout, additional retention structures would need to be provided to attenuate the peak runoff flows collected by the new drainage infrastructure and meet the discharge requirements.

The proposed attenuation tank for this network is located west of Inchicore Depot with a retention volume of 4,681m<sup>3</sup>.



**Figure 5-15 Proposed attenuation tank and outfall for Network 1.**

The existing invert level of the proposed outfall sewer will require a storm water pumping station to allow for the outfall connection, as shown in **Figure 5-15**.

The proposed discharge point for the second drainage network, that drains from Inchicore to Sarsfield Road, is placed at the existing culvert that crosses the track south to north at chainage 10+570. The attenuation requirements for this network involves a retention tank of 2,714 m<sup>3</sup>, which would be placed at the available open area east of Inchicore, as shown in **Figure 5-16**.

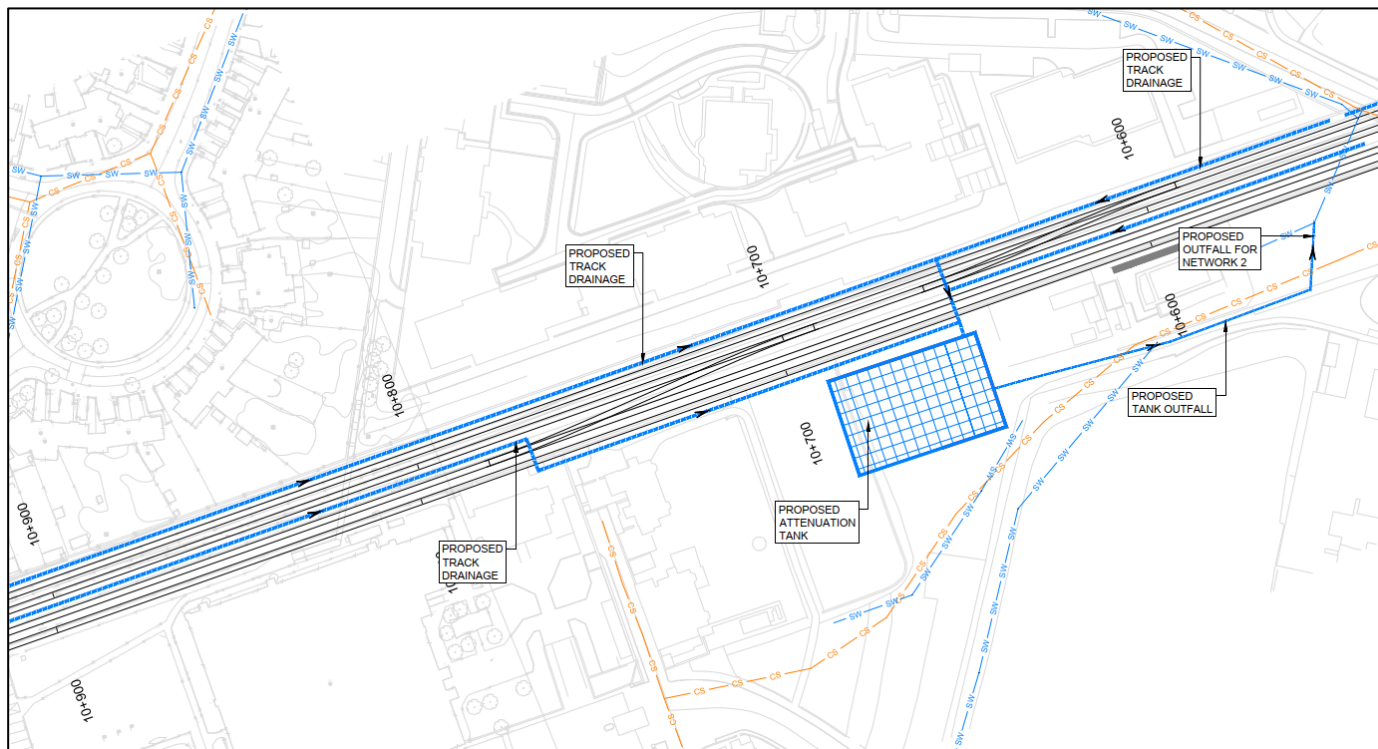


Figure 5-16 Proposed attenuation tank and outfall point for Network 2.

The proposed discharge rates into the public sewer are in line with Dublin City Council requirements and currently subject to agreement.

### 5.1.9. Buildings (All Do-Something Options)

According to the preferred and compliant options for the new tracks' arrangement, the attached building to the Maintenance Shed must be removed to provide room for the Long siding. This extension has offices, toilets, lockers and plant rooms which house tanks and pumps for the train wash. All these elements contained in the ancillary bay attached to the north of the maintenance shed are to be demolished and relocated. The shunters hut to the west will also be affected.

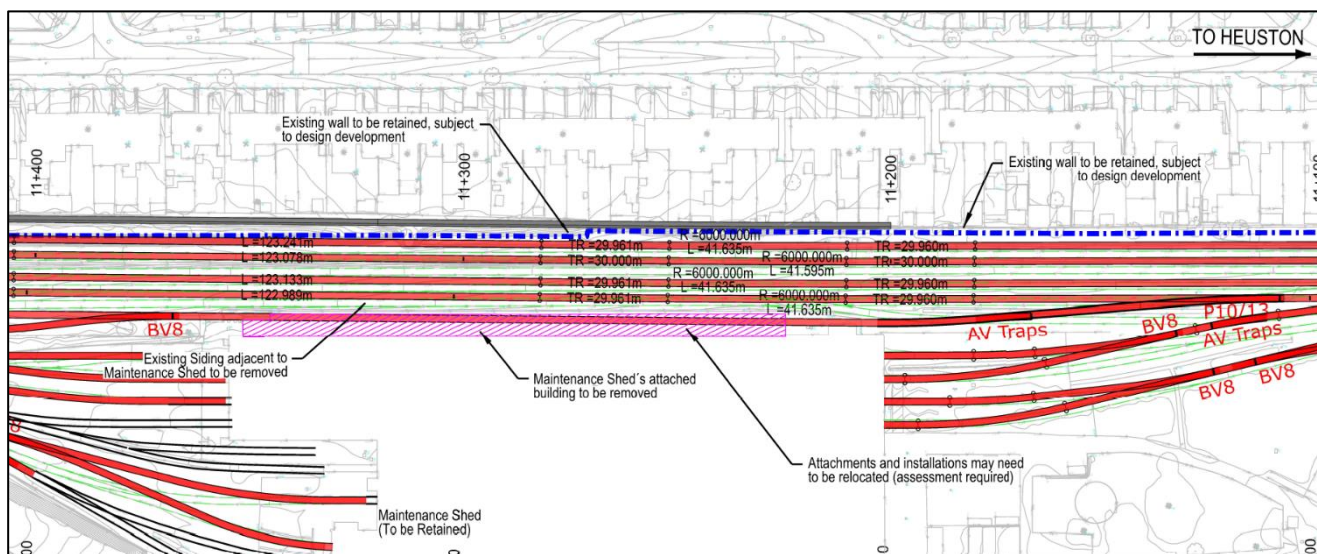


Figure 5-17 Ancillary bay affected by trackwork.



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

- A new building will be built, in the area east of the maintenance shed, providing room in two stories for:
  - The administration rooms and facilities for staff currently located in the bay to be demolished.
  - Other administrative offices, now in small prefab units in this same area.
- Plant rooms, other maintenance services and the shunter building are to be relocated either into the maintenance shed or in other small extensions of the maintenance shed.

The ancillary bay is not listed in any record of protected structures. However, the maintenance shed is shown a early 1900s and its stonework, adjacent to the ancillary bay, is a feature of potential heritage interest. Demolition works will need careful consideration to preserve original construction features. **In Figure 5-18;** hatched areas are used to indicate the areas of the ancillary bay extension that will be demolished from the Main Maintenance buildin. In addition; the proposed location for the new Administration Building to house some the operational elements currently in the existing extension that is proposed for demolition.



**Figure 5-19 Demolition of the Ancillary Bay and proposed location for new administration building.**

## 5.2. Construction Compounds

Three construction compounds are required in the area around Inchicore Works and Khyber Pass Bridge. These are the proposed locations:

- Inchicore
- Khyber Pass Footbridge
- Sarsfield Road

### 5.2.1. Inchicore Construction Compound

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

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

A construction compound located within Irish Rail's Inchicore Depot is the most suitable location convenient for much of the excavation and widening work between Kylemore and Sarsfield Road, located in an industrial area of Inchicore.

No additional land will need to be acquired as it is Irish Rail owned land.

Personnel and machinery access to the railway on the south side of the works will use this construction compound, but access to the North side will be also via alternative locations at either Sarsfield Road or Kylemore. Access to the site is through the Inchicore Depot to Jamestown Road, Kylemore Way, Kylemore Road to the Naas Road. This area will also be used for a proposed attenuation tank.

Inchicore being one of the main existing maintenance areas owned and operated by Iarnród Éireann provides an opportunity to transport materials and spoil efficiently through an existing facility.

As works are already proposed in this area for a new attenuation tank, and due to space constraints elsewhere in this area south of the existing railway, it is proposed to manage the construction programmes for both an attenuation tank and a construction compound. This is proposed in order to minimise the potential impact on other property owners as a result of having to find 2 no. different sites. For the reasons provided above, no other option was identified for this construction compound. See **Figure 5-19** for the proposed compound location whereas **Figure 5-15** indicates the attenuation tank permanently requiring more than half of this proposed site.



**Figure 5-20 Inchicore Proposed Construction Compound Location**



### 5.2.2. Khyber Pass Footbridge

To facilitate the reconstruction of the Khyber Pass Footbridge in Inchicore Works, two construction compounds (one either side of the tracks) will be required. The works required in this area include the demolition of the existing footbridge the construction of the ramps and stairs and the lifting in of a prefabricated bridge.

On the southern side there is a green space on Irish Rail Property in Inchicore depot, adjacent to the bridge. This area has been identified as a suitable location for a construction compound. The site located to the south will accommodate offices, parking for workers vehicles and site vehicles and a materials storage and laydown area. The site is located within Irish Rail's Inchicore Works, on Irish Rail Property. 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.

A suitable working space is also required on the north side of the tracks to facilitate the bridge reconstruction. On the north side, access is restricted by a narrow pedestrian footpath which is bounded by private property on both sides. Access will be needed to and from Sarsfield Road. There is an existing pedestrian access route, this may require localised alterations to facilitate material and equipment access. The north side of the bridge is constrained by private properties on both sides of the access route.

Access to the Northern construction compound would be through a widened temporary road to Con Colbert Road. The pedestrian footpath narrows to the south and the widening would be required to east of this narrow section of the footpath. See **Figure 5-20**.



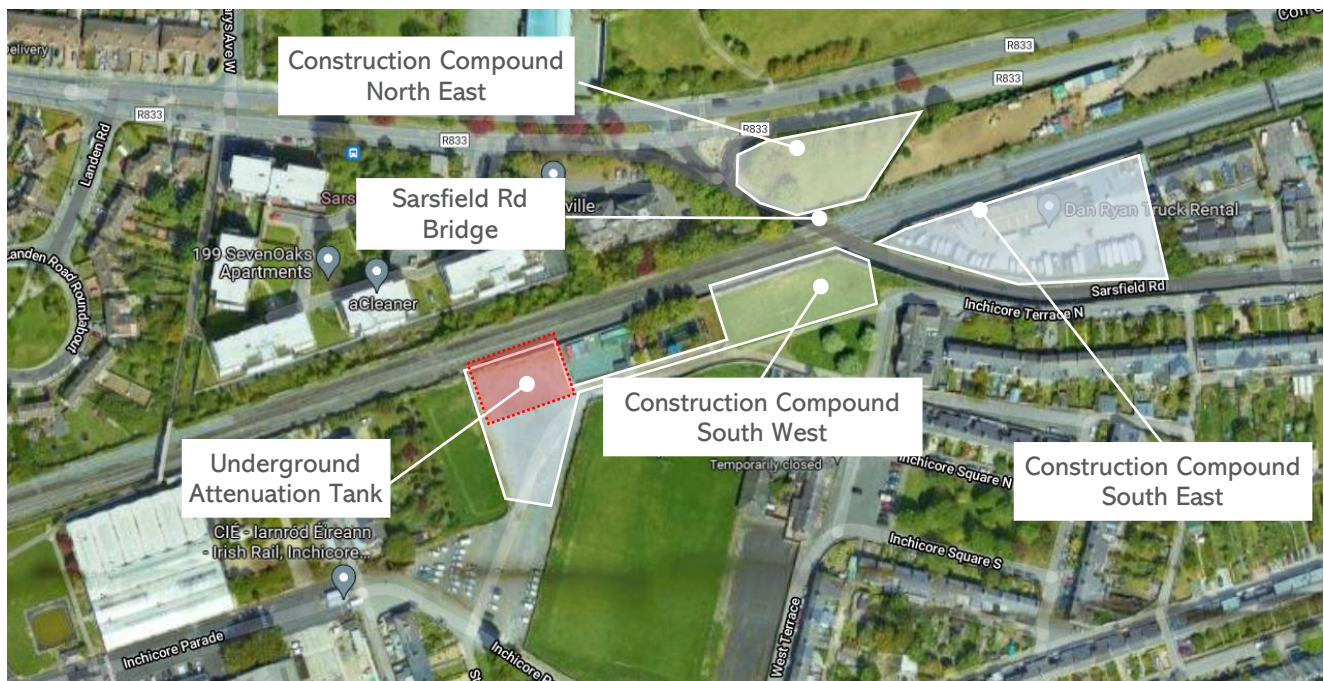
**Figure 5-21 Khyber Pass Proposed Construction Compound Location**

### 5.2.3. Sarsfield Road

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 grassed area to the South West 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 but is primarily for the bridge and track local to this adjacent area.

The North East and South East sites are reserved for the Sarsfield to Memorial Section of the Project. See **Figure 5-21. For an understanding of potential 5-22** for Location and Alternative Access Roads respectively.



**Figure 5-21 Sarsfield Proposed Construction Compound Locations**



## 6. Options Selection Process

### 6.1. Option Selection Process Summary

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 assess the options associated with the following elements on the section between Kylemore and Sarsfield Road:

- Civil and OHLE Infrastructure
- Construction Compounds

The Kylemore substation optioneering is covered under **Volume 3C – Technical Optioneering Report Le Fanu to Kylemore Bridge**.

#### 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.

A total of five options were initially developed for the area around Inchicore Works. These 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.

The 'Do-Something' Options in this area involve the widening of the existing rail corridor to accommodate the required four tracks while also maintaining the operational requirements of the adjacent Inchicore Works. The options examine widening of the rail corridor to both the north and south of the existing tracks with varying degrees of impact noted to adjacent properties for each option.

The sifting process for the area around Khyber Pass Footbridge, specifically focuses on the four-tracking area and the clearances of the Khyber Pass Footbridge (OBC5). A total of four options were initially developed for selecting the Preferred Option for the Inchicore Works area. These ranged from a 'Do-Nothing' Option, 'Do-Minimum' Option to a range of 'Do-Something' Options. Each of the options was assessed to determine if they were feasible and met the Project Objectives / Requirements. The 'Do-Something' Options in this area involve the replacement of the current bridge, or the removal of the bridge and use an alternative pedestrian / cycle route.

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 of the optioneering process comprises a detailed multi-disciplinary comparative analysis of the feasible options that 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 Emerging 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 Emerging 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 process adopted for the Stage 2 MCA 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.

**Table 6-1 Comparison Criteria**

### Comparison Criteria Legend

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

## 6.2. Civil and OHLE Option Selection

### 6.2.1. Corridor at Inchicore Works area

#### 6.2.1.1. Stage 1 Sifting

**Table 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 corridor area around Inchicore Works. See **Appendix A Sifting Process Backup** for more details.

Options which were assessed as feasible and fulfilled the project requirements were brought forward to Stage 2 MCA for a more detailed assessment.

**Table 6-2 Sifting Process for the selection of the Preferred Option for the project (Inchicore Works area)**

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.
		4-tracking Park West-Heuston	FAIL. No intervention proposed. 4-tracking is not achieved.
		Electrification of DART+ tracks	FAIL. No intervention proposed. Electrification of the DART+ tracks not achieved.
		Vertical electrical clearance in structures	FAIL. No intervention proposed. Vertical electrical at structures not achieved.
		Keep current functionality of railway (Inchicore Works)	Not applicable. No intervention proposed.
		Track alignment and drainage requirements	PASS. No intervention proposed.
	Economy		Compatible with the investment guidelines and programme for DART+
	Environment		No impact on Environmental sites of National or International significance.
	<b>SIFTING OUTCOME</b>		<b>FAIL. Do not progress to Stage 2 Assessment</b>
1	Engineering	Constructability	PASS. Minor interventions to the rail corridor are possible.
		Geometrical fitness for intervention	PASS. Minor interventions without geometrical fitness concerns are possible.



Option	Requirements		Description
		Safety	PASS. Minor interventions that pose no safety concerns are possible.
		4-tracking Park West-Heuston	FAIL. Minor interventions only cannot achieve 4-tracking in the whole area.
		Electrification of DART+ tracks	PASS. Minor interventions only could achieve electrification of two tracks.
		Vertical electrical clearance in structures	PASS. Minor interventions only could achieve vertical electrical clearance requirements at structures.
		Keep current functionality of railway (Inchicore Works)	PASS. Minor interventions to the rail corridor in accordance with standards are possible.
		Track alignment and drainage requirements	FAIL. Minor interventions to rail corridor would affect Inchicore Works functionality.
	Economy		Compatible with the investment guidelines and programme for DART+.
	Environment		No impact on Environmental sites of National or International significance.
	SIFTING OUTCOME		FAIL. Do not progress to Stage 2 Assessment
2	Engineering	Constructability	PASS. This Option would be difficult to construct, but it is considered feasible.
		Geometrical fitness for intervention	FAIL. This Option would not be feasible, since there would be no room for the installation of the tunnel portals in the existing railway corridor.
		Safety	PASS. No issues.
		4-tracking Park West-Heuston	PASS. This option achieves the 4 tracking.
		Electrification of DART+ tracks	PASS. This option achieves the electrification of DART+ tracks.
		Vertical electrical clearance in structures	PASS. This option achieves electrical clearance in structures.
		Keep current functionality of railway (Inchicore Works)	PASS. Current rail functionality maintained.
		Track alignment and drainage requirements	PASS. Option would be in accordance with standards.
	Economy		It would not be aligned with the investment guidelines and programme for DART+
	Environment		No impact on Environmental sites of National or International significance.
	SIFTING OUTCOME		FAIL. Do not progress to Stage 2 Assessment
3	Engineering	Constructability	PASS. This option would be feasible to construct
		Geometrical fitness for intervention	PASS. This option would require land take of private properties, but it is considered feasible.
		Safety	PASS. No issues.
		4-tracking Park West-Heuston	PASS. This option achieves the 4 tracking.
		Electrification of DART+ tracks	PASS. This option achieves the electrification of DART+ tracks.
		Vertical electrical clearance in structures	PASS. This option achieves electrical clearance in structures.
		Keep current functionality of railway (Inchicore Works)	PASS. Current rail functionality maintained.

Option	Requirements		Description
		Track alignment and drainage requirements	PASS. Option would be in accordance with standards.
	<b>Economy</b>		Compatible with the investment guidelines and programme for DART+
	<b>Environment</b>		No impact on Environmental sites of National or International significance.
	<b>SIFTING OUTCOME</b>		<b>PASS. Proceed to Stage 2 Assessment</b>
<b>4</b>	<b>Engineering</b>	Constructability	PASS. This Option would be feasible to construct.
		Geometrical fitness for intervention	PASS. This option would require some land take of private properties but it is considered feasible
		Safety	PASS. No issues.
		4-tracking Park West-Heuston	PASS. This option achieves the 4 tracking.
		Electrification of DART+ tracks	PASS. This option achieves the electrification of DART+ tracks.
		Vertical electrical clearance in structures	PASS. This option achieves electrical clearance in structures.
		Keep current functionality of railway (Inchicore Works)	PASS. Current rail functionality maintained.
		Track alignment and drainage requirements	PASS. Option would be in accordance with standards.
	<b>Economy</b>		Compatible with the investment guidelines and programme for DART+
	<b>Environment</b>		No impact on Environmental sites of National or International significance.
	<b>SIFTING OUTCOME</b>		<b>PASS. Proceed to Stage 2 Assessment</b>

4 no. Main Options were developed for the area around Inchicore Works, following the assessment completed as part of the sifting process, 2 no. Main Options have been shortlisted and progress to Stage 2 (MCA) of the assessment process. **Table 6-3** provides a summary of the sifting process results.

**Table 6-3 Summary of Sifting Process Results (Inchicore Works area)**

Main Option	Result	Brought forward to MCA
Option 0: 'Do Nothing'	FAIL	No
Option 1: Do Minimum	FAIL	No
Option 2	FAIL	No
Option 3	PASS	YES
Option 4	PASS	YES

In terms of the Economy, all options (except for Option 2) are compatible with the investment guidelines and the DART+ Programme. However, Option 2 is not aligned with Government Policy for the DART+ Programme.

The sifting process noted there are no environmental issues at this stage which would discount any option solely on environment criteria i.e. no impact on Environmental sites of National or International significance. However, relevant environmental issues for the area include potential impact of options on residential properties to the north (Option 3 and 4), the Signal Box (Protected Structure) (Option 3 and 4), the Turret and Inchicore buildings and boundary wall (Protected Structures) and residential properties on the south side (Option 4). These and other Economy and Environment considerations feed into the Stage 2: MCA process.

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

- **Option 0:** The Do-Nothing Options proposes no changes to the existing rail infrastructure, as such, this option would not facilitate the inclusion of the required four tracks or the installation of the OHLE equipment. This option will not achieve the project requirements or objectives and therefore will not be carried forward to the next stage of assessment.
- **Option 1:** This option seeks to achieve the four-tracking and electrification by means of minor interventions only. Due to the constraints in this area, minor interventions would not be sufficient to meet the project requirements or objectives, as such this option will not be carried forward to the next stage of assessment.
- **Option 2:** This option assumes that the four tracking is realised by installing a tunnel from the East of Park West station through to the area around Sarsfield Road Bridge (UBC4). This option does not meet the project requirements because it would not be possible to fit the tunnel portals in the existing railway corridor. The capital outlay required would also be prohibitively expensive and not aligned with Government Policy for the DART+ Programme. Therefore, this option will not be carried through to the next stage of assessment.

The following options meet the necessary Engineering Feasibility and Project Requirements, and it is recommended that these options are carried forward for further detailed assessment under the Stage 2 (MCA) assessment process:

- **Option 3:** This option provides an additional track to the north and includes electrification of the lines to facilitate DART services. It also maintains operational requirements of the Inchicore Works and sidings. The track enhancements are achieved to the north towards the boundary with Landen Road properties. This option is feasible and therefore will be carried forward to the Stage 2 (MCA) assessment.
- **Option 4:** This option provides an additional track to the south and includes electrification of the lines to facilitate DART services. It also maintains operational requirements of the Inchicore Works and sidings. The track enhancements are achieved to the south towards the boundary with Inchicore Works. This option is feasible and therefore will be carried forward to the next stage of assessment. The starting principle of the optioneering process has been to accommodate necessary works and interventions within the existing horizontal and vertical rail corridor, where practicable, to reduce the potential for new or additional impacts on the receiving environment, i.e. the 'Do-Minimum' option. In this case the 'Do-Minimum' option is feasible and therefore is the preferred option or solution for the subject area.

#### 6.2.1.2. Stage 2 MCA

The table below shows the summary findings of the comparative assessment undertaken during the Stage 2 MCA. The detailed matrix is provided in **Appendix B MCA Process Backup**.



**Table 6-4 MCA Summary (Corridor Area around Inchicore Works)**

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

Option 4 is identified as the preferred option or solution for this area, the basis for which is outlined as follows:

**Economy:** Option 4 is preferred because it requires less permanent land take than Option 3 – in particular from the residential properties to the north along Landen Road. It also requires less retaining structure to the north to contain the resulting slope. **In terms of Economy, Option 4 is the preferred option.**

**Integration:** Option 4 is considered to have a ‘Some Comparative Advantage’ over Option 3 because it will have less long-term impact on residential properties and residentially zoned land. Land to the south is identified as having significant regeneration potential and is part of the Naas-Ballymount-Cherry Orchard-Park West URDF Masterplan, currently being prepared by Dublin City Council and South Dublin County Council. It is anticipated in the long term that low density industrial units will give way to more sustainable high-density development adjacent to the railway. **In terms of Integration, Option 4 is the preferred option.**

**Environment:** Option 4 was found to have a ‘Some Comparable Advantage’ over option 3 in terms of minimising the potential effect on: Noise and Vibration, Air and Climate; Landscape and Visual; Water Resources, Agricultural and non-agricultural land use; and Geology and Soils factors. Moving the railway and works away from the residential properties to the north was the key advantage of Option 4. **In terms of Environment, Option 4 is the preferred option.**

**Accessibility and Social Inclusion:** There is no comparative advantage or disadvantage between the options. This criterion is not relevant for this specific study area. Both options are focused on widening the existing rail corridor for four tracking where there is no access to the public. **In terms of Accessibility and Social Inclusion all options are identified as comparative.**

**Safety:** There is no comparative advantage or disadvantage between the options. **In terms of Safety all options are identified as comparative.**

**Physical Activity:** There is no comparative advantage or disadvantage between all the options. This criterion is not relevant for this study area. Both options are focused on widening the existing rail corridor for four tracking where there is no access to the public. **In terms of Physical Activity all options are identified as comparative**

## 6.2.2. Corridor at Khyber Pass Footbridge area

### 6.2.2.1. Stage 1 Sifting

Details of the assessment undertaken as part of the Stage 1 Preliminary Assessment (Sifting) Process are provided in **Table 6-5**. Options which were assessed as feasible and fulfilled the project requirements were

brought forward to Stage 2 MCA for a more detailed assessment. See **Appendix A Sifting Process Backup** for more details.

**Table 6-5 Preliminary Assessment (Sifting) Findings at Khyber Pass Footbridge area**

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.
		4-tracking Park West-Heuston	FAIL. No intervention proposed. 4-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. Existing structure has vertical clearance for OHLE.
		Bridge Design Standards	Not applicable. No intervention proposed.
		Keep current functionality of footbridge	PASS. The existing footbridge is retained.
		Ambulant Disabled & Bicycle Ledge	PASS. No intervention proposed therefore not applicable.
	Economy		Compatible with investment guidelines & DART+ programme
1	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		FAIL. Do not progress to Stage 2 Assessment
	Engineering	Constructability	PASS. This option is considered feasible.
		Geometrical fitness for intervention	PASS. This option is considered feasible.
		Safety	FAIL. Horizontal clearance to derailment protection walls is <2m therefore less than the 2.5m required by standards.
		4-tracking Park West-Heuston	PASS. This option achieves the 4 tracking.
		Electrification of DART+ tracks	PASS. This option achieves the electrification of DART+ tracks.
		Vertical electrical clearance in structures	PASS. Existing structure has vertical clearance for OHLE.
		Bridge Design Standards	FAIL. Horizontal clearance to derailment protection walls is <2m therefore less than the 2.5m required by standards.
		Keep current functionality of footbridge	PASS. The existing footbridge is retained.
		Ambulant Disabled & Bicycle Ledge	PASS. No intervention proposed therefore not applicable.
	Economy		Compatible with the investment guidelines and programme for DART+
2	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		FAIL. Do not progress to Stage 2 Assessment
	Engineering	Constructability	PASS. This option is considered feasible.
		Geometrical fitness for intervention	PASS. This option is considered feasible.
		Safety	PASS. No issues.
		4-tracking Park West-Heuston	PASS. This option achieves the 4 tracking.
		Electrification of DART+ tracks	PASS. This option achieves the electrification of DART+ tracks.
		Vertical electrical clearance in structures	PASS. Bridge is permanently removed.
		Bridge Design Standards	PASS. Bridge is permanently removed.
		Keep current functionality of footbridge	FAIL. Bridge is permanently removed.
		Ambulant Disabled & Bicycle Ledge	PASS. Not applicable as bridge is permanently removed.
	Economy		Compatible with the investment guidelines and programme for DART+

Option	Requirements		Description
	<b>Environment</b>		No impact on Environmental sites of National or International significance.
	<b>SIFTING OUTCOME</b>		<b>FAIL. Do not progress to Stage 2 Assessment</b>
<b>3</b>	<b>Engineering</b>	Constructability	PASS. This option is considered feasible.
		Geometrical fitness for intervention	PASS. This option is considered feasible.
		Safety	PASS. No issues.
		4-tracking Park West-Heuston	PASS. This option achieves the 4 tracking.
		Electrification of DART+ tracks	PASS. This option achieves the electrification of DART+ tracks.
		Vertical electrical clearance in structures	PASS. This option achieves electrical clearance at structures
		Bridge Design Standards	PASS. Option is in accordance with standards.
		Keep current functionality of footbridge	PASS. Footbridge functionality is maintained.
		Ambulant Disabled & Bicycle Ledge	PASS. Ambulant disabled access and bicycle ledge would be provided.
	<b>Economy</b>		Compatible with the investment guidelines and programme for DART+
	<b>Environment</b>		No impact on Environmental sites of National or International significance.
	<b>SIFTING OUTCOME</b>		<b>PASS. Proceed to Stage 2 Assessment</b>

Following the assessment completed as part of the sifting process, only one Option has passed the assessment criteria. **Table 6-6** provides a summary of the sifting process results.

**Table 6-6 Summary of Sift Process Results (Khyber Pass Footbridge area)**

Main Option	Result	Brought forward to MCA
<b>Option 0: 'Do Nothing'</b>	<b>FAIL</b>	<b>No</b>
<b>Option 1: Do</b>	<b>FAIL</b>	<b>No</b>
<b>Option 2</b>	<b>FAIL</b>	<b>No</b>
<b>Option 3</b>	<b>PASS</b>	<b>YES</b>

In terms of the Economy, all options are compatible with the investment guidelines and programme for DART+.

The sifting process noted no environmental issues at this stage which would discount any option solely on environment criteria i.e. no impact on Environmental Sites of National or International significance.

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

- **Option 0:** The Do-Nothing Option proposes no changes to the existing infrastructure, as such, this option would not facilitate the inclusion of the required four tracks or the installation of the OHLE equipment. This option will not achieve the project requirements or objectives and therefore will not be carried forward to the next stage of assessment.
- **Option 1:** The Do-Minimum Option seeks to achieve the four-tracking and electrification by means of minor interventions only, i.e. with the least amount of work to the structure itself. The addition of the



fourth track would result in insufficient horizontal clearance between the tracks. Provision of derailment protection walls would be located within the 2.5m clearance required by standards. The minor interventions would not be sufficient to meet required bridge design and railway safety standards and therefore this option does not pass the preliminary assessment.

- **Option 2:** This option seeks to permanently remove the bridge and provide an alternative route for pedestrian and cycle access to Inchicore Works. By removing the bridge, the key objective of maintaining the functionality of the structure is not met. As this option does not meet the project requirements it does not pass the preliminary assessment.

Only **Option 3** meets the necessary Engineering Feasibility and Project Requirements through the provision of a replacement bridge structure to achieve the required increase in horizontal and vertical clearance.

#### 6.2.2.2. Stage 2 MCA

As only a single option has been identified as feasible, this option becomes the Preferred Option and there is no requirement to continue with a detailed assessment (MCA).

Therefore Option 3 becomes the preferred option for the corridor at the Khyber Pass Footbridge area. This option proposes to replace the existing Khyber Pass Footbridge (OBC5) structure with a new structure that has adequate vertical clearance to achieve the required contact wire height and OHLE clearance and a span that facilitates a minimum horizontal clearance to abutments of 4.5m. See Section 7 for more details on the preferred design option.

### 6.3. Construction Compounds

The works are taking place in a spatially constrained locations. The proposed locations for the Construction Compounds are the only ones with available space in this area and as such did not require multi-criteria analysis.

#### 6.3.1. Inchicore Construction Compound

Access is required for localised works, in particular materials processing, and the proposed location for the construction compounds is required to facilitate this work. As there are no other suitable alternative locations in the area, the selected construction compound locations did not require multi-criteria analysis.

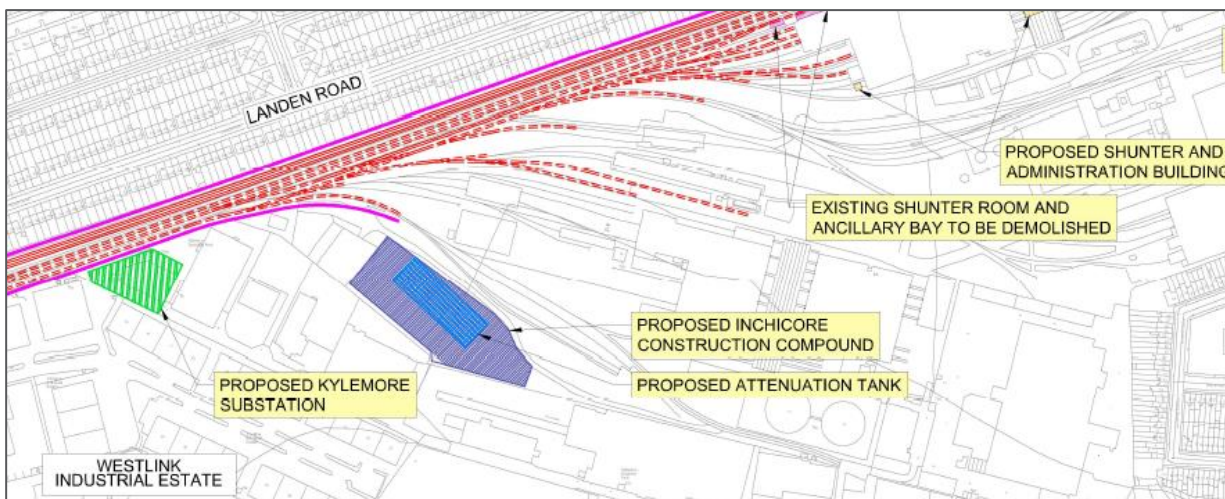


Figure 6-1 Inchicore Proposed Construction Compound Location

### 6.3.2. Khyber Pass Footbridge

Access is required for localised works, in particular the bridge reconstruction, the proposed locations for the construction compounds are required to facilitate this work. As there are no other suitable alternative locations in the area, the selected construction compounds locations did not require multi-criteria analysis.

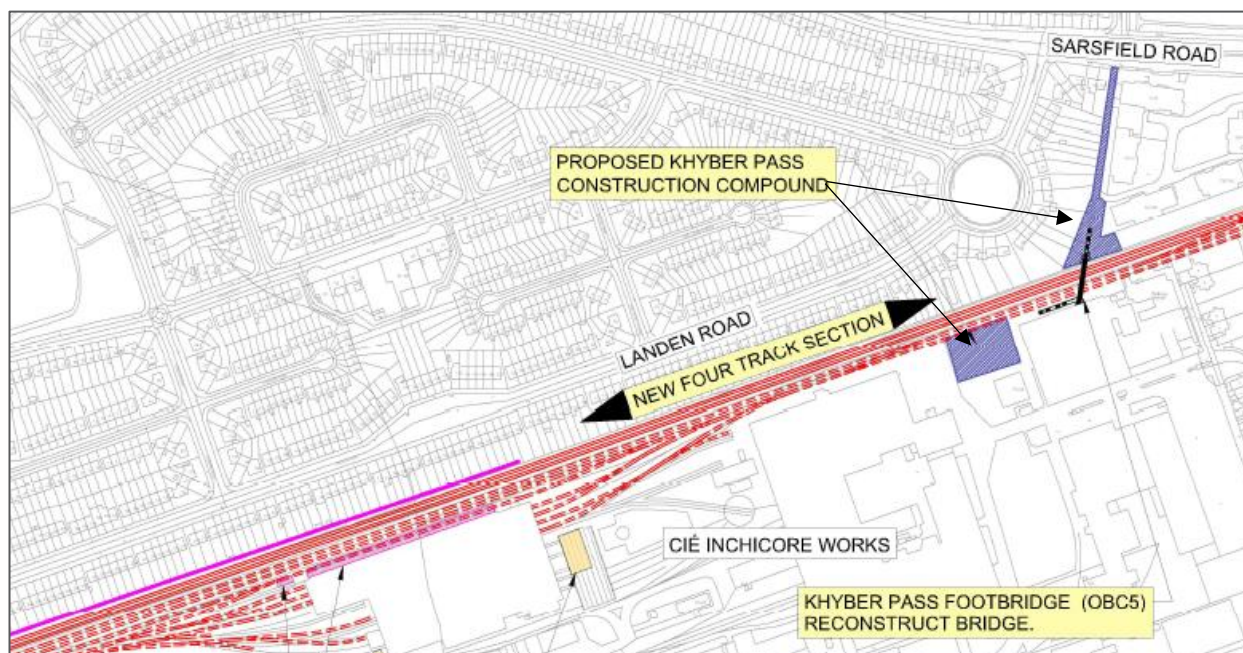


Figure 6-2 Khyber Pass Footbridge Proposed Construction Compound Location

### 6.3.3. Sarsfield Road

Access is required for localised works, in particular the attenuation tank and the track works east of the main Depot maintenance building local to the attenuation tank area, This compound is required for the Sarsfield Road Bridge and track works immediately adjacent to the bridge area, with the close proximity of works in this section it is practical to make use of the same site particularly as many of the works will be concurrent and it minimises haulage noise and disruption to surrounding residents.

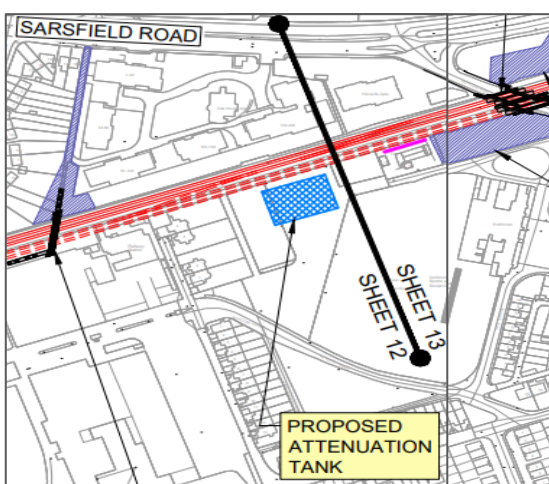


Figure 6-3 Construction Compound Location

## 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 impacted the optioneering and MCA outcomes that resulted in the selection of Option 3 as the Preferred Option for the corridor area around Inchicore Works. The Preferred Option at Inchicore Works area focuses the necessary enhancement of the rail corridor to the south requiring the demolition / relocation of some Iarnród Éireann facilities within the Inchicore Depot but minimising the impact on third party properties. However, there will be potential interference to property rights.

In light of the above, the Option has been validated, and its design progressed as the Preferred Option.

The preferred Option at Khyber Pass Footbridge involves the reconstruction of the Khyber Pass Footbridge (OBC5) with a new bridge that would have sufficient vertical and horizontal clearance to meet the requirements for four-tracking and electrification. The existing bridge would be replaced with a new structure that has adequate vertical clearance to achieve the required contact wire height and OHLE clearance and a span that facilitates a minimum horizontal clearance to abutments of 4.5m. The superstructure would be formed using Y8 beams and an RC deck. The bridge would be enclosed and the bridge stairs would be designed to ambulant disabled standards. The stairs would also incorporate a bicycle ramp ledge.

It is noted that Permanent Way Option 4 for the area around Inchicore Works (which is the Emerging Preferred Option for the area) is compatible with this Emerging Preferred Option for Khyber Pass Footbridge (OBC5). Since the rail corridor is widened to the south, the available space at the south side of the structure is geometrically constrained in Perway Option 4. However, where stairs are positioned within 4.5m (horizontally from the edge of nearest rail), they will be detached and not integral with the main structure and supports.

The design development since PC1 did not materially affect any of the previously assess options outlined in **Section 5 Options** and **Section 6 Options Selection Process** but resulted in a raising of the track to reduce the impact on adjacent sensitive masonry retaining walls to the south of the corridor and reduction in earthworks haulage and construction duration associated with the proposed electrified slow tracks.

### 7.2. Review of Stakeholder Feedback

In so far as respondent submissions about air pollution are concerned; it should be noted that air pollution associated with railway operations in this section of the project between Kylemore Road and Sarsfield Road will be the subject of an Air Quality Assessment as part of the Environmental Impact Assessment Report (EIAR) which will accompany the Railway Order application to An Bord Pleanála. . The assessment will consider the potential impacts on Air Quality during the construction and operation phase.

During the construction phase there will be a localised increase in traffic as is the case whenever construction takes place but will ultimately be temporary; with the project intent itself being to reduce pollutant and traffic loads to the city through modal change.

Typically the construction traffic will be required to exit the compounds located in the Inchicore Depot via the most direct routes to Naas Road (R810); namely James Town Road and Kyelmore Way and then eastwards to the M50, away from residential areas where possible. Sarsfield Road Bridge (UBC4) route to inchicore will not be a construction thoroughfare for this section of the project but . Sarsfield Road between Landen Road and the Chapelizod Bypass is proposed as a construction exit point for the reconstruction of the Khyber Pass Footbridge (OBC5) and as an exit for north track construction via the Khyber Pass access road situated west of the Seven Oaks Apartments.

Submissions cited that infrastructure was already in place for a station in Inchicore and to not include a station would be a massive 'over sight'. A station is not currently proposed within the groudns of the Inchicore Depot;



business case studies are afoot to determine the best integrated public transport solutions for area; that includes the local development plan for the area, potential Luas routes (and associated stations) and accordingly an appropriate DART station. Any implementation of the same will be part of a separate project.

The Khyber Pass Footbridge (OBC5) cannot be opened to the public due to health and safety reasons associated with the type of operational activities within Inchicore Works Depot as well as its proximity to these operational areas as well as the railway lines.

## 7.3. Design Development

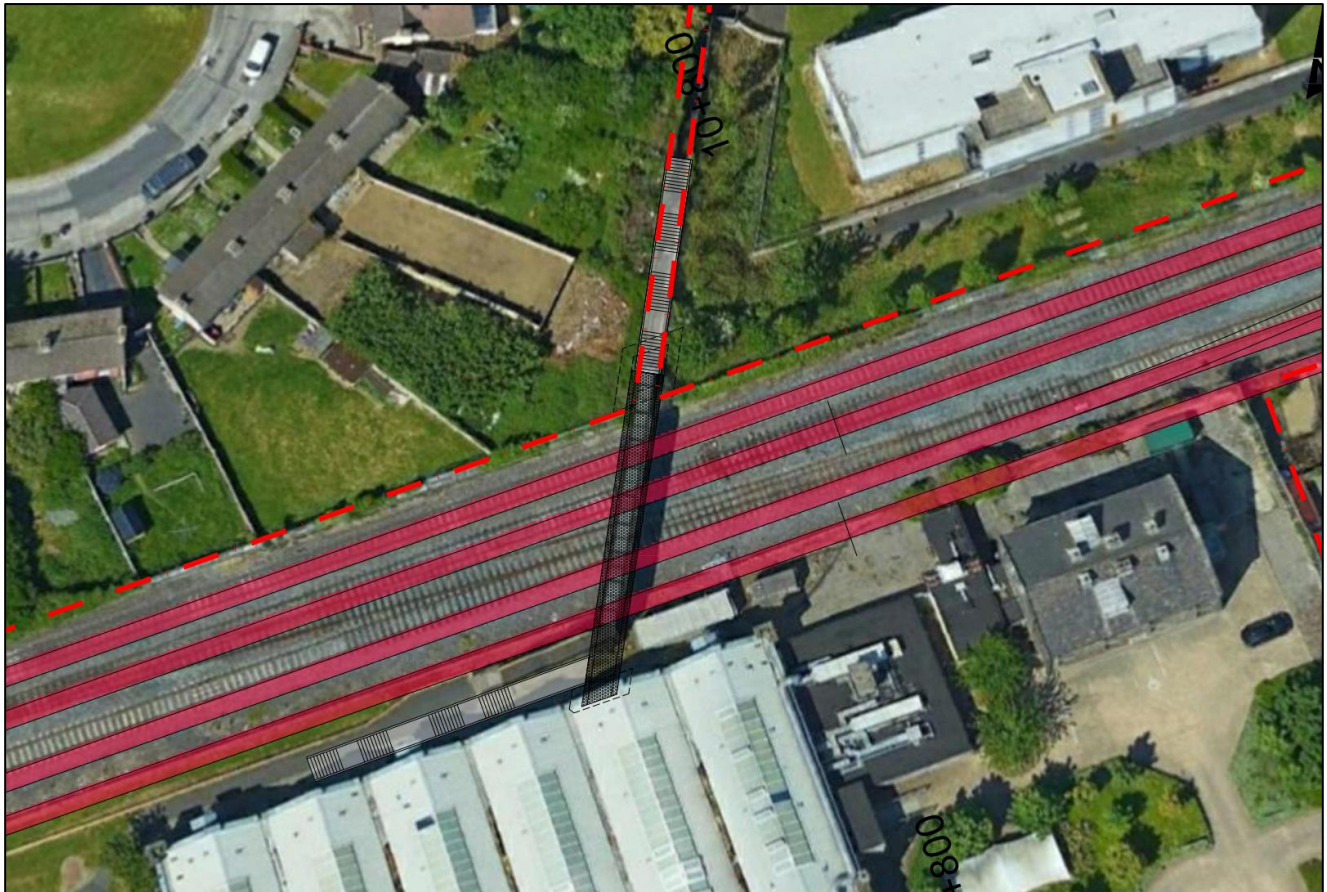
The following sub-sections provide greater clarity on the development of the design towards the preferred option, including:

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

### 7.3.1. Structures

#### 7.3.1.1. Bridges

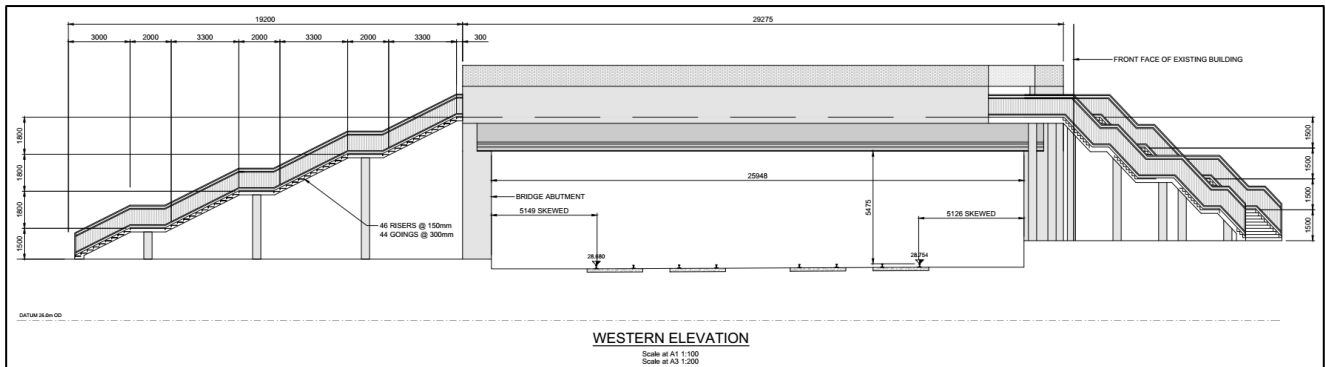
Further geotechnical site investigation and P-Way alignment design has been undertaken to ensure that the original design remained clearance compliant. See **Figures 7-1** and **7-2** for a general arrangement of the bridge and the deck longitudinal section, and **Appendix C Drawings** for details of this footbridge.



**Figure 7-1 Khyber Pass Footbridge (OBC5) General Arrangement**

Design development has focused on providing a bridge structure that facilitates (as a minimum) the same road corridor width that currently exists over the structure. Summary of the proposed bridge details:

- Proposed Bridge Type = Prestressed Beams and Precast U-Deck with integrated parapets founded onto a piled base at the abutments.
- Proposed Replacement Stairs = Stairs and intermediate riser platforms to be supported over concrete piers. Stairs to include and integrated cycle channel aid cyclist to transfer their equipment while walking the stairs.
- Proposed Bridge Span (incl. Abutment Length) = 28.51m (Approx.)
- Proposed Bridge Width (incl. Parapets) = 2.9m
- Proposed Bridge Slab Depth = 0.25m
- Proposed Bridge Beam Depth = 1.350m
- Proposed Parapet Height = 1.5m (with a protective steel mesh top structure enclosing the walkway attached to the parapet)



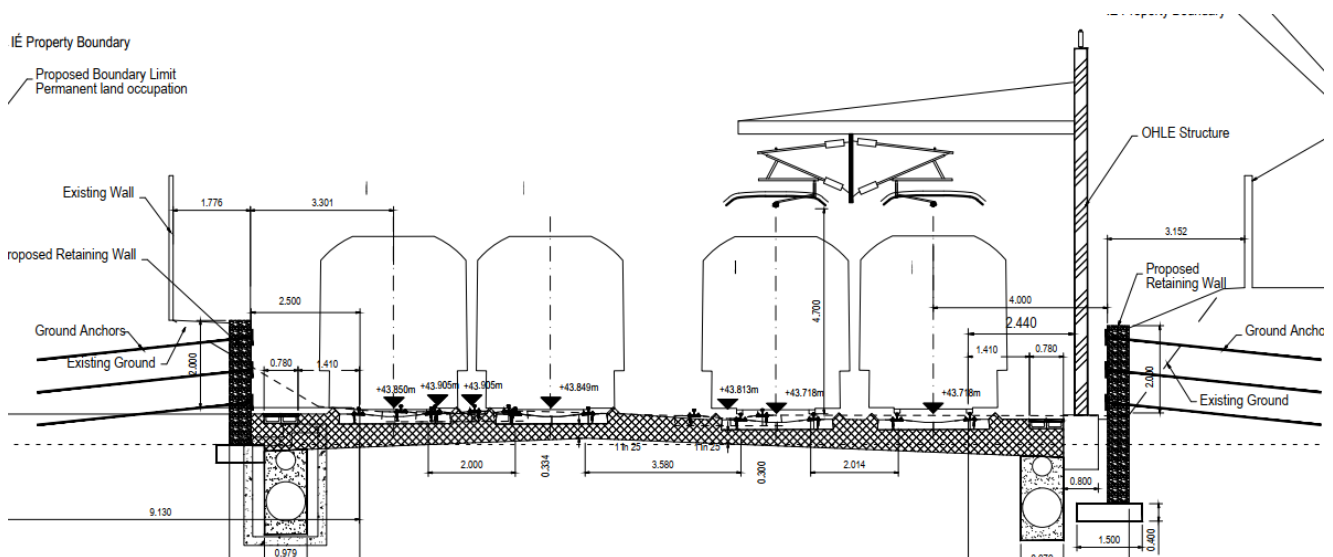
**Figure 7-2 Khyber Pass Footbridge (OBC5) Bridge Deck and Stairs Longitudinal Section – Facing East**

### 7.3.1.2. Retaining Walls

The over steepened nature of the existing cutting slopes, proximity of the adjacent domestic and industrial properties and height of the cutting slope 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 Kylemore Road 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, the retaining wall height (above track cess level) will vary between 1 and 6 m along this section and bored secant pile wall and cantilever wall solutions will be adopted for this section of retaining wall.

An example of a typical section of the wall and finished wall are shown in **Figures 7-3, 7-4 and 7-5.**



**Figure 7-3 Retaining Walls & Ground Anchors – Facing West**





Figure 7-4 Example of a Secant Wall



Figure 7-5 Examples of Retaining Walls

#### 7.3.1.3. Signalling Cantilevers

Where possible, signalling infrastructure will be located within IE existing land; however, in areas where the track encroaches into adjacent land, then consideration will be given to nominal additional land take for signalling structure access. Where space for foundations in the cess is not available, consideration will be given to integrating the signalling cantilevers into the retaining wall structural design locally.

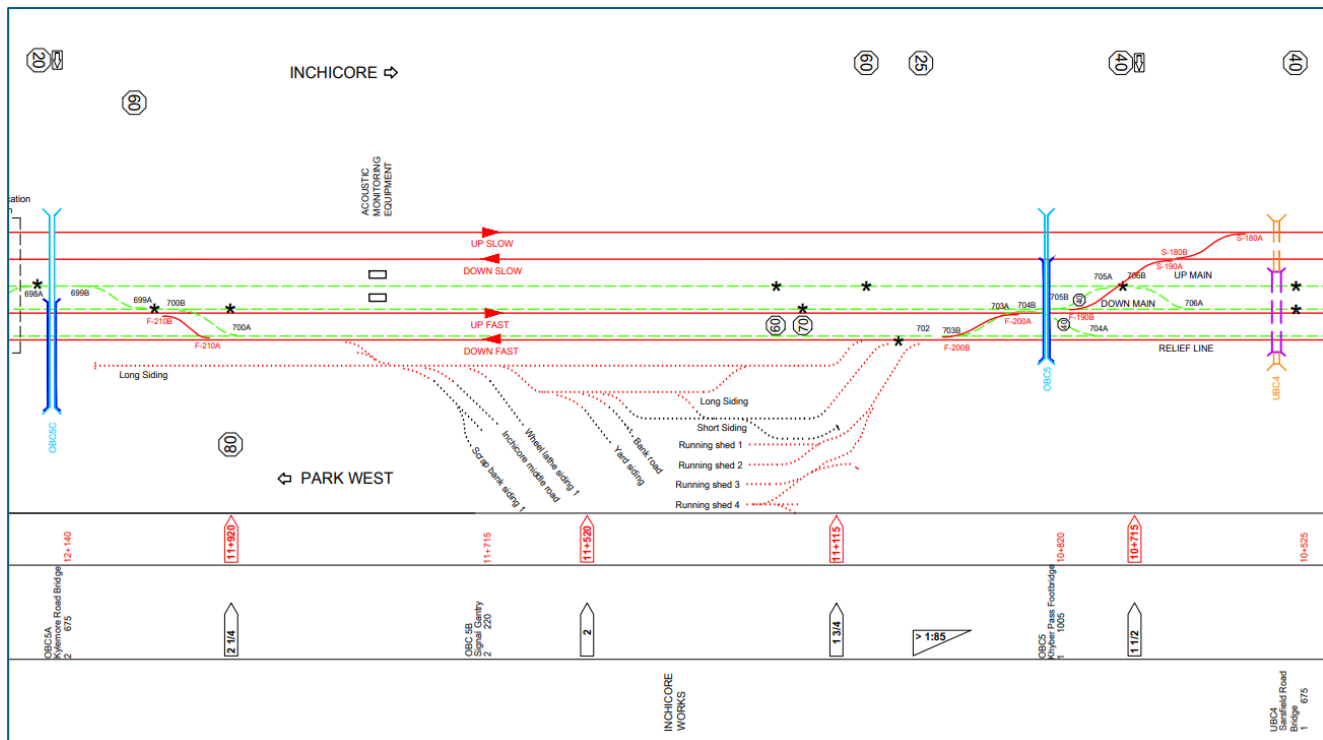
Access to the top of man access cantilevers will be from steps within the cess unless local access from IE land is safer and operationally more efficient.

#### 7.3.2. Track Bed Design

A new track bed design is required along this section. Bedrock has been indicated between Kylemore Road Bridge and 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.

#### 7.3.3. Permanent Way

The proposed 4-track layout comprises 2 existing tracks realigned on the south side of the rail corridor to become the Fast lines, subject to maintaining the connections into the Inchicore Works. 2 new tracks – the Slow lines – will be situated on the north side of the corridor and multiple crossovers provide the necessary train pathways to access Inchicore Works as shown in the figure below.



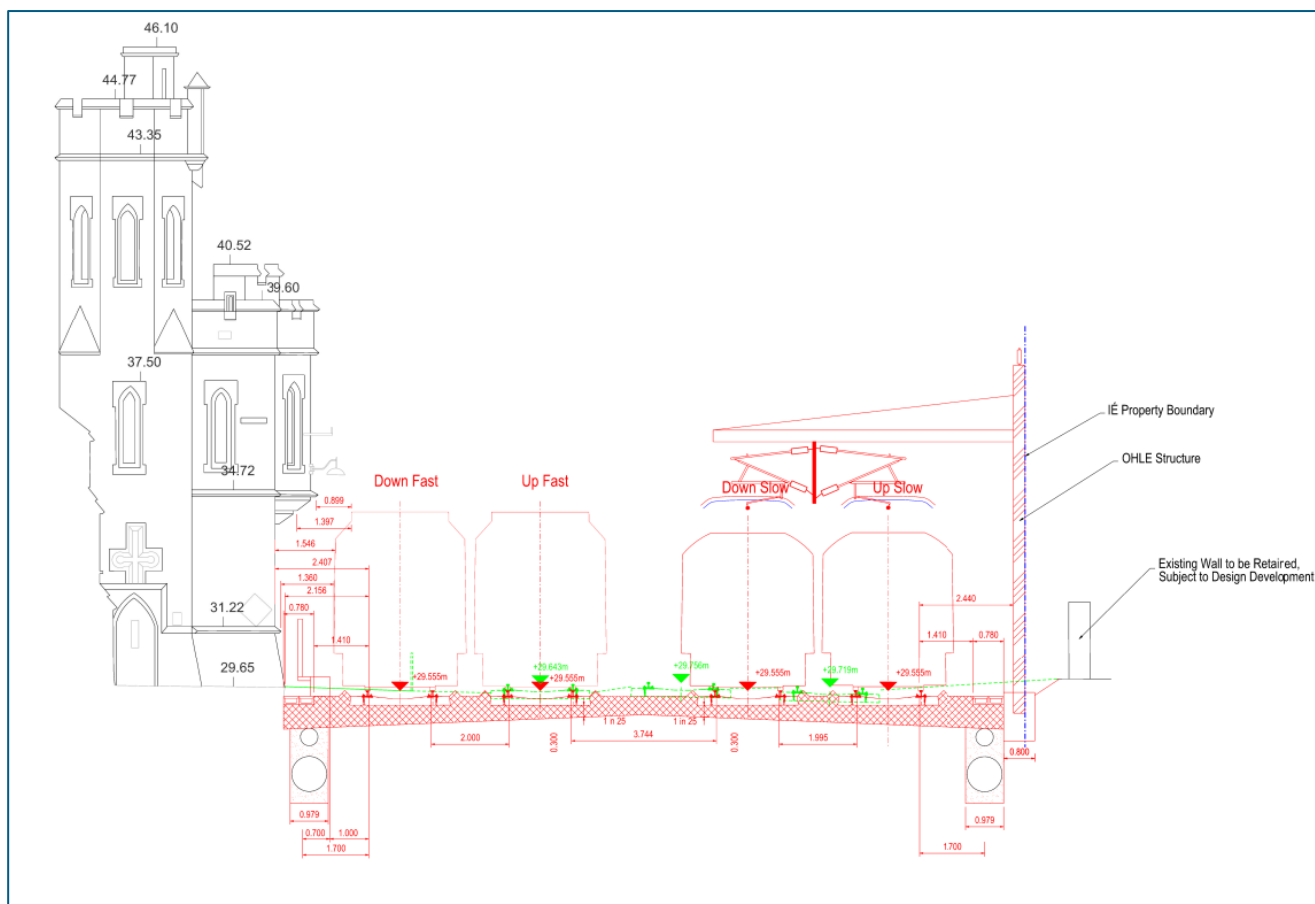
**Figure 7-6 Kylemore Road Bridge (OBC5A) to Sarsfield Road Bridge (UBC4) – Track Plan Layout (new tracks = red, removed tracks = dashed green, structures = blue)**

Vertically, the Slow and Fast tracks are co-planar (at the same level and gradient) through this section, in order to accommodate the crossovers laddering across the 4-tracking to the east of Inchicore Works.

Track levels are nominally at grade to maintain the connections from the main lines into the Inchicore Works, with the gradient through the section being 1.044% at the west end then 0.300% at the east end of the Works, for all 4 no. tracks. This then becomes 1.108% as we approach Sarsfield Road Bridge (UBC4), again for all 4 tracks, ensuring a consistent level across the new deck perpendicular to the tracks.

Khyber Pass Footbridge (OBC5) is to be reconstructed to achieve the 4.4m contact wire height needed for the OHLE equipment on the Slow lines.

Retaining walls are required to both the north and south sides of the rail corridor in the vicinity of Inchicore Works. As a result of design development, a track alignment solution has been identified which enables the Turret structure to be retained, as illustrated in the figure below.



**Figure 7-7 Cross Section looking West at CH 11+000 showing retained Turret at Inchicore Works – Facing West**

(new tracks = red, existing ttracks = green)

It can be seen from the above that the Turret structure is protected from a derailment on the Down Fast by the implementation of a derailment kerb, that also features a raised walkway featuring a safety handrail.

#### 7.3.4. Signalling, Electrical and Telecommunications (SET)

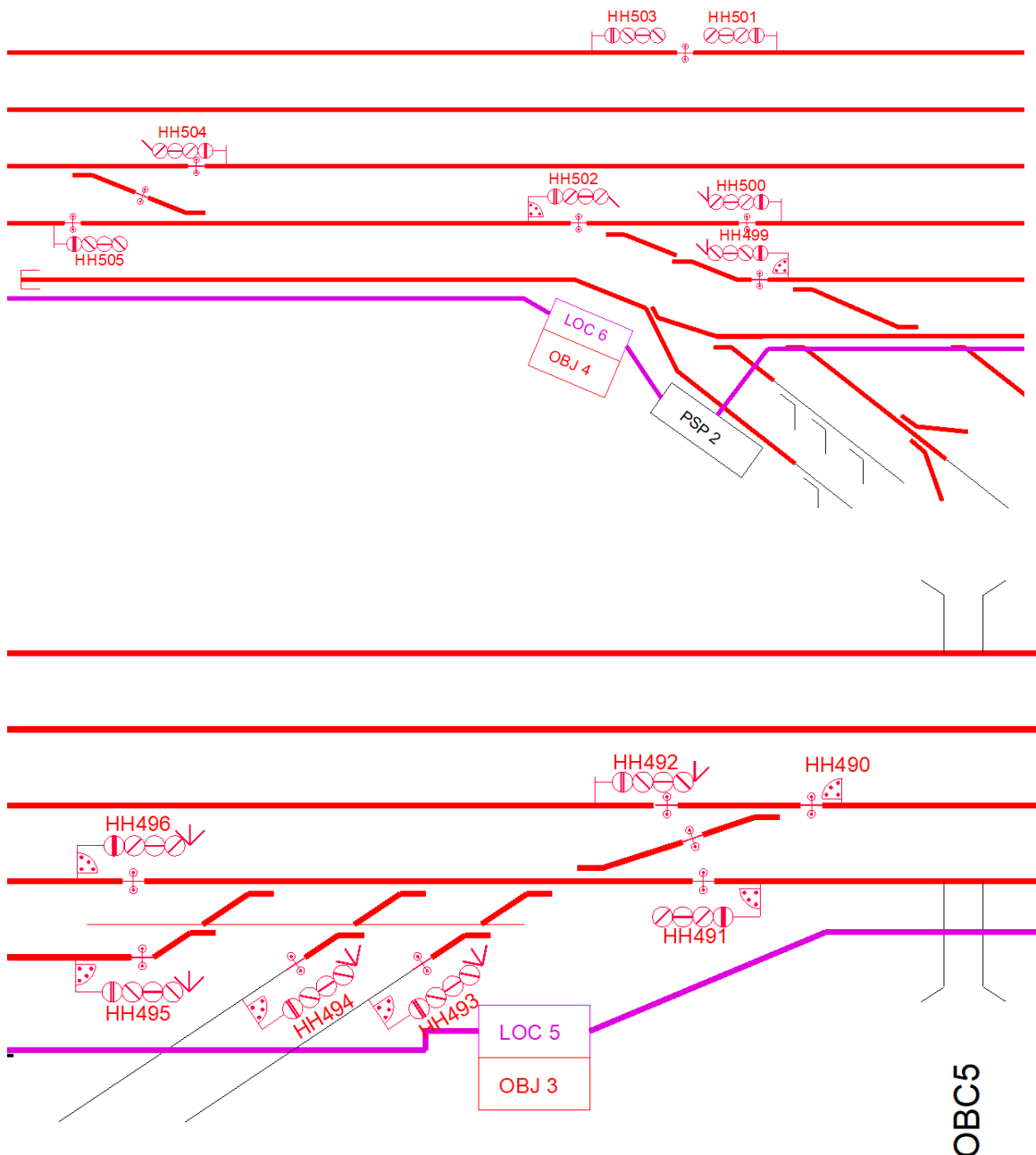
This section provides detail on the proposed SET equipment and components which will be distributed along this section of the railway. More information on the typical SET equipment is included in **Volume 2 Option Selection – Technical Report**.

#### 7.3.4.1. Signalling

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

A Signalling scheme plan has been developed for the entire route, the section pertaining to this area is detailed in **Figure 7-8**. 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 7-8 Signalling Scheme Plan (Kylemore – Sarsfield Road)**

Legend:

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

The physical signalling infrastructure has been developed and is indicated in **Figure 7-9 to 7-11**. This figure shows Object Controller Cabinets (blue box) and a Location Cases (black box). All equipment proposed will be located within the existing IE land boundary to minimise the impact to the public.

Infrastructure highlighted as follows at **Figures 7-9 to 7-11**:

- Blue box – Object Controller Cabinet
- Red box – Location case & ASP1

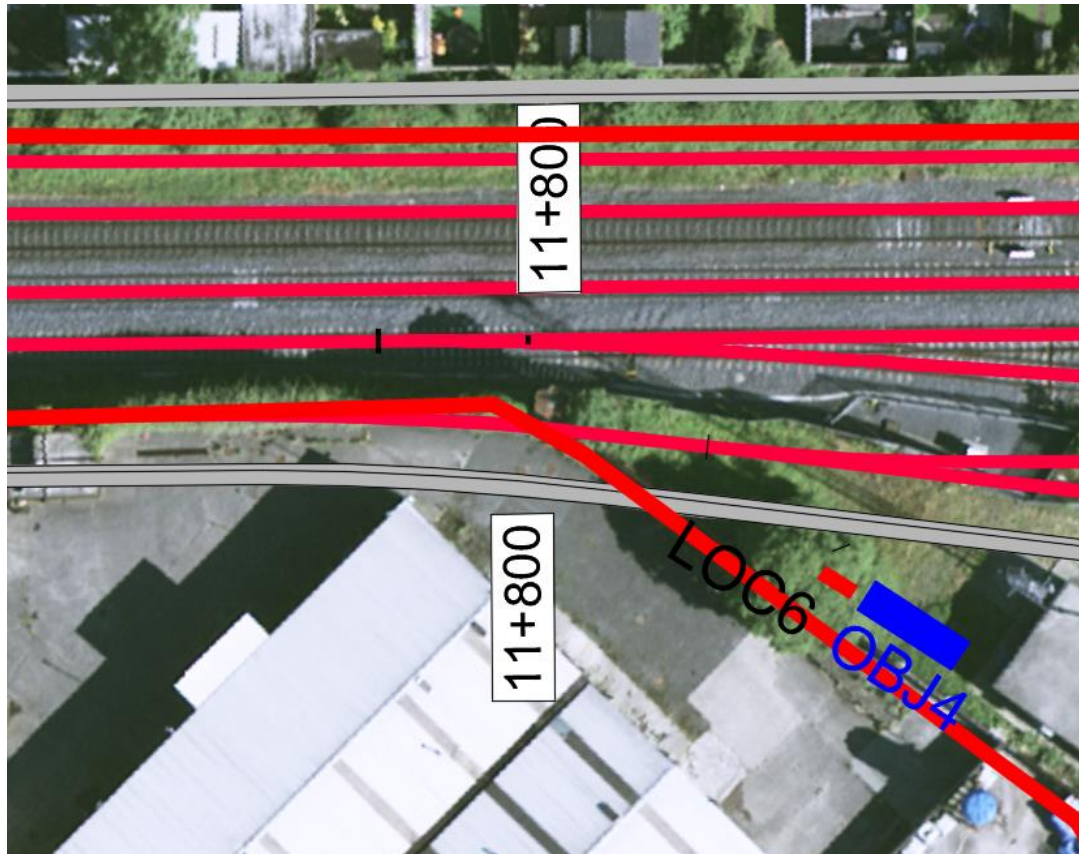


Figure 7-9 Signalling and LV Infrastructure (Kylemore – Sarsfield Road) (1 of 3)



Figure 7-10 Signalling and LV Infrastructure (Kylemore – Sarsfield Road) (2 of 3)

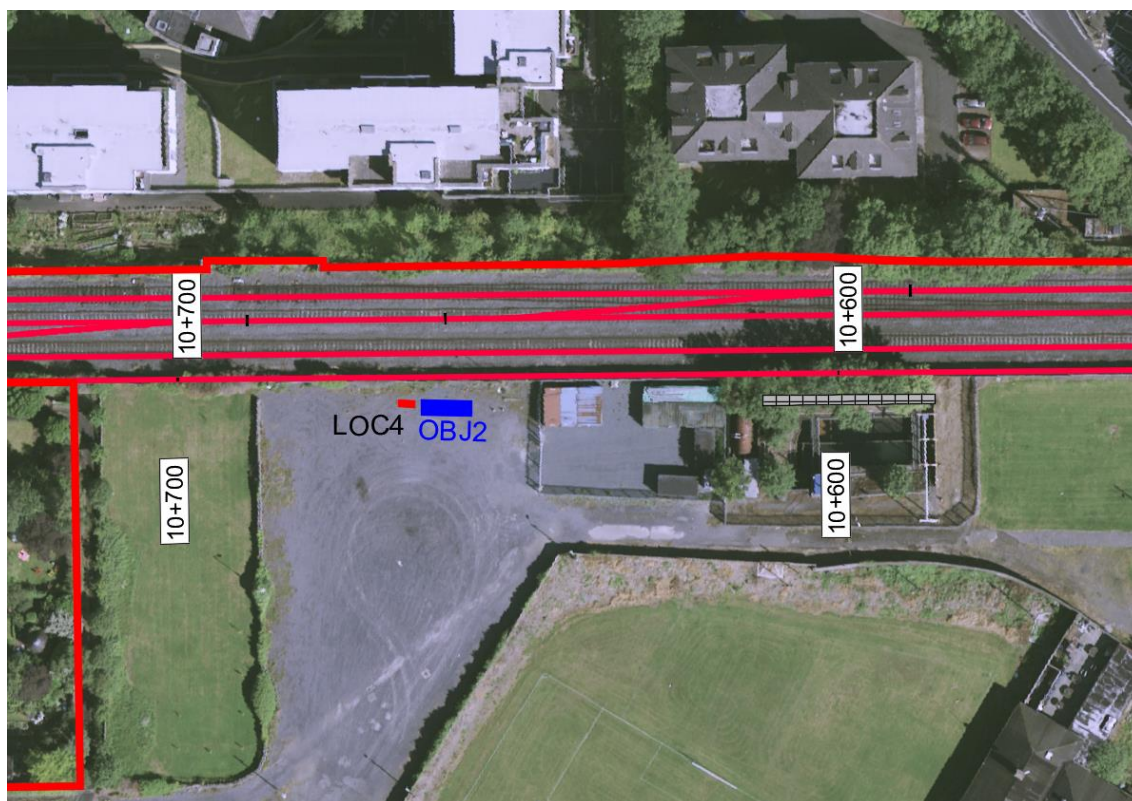


Figure 7-11 Signalling and LV Infrastructure (Kylemore – Sarsfield Road) (3 of 3)

#### 7.3.4.2. 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 signal post is shown in **Figure 7-12**.



Figure 7-12 Typical Signal Post

#### 7.3.4.3. 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**.



**Figure 7-13 Typical Object Controller Cabinet (OBJ)**

#### 7.3.4.4. 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**.



**Figure 7-14 Typical Location Cases**

#### 7.3.4.5. Cable Containment

A cable containment strategy has been progressed and following review of several alternatives such as traditional concrete troughing and direct burying 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 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.



**Figure 7-15 Containment walkway**

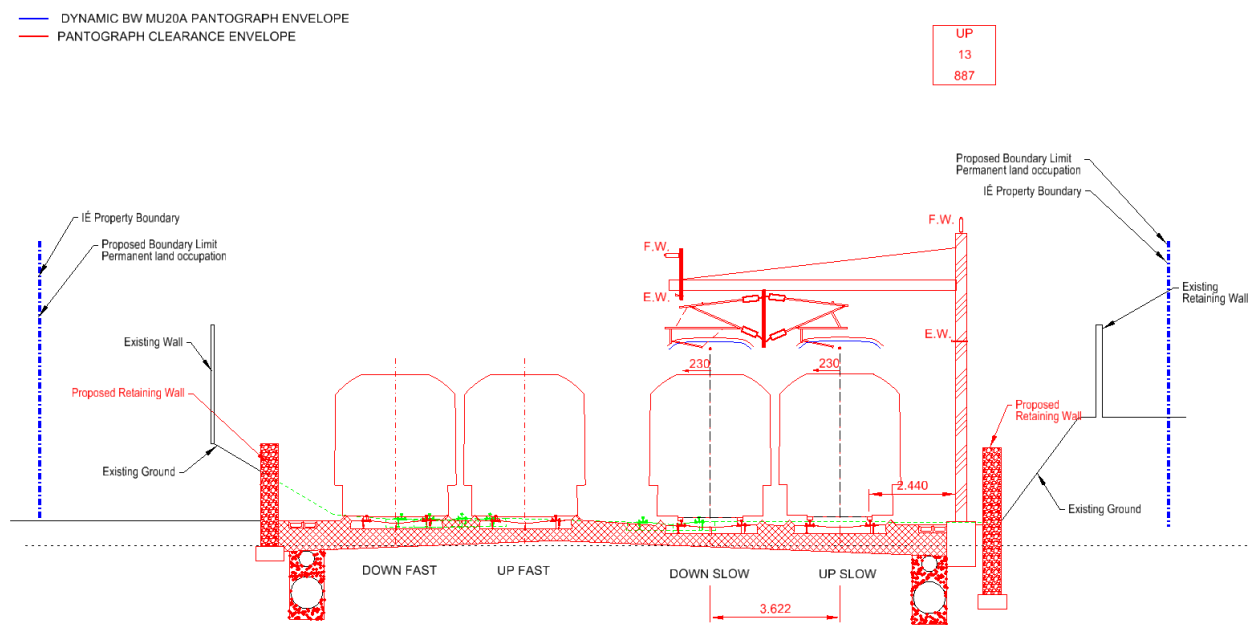
Cable containment route will run adjacent to the track in accordance with standard railway practice and will cross under the track where required using under track crossings (UTX) and secure turning chamber. Type of containment at each stage of the track will be shown at the permanent way cross section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

#### 7.3.4.6. Telecommunications

According to the current design, no TER rooms are expected in this area.

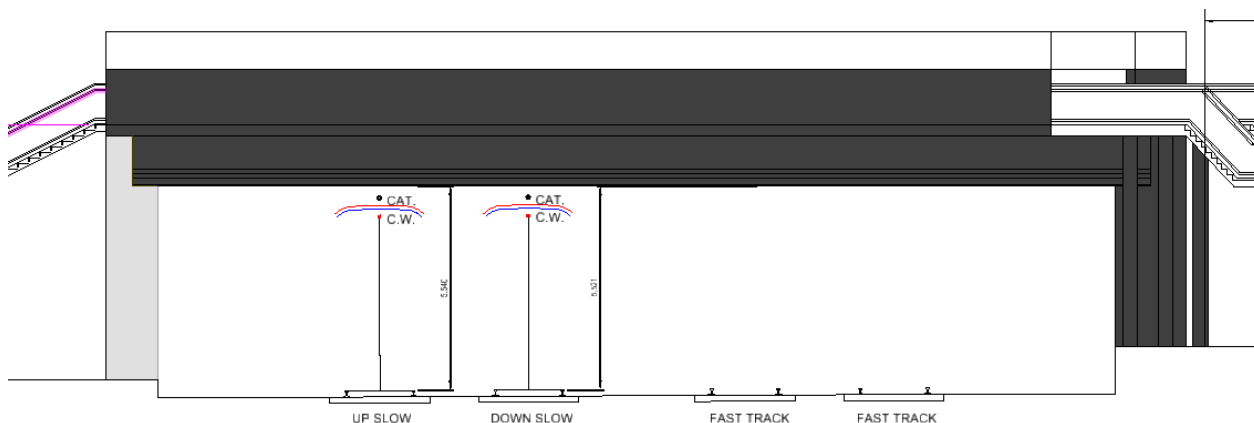
#### 7.3.4.7. Electrification

In Kylemore Bridge to Sarsfield Road section, in 4 track area, the electrification equipment 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**. **Figure 7-16** shows an example OHLE TTC arrangement in a four track open route.



**Figure 7-16 Typical OHLE TTC arrangement in four-track open route – Facing West**

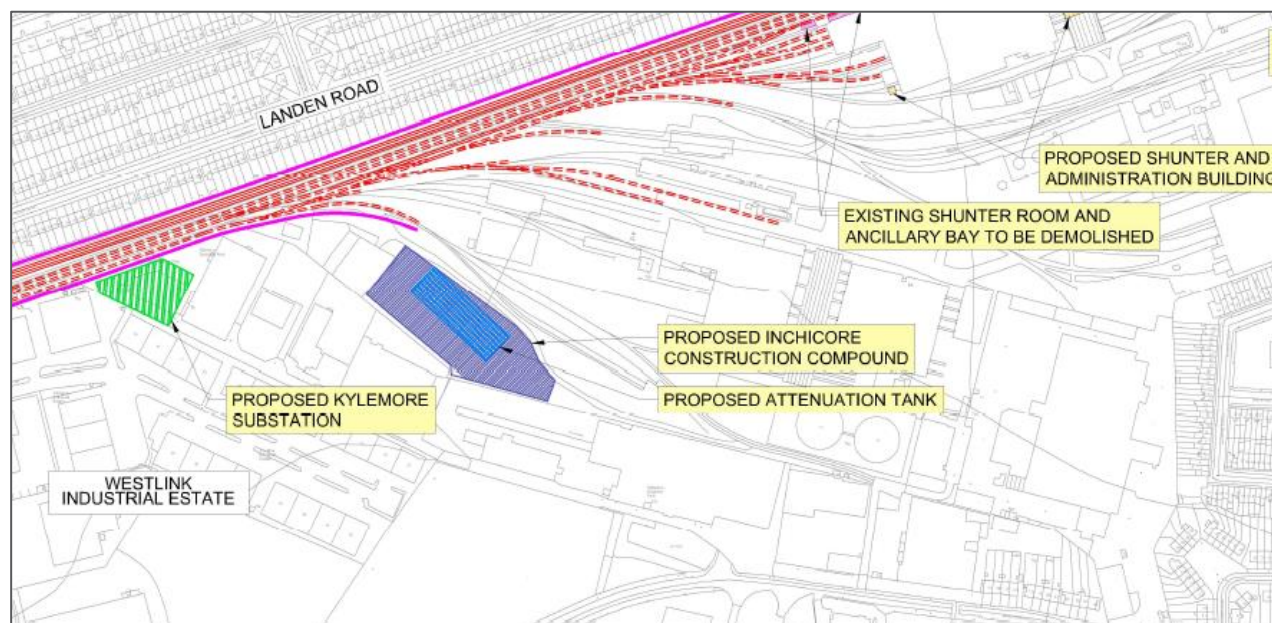
Khyber Pass (OBC5) will be designed to provide a soffit clearance of 5.52m. In this configuration the OHLE will be wired using a free-running arrangement. The contact wire height will be 4.7m throughout, and so no grading is required. A reduced system height will be required with a 300mm minimum dropper length, and catenary will be substituted through the bridge span. A minimum contact wire height will be 4.4m through the bridge under all conditions. Electrical clearance from the live OHLE to the bridge will be 150mm static and 100mm dynamic. Typically, OHLE masts are expected to be positioned around 20m to 30m from each outer edge of the bridge. **Figure 7-17** shows an example of a cross section for free running OHLE system in the four-tracking area under Kyber Pass Bridge (OBC5).



**Figure 7-17 Example of a free running OHLE system at Kyber Pass Bridge (OBC5) – Facing East**

#### 7.3.4.8. Substations

One substation is proposed within the limits of the area covered by this volume. Kylemore substation preferred location is outside of IE land in a derelict industrial unit. It is in the possession of private landowners on the southern side of the railway. See **Volume 3C – Technical Optioneering Report - Le Fanu to Kylemore Bridge** for details on the optioneering process. See **Figure 7-18** for a plan view of the preferred substation location.



**Figure 7-18 Kylemore Substation Preferred Location**



### 7.3.5. Roads

No new roads or road reconstruction is currently part of the scope of works in this area. The existing Khyber Pass footbridge is an Irish Rail owned and managed bridge for the daily use of Inchicore Depot operational personnel. The footbridge is reached from the north of the rail corridor via an access controlled pedestrian walkway that begins off a vehicular 'pan-handle' access road from Landen Road. The only works to the footpath will be its reinstatement in the location of new foundations for the replacement footbridge.

For details on temporary accesses off public road or through 3<sup>rd</sup> party lands to facilitate construction of the section of railway and associated facilities refer to **Section 8.7 Temporary Traffic Management**.

### 7.3.6. Drainage Requirements

The proposed 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 structures and discharge points, located west of Inchicore Depot and at Sarsfield Road. 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 is split in two independent networks based on the above-mentioned outfalls, and both consist of two main branches running parallel to the track beneath the ballast layer.

Two attenuation tanks are proposed along this track length in order to retain rainfall volumes and comply with the discharge rates required by Dublin City Council:

- Attenuation tank for Network 1 located on Inchicore Depotlands.
- Attenuation tank for Network 2 located on the open area south of the track alignment and prior to the discharge point at Sarsfield Road.

## 8. Construction

This section of the report sets out the approach in relation to the construction methodology for the works based on the preferred option along the section between Kylemore Bridge to Sarsfield Road, including Inchicore Works and Kyber Pass Footbridge.

This section requires a reconfiguration of all the tracks adjacent and tying into the Inchicore Depot to facilitate the proposed additional 2 no. electrified slow tracks, as well as the increased yard headshunt. To limit the impact on residential properties the majority of the existing tracks would be shifted to the south to accommodate that aforementioned amendments. The majority of embankment retaining structures are to the west of the section while the Khyber Pass Footbridge (OBC5) would need to be reconstructed to facilitate the widening. The section is vast in terms of its track drainage works and as such includes proposed 2 no. new attenuation tanks in the area serving a catchment from Cherry Orchard Footbridge (OBC8B) to Sarsfield Road Bridge (UBC4).

### 8.1. 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.

#### 8.1.1. 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.

#### 8.1.2. Soil Nailing

Soil nailing is a top-down walling method. From the top, soil is excavated over a short height. The surface of the excavation 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.

### 8.1.3. Retaining Walls Design

It is proposed that a bored secant pile wall solution will be adopted for the section of retaining wall immediately east of Kylemore Road Bridge along the perimeters to form the northern and southern tracks cess edge. The retaining walls vary between 4 to 6 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 both the northern and southern side of the rail corridor. The length of the soil nails/ground anchors will vary based on the height of the cutting slope to be retained and are anticipated to be approximately 10 to 15 m in length

The soil nails/ground anchors will be installed utilising access from 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 at the wall locations east of the secant pile wall towards Khyber Pass Footbridge. The cantilever walls will typically range from 0.5 to 3 m in height.

## 8.2. Bridges

The construction of the Kyber Pass Footbridge (OBC5) will require a small portion of permanent landtake to accommodate the new foundations of the abutment to the north of the rail corridor (note the foundation outline in **Figure 7-1**). The proposed bridge and stair would be predominantly comprised of elements that are pre-cast or prefabricated off site due to the installation site constraints and to reduce the installation period. The site occupation would be associated with the foundation construction, jointing and protection of stairway sections as well as the lifting and finishing of the off-site fabricated elements.

## 8.3. Permanent Way

Some minor track lowering will be required 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
- Connection into existing internal Inchicore Works Sidings to retain their operational capability

Several temporary P&Cs will be required in this section:

- Between Khyber Pass Footbridge (OBC5) and Sarsfield Road Bridge (UBC4) to facilitate the phased construction of the 2 no. bridge decks of Sarsfield Road Bridge (UBC4) in the adjacent section.
- Between Kylemore Road Bridge (OBC5A) and Khyber Pass Footbridge (OBC5) to facilitate the construction of the retaining walls along the north of the track which are a future precursor to reconstructing Kylemore Road Bridge (OBC5A).



Where feasible, the numerous existing crossings associated with Inchicore Works may be used to minimise disruption to the existing railway operations and avoid unnecessary works. This will be defined in a staging plan prior to construction.

## 8.4. OHLE Infrastructure

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

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

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

## 8.5. Substations

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

The typical duration of construction for an electrical substation is six months, including civil, mechanical, and electrical works. The area reserved for construction works is approximately 1000 m<sup>2</sup>.

## 8.6. Construction Compounds

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

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

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

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

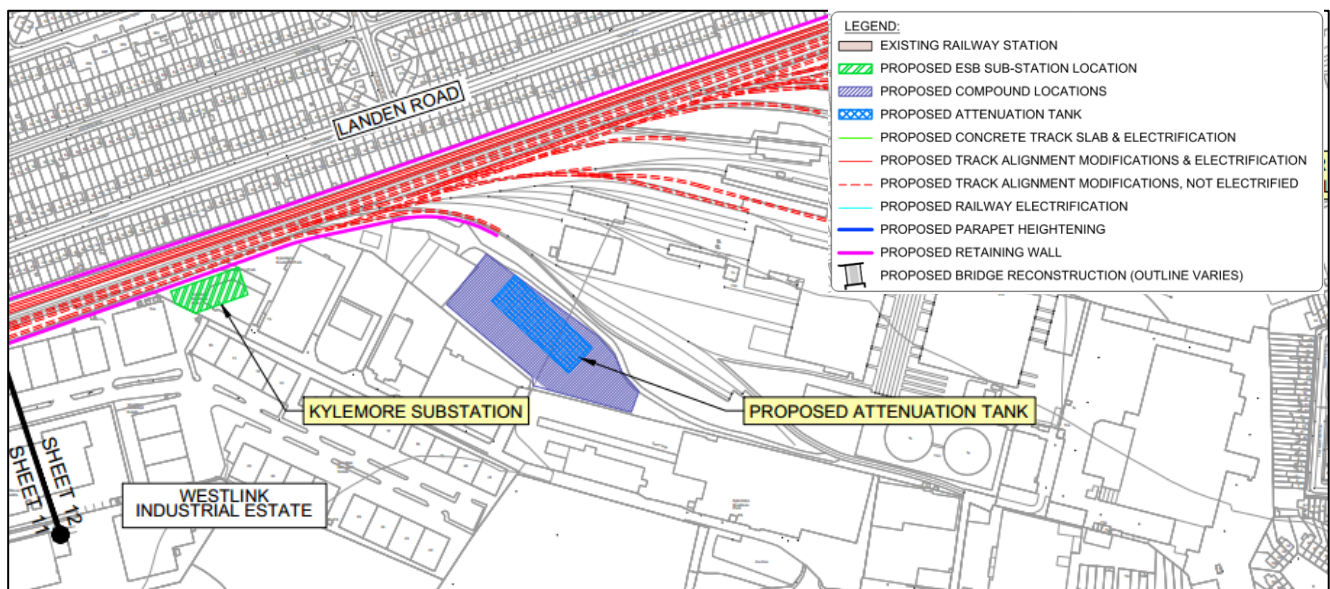
Construction compounds will need to accommodate offices for the contractor and client teams, storage facilities, recycling facilities, parking for cars and plant and potentially fabrication areas. It is a requirement that the construction compounds are located close to and ideally with direct access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

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

A number of potential geographic locations have been identified as construction compounds along the route to support the project construction; three of them have been identified at the vicinity of Kylemore Bridge and Sarsfield Road:

- Inchicore Materials Processing Center
- Khyber Pass Footbridge
- Sarsfield Road

**Section 5 Options** outlines the preferred locations for the two construction compounds required for this area; **Section 6 Options Selection Process** provides a detail of the option selection methodology. **Figure 8-1 and Figure 8-2** illustrates the preferred option indicative site layout for these construction compounds.



**Figure 8-1 Proposed construction compound Locations – Inchicore Materials Processing Center**

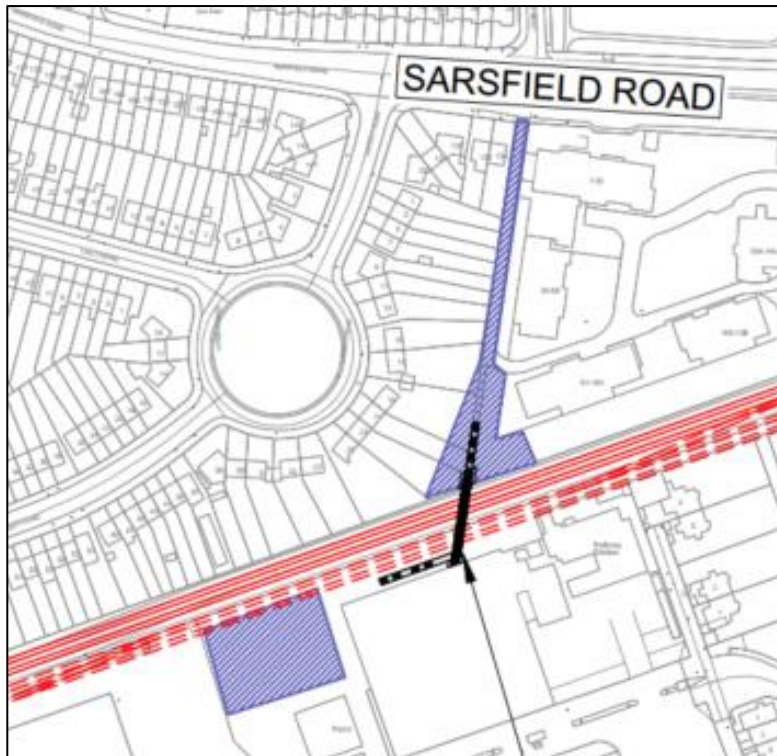


Figure 8-2 Proposed construction compound Locations – Khyber Pass Footbridge

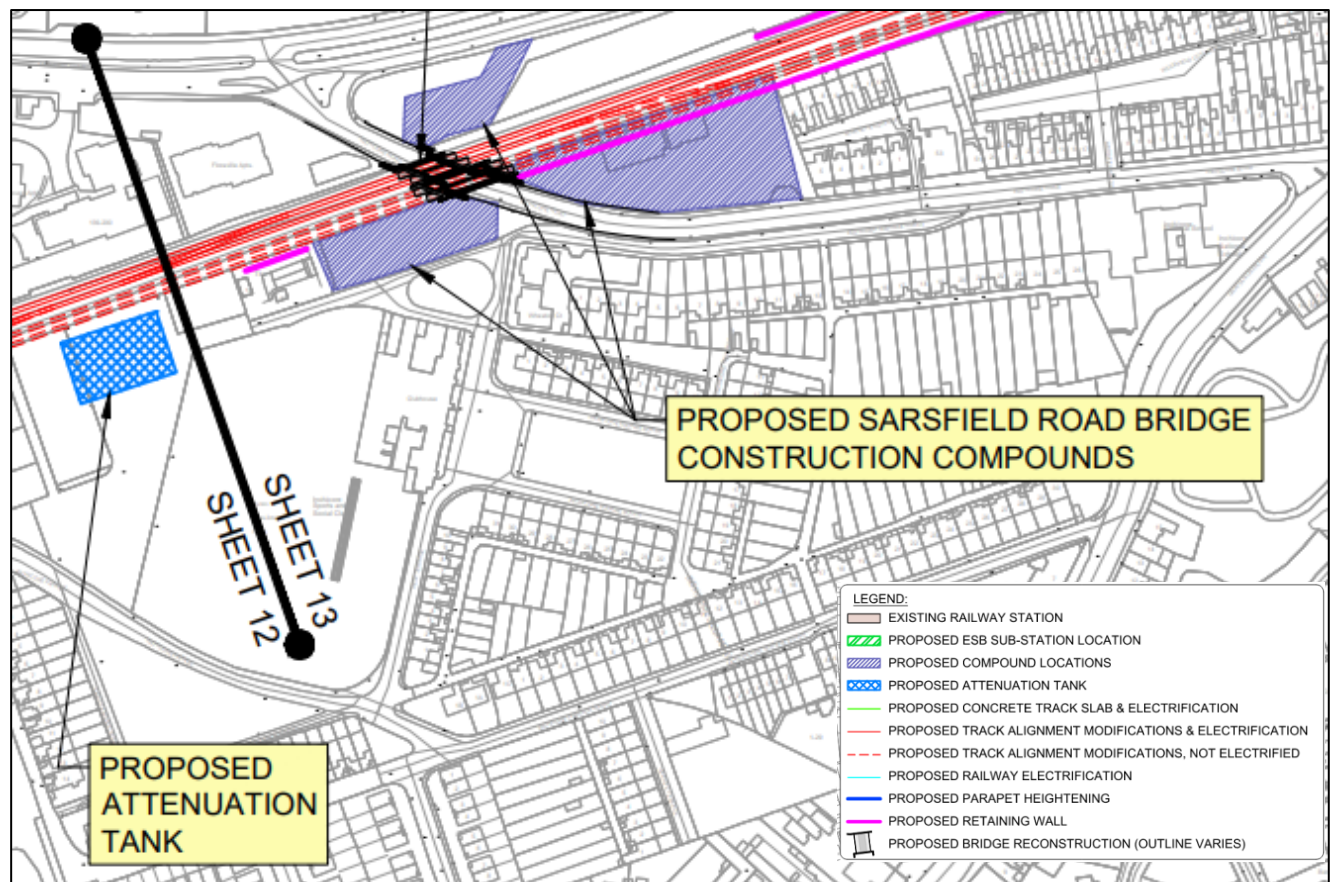


Figure 8-3 Proposed construction compound Locations – Khyber Pass Footbridge



## 8.7. Temporary Traffic Management

While no major public road diversions or closures are envisaged for this section of railway construction; there are a number of compounds earmarked as critical for the area (see **Section 8.6 Construction Compounds**). This is one of the few areas where the Rail Corridor has a substantial southern proportion that is not within a cutting, but the northern section is difficult to access from the south due to the operational needs of the railway.

Accordingly, access will be required via:

- North western side adjacent to Kylemore Bridge (OBC5A) and the ESB substation. This will be in advance of the Kylemore Road temporary bridge installation and bridge reconstruction. This is required in order to construct piling platforms and retaining walls along the northern boundary to the railway corridor (track side of the Landen Road properties).
- In addition; the Khyber Pass Bridge (OBC5) 'pan-handle' access road (running along the western boundary of the Seven Oaks Apartment Complex) would be required as an exit point from the railway corridor for material delivery and heavy works vehicles entering the railway corridor at Kylemore Road. This 'pan-handle' is also required for a period to provide access to the compound and works associated with the construction of the Khyber Pass Footbridge (OBC5). It also serves as a secondary fire tender access. The majority of the vehicular movements will be out of this access road and directed to the Chapelized Bypass.



Figure 8-4 Alternative Access roads

Construction traffic will be made to travel through the Inchicore Depot to Jamestown Road and Kylemore Way and via Tyrconnell and Kylemore Roads to the Naas Road. Construction traffic may periodically need to travel through Sarsfield Road to the compound site south east of the bridge; as many of these works will be taking place concurrently, where feasible. It is not recommended to use Inchicore Terrace for such journeys as it a narrow street.

The Inchicore Depot's operational personnel, that currently use Khyber Pass Bridge (OBC5), would need to be temporarily diverted via Sarsfield Road Bridge (UBC4); and onwards to the main entrances of the Inchicore Depot; or alternative transport arrangements made.

## 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 – Inchicore Works

A.2 Sifting Process Backup – Khyber Pass Footbridge



# Appendix B – MCA Process Backup

## B.1 MCA Process Backup – Inchicore Works

# Appendix C – Drawings

The following drawings accompany this Technical Report:

## Structures Drawings

DP-04-23-DWG-ST-TTA-57150: Khyber Pass Footbridge (OBC5) – General Arrangement

DP-04-23-DWG-ST-TTA-57151: Khyber Pass Footbridge (OBC5) – Bridge Deck Plan

DP-04-23-DWG-ST-TTA-57152: Khyber Pass Footbridge (OBC5) – Bridge Deck Elevation

DP-04-23-DWG-ST-TTA-57153: Khyber Pass Footbridge (OBC5) – Bridge Deck Cross Section

## Permanent Way Drawings

DP-04-23-DWG-PW-TTA-56990: Inchicore Works and Khyber Pass Footbridge (OBC5) – Track Plan Layout

DP-04-23-DWG-PW-TTA-56992: Inchicore Works and Khyber Pass Footbridge (OBC5) – Cross Section CH 11+000

DP-04-23-DWG-PW-TTA-56998: Inchicore Works and Khyber Pass Footbridge (OBC5) – Cross Section CH 10+751

## Substations Drawings

DP-04-23-DWG-EL-TTA-09422: Kylemore – IE Proposed Substation Location