



# **DART+ South West**

Technical Optioneering Report Park West to Heuston Station Area Around Inchicore Works Iarnród Éireann







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## **Glossary of Terms**

Reference	Description
ABP	An Bord Pleanála
ACA	Architectural Conservation Area
APIS	Authorisation for Placing in Service
ASA	Application for Safety Approval
AsBo	Assessment Body
ASPSC	Application Specific Project Safety Case
ATP	Automatic Train Protection
CAF	Common Appraisal Framework
Cantilever	OHLE structure comprising horizontal or near horizontal members supporting the catenary projecting from a
	single mast on one side of the track.
Catenary	The longitudinal wire that supports the contact wire.
CAWS	Continuous Automatic Warning System
CBI	Computer-Based Interlocking
CCE	Chief Civils Engineers Department of IE
CCRP	City Centre Re-signalling Project
CCTV	Closed Circuit Television
CDP	County Development Plan
CIE	Córas Iompair Éireann
Contact wire	Carriers the electricity which is supplied to the train by its pantograph.
CPO	Compulsory Purchase Order
Cross overs	A set of railway parts at the crossing of several tracks which helps trains change tracks to other directions.
CRR	Commission for Rail Regulation (formerly RSC – Railway Safety Commission)
CSM RA	Common Safety Method for Risk Evaluation and Assessment
CTC	Central Traffic Control
Cutting	A railway in cutting means the rail level is below the surrounding ground level.
D&B	Design & Build (contractor)
DART	Dublin Area Rapid Transit (IÉ's Electrified Network)
DART+	DART Expansion Programme
DeBo	Designated Body
Direct Current	Electrical current that flows in one direction, like that from a battery.
(DC)	
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
500	railways can handle large amounts of traffic and are often used on busy routes.
FRS	Functional Requirements Specification
F5P	Final Supply Points
GDA	Greater Dublin Area
	Hazard Identification
	The horizontal distance between a bridge support and the hearest railway track is referred to as horizontal elegence. Bridge supports include obutments (at the onde of the bridge) and piers (at intermediate legence)
	Liearance, bruge supports include abutitients (at the ends of the bruge) and piers (at intermediate locations).
	Independent Assessor
	Independent Assessul
	Iannou Eineann Infrastructura Managar (IÉ)
	Infrastructure Manager Safety Approval Danal
	Components that senarate electricity live parts of the OHLE from other structural elements and the earth
moulators	Traditionally ceramic today they are often synthetic materials
KCC	Kildare County Council
NOC	







Reference	Description	
Lateral Clearance	Clearances between trains and structures.	
I CA	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	Maior 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	
PRS	Project Requirement Specification	
PSCS	Project Supervisor Construction Stage	
PSDP	Project Supervisor Design Process	
PSP	Primary Supply Points	
QA/QC	Quality Assurance/Quality Control	
RAM	Reliability, Availability, Maintainability	
RC	Reinforced Concrete	
Re-signalling	Re-signalling of train lines will regulate the sage movement of trains and increase the capacity of train services	
	along the route.	
RMP	Record of Monuments and Places	
RO	Railway Order	
RPS	Record of Protected Structures	
RSC-G	Railway Safety Commission Guideline	
RU	Railway Undertaking (IE)	
SAM	Safety Assurance Manager	
SAP	Safety Approval Panel	
SDCC	South Dublin County Council	
SDZ	Strategic Development Zone	
SEI	Signalling, Electrical and Telecommunications	
Sidings	A siding is a short stretch of raliway track used to store rolling stock or enable trains on the same line to pass	
SMR	Sites and Monuments Records	
	IE Safety Management System	
	Trains per Hour	
	Train Spectro System	
Track Alignment	Train Protection System	
Track Alignment	and vertical planes. Horizontal alignment means the direction of the railway track on the plan including the straight	
	nate and the curves it follows	
TSI	Technical Specifications for Interoperability	
TSS	Train Service Specification	
TTAIV	TYPSA_TUC RAIL and ATKINS Design Joint Venture (also referred to as TTA)	
Underbridge (LIR)	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.	
WED	Water Framework Directive	







## 1. Introduction

### 1.1. Purpose of Report

The purpose of this report is to provide technical input to the Preliminary Option Selection Report. This report shows the options considered as part of the project development and why the emerging preferred option was chosen.

This report provides the technical assessment of the area around Inchicore Works but excludes the Khyber Pass Footbridge (OBC5) (refer to separate report for optioneering process specific to this structure). 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, Electrical and Telecommunications
- Overhead Line Equipment (OLE)
- Environment
- Highways
- Geotechnical

The report provides:

- An area overview and a detailed description of the existing railway infrastructure and challenges.
- The Project Requirements for this area.
- The technical and environmental constraints, including the horizontal and vertical clearances at structures.
- The options considered for this area.
- The option selection process is leading to the identification of the Emerging Preferred Option, including the Sifting Process and the Multi-Criteria Analysis Process.

### 1.2. DART+ Programme Overview

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









Figure 1-1 DART+ Programme

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

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







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

The Programme also has been prioritised as part of Project Ireland 2040 and the National Development Plan 2018-2027 as it is integral to the provision of an integrated, high-quality public transport system.

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

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

### 1.3. DART+ South West Project

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

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

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



Figure 1-2 DART+ South West Route Map

### 1.4. Capacity Increases Associated with DART+ South West

DART+ South West will improve performance and increase train and passenger capacity on the route between Hazelhatch & Celbridge Station to Heuston Station and through the Phoenix Park Tunnel Branch Line to the City







Centre, covering a distance of circa 20km. It will significantly increase train capacity from the current 12 trains per hour per direction to 23 trains per hour per direction (i.e. maintain the existing 12 services, with an additional 11 train services provided by DART+ South West). This will increase passenger capacity from the current peak capacity of approximately 5,000 passengers per hour per direction to approximately 20,000 passengers per hour per direction. Upon completion of the DART+ South West Project, train services will be increased according to passenger demand.

### 1.5. Key infrastructural elements of DART+ South West Project

The key elements of DART+ South West 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, via the Phoenix Park Tunnel Branch Line, where it will link with proposed DART+ West.
- Undertaking improvements / interventions to bridges to achieve vertical and horizontal clearances.
- Remove rail constraints along the Phoenix Park Tunnel Branch Line.
- Feasibility report and concept design for a potential new Heuston West Station.

#### 1.6. Route Description

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

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

Table	1-1	Route	Breakdown
10010		1.0410	Dioditaomi









Area Name	Sub-area Description	Extents	Main Features
	Area around Kylemore Road Bridge (OBC5A)	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 around Inchicore Works	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)	Vicinity of Khyber Pass Footbridge (OBC5)	Khyber Pass Footbridge (OBC5)
	Area around Sarsfield Road Bridge (UB4)	West of Sarsfield Road Bridge (UBC4) to the West of Memorial Road Bridge (OBC3)	Sarsfield Road Bridge (UBC4)
	Area around Memorial Bridge (OBC3)	Vicinity of Memorial Road Bridge (OBC3)	Memorial Road Bridge (OBC3)
	Area around South Circular Road Junction	East of Memorial Road Bridge (OBC3) East of St John's Road Bridge (OBC0A)	South Circular Road Junction South Circular Road Bridge (OBC1) St Johns Road
	Area around Heuston Station and Yard	Area at the South side of the Heuston Station Yard (non- DART+ tracks)	Bridge (OBC0A) Heuston Station Sidings around Heuston Station Potential new Heuston West Station
St John's Road Bridge to Glasnevin	Area from East of St John's Road Bridge (OBC0A) to East of Phoenix Park Tunnel	East of St John's Road Bridge (OBC0A) to East of Phoenix Park Tunnel	Liffey Bridge (UBO1). Conyngham Road Bridge (OBO2) Phoenix Park Tunnel
Sunction	Area from East of Phoenix Park Tunnel to Glasnevin Junction	East of Phoenix Park Tunnel to South of Glasnevin Junction	McKee Barracks Bridge (OBO3) Blackhorse Avenue Bridge (OBO4)









Area Name	Sub-area Description	Extents	Main Features
			Old Cabra Road Bridge (OBO5)
			Cabra Road Bridge (OBO6)
			Fassaugh Avenue Bridge (OBO7)
			Royal Canal and LUAS Twin Arches (OBO8)
			Maynooth Line Twin Arch (OB09)
			Glasnevin Cemetery Road Bridge (OBO10)







## 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 on the west side at the Points 700B that corresponds to the project chainage 252+795. At this point, the track is in a cutting, and from there the two main lines run parallel to the Inchicore Works sidings. On the North, the back gardens of the houses at Landen Road limits the rail corridor, and on the South, Inchicore Works is found.

The Maintenance Shed is located at Chainage (Ch) 252+050 at the South. From the Maintenance Shed, the railway is at grade, and the tracks run between the Old Signal Box and the Turret (at Ch 251+800). The Track and Signal building and Khyber Pass Footbridge (OBC5) are located at the Ch 251+620. The options relating to the Khyber Pass Footbridge (OBC5) are covered under a separate report.

On the East side of this area, the tracks are on an embankment. The Seven Oaks apartment building and Floraville apartment building are located to the North at a lower level than the track. On the South, St George's Villas (Ch 251+540) and existing drainage attenuation facilities (Ch 251+400) are 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.

#### 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 2-3**, the main elements that constrain the track alignment are shown.









Figure 2-3 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 trains (diesel 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 Khyber Pass Footbridge (OBC5) is located in this study area. This is a private footbridge for IÉ employees to access from the depot from the north of the railway. A separate report deals with this feature of the scheme.

### 2.3. Permanent Way and Tracks

The area around Inchicore Works from east to west starts at the connection of the Down Main line to the Long Siding at Points 700B. From there, Ch 252+795 up to Ch 252+340 three tracks are found: two running lines (Up & Down Main tracks) and a siding (Long Siding). A fourth siding, called Short Siding, parallel to the mainline extends from Ch 252+340 up to Ch 251+880, past the Maintenance Shed of Inchicore Works. The Long siding is connected to the different tracks leading into the depot, and the Short siding is used for train stabling. The Long siding ends at trap points 702 (Ch 251+800) to the west of Inchicore depot, and from there the track is named as Relief Line. The Relief line completes the three tracks that run up to Heuston Station. The track layout is shown in Figure 2-4.

There is an existing speed limit in front of the maintenance shed, with speed increasing from 40mph to 60 and 70mph (moving towards Heuston) for the Up and 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.







To Park West

To Heuston



#### Figure 2-4 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, and a fixed buffer stop as an arresting device (refer to Figure 2-5). The level difference between the siding and the main tracks can be observed in the picture.



Figure 2-5 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 2-6. After this, the Long Siding becomes the Relief Line.



Figure 2-6 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.

### 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 2-7, 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 2-7 Inchicore Works; technical buildings and offices.

The access to the depot is through the Long siding where all the depot tracks are connected to. The maximum length of the train using this depot is 240m (8 Mark IV carriage + loco).

Refer to sections 4.1 and 4.6 for 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. The structure has a vertical clearance of 5.2m (approx.) above existing rail levels and a span of 24m (approx.). A separate report covers this feature of the scheme.

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 (derailment clearance requirement). 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 larnród 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 structure is fully enclosed.

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 larnród Éireann staff and does not form part of a public footway.

### 2.6. Topography and Ground Conditions

The western extents of this 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 larnród Éireann at the Inchicore Railway Works.

Close to the Khyber Pass Footbridge (OBC5), the railway transitions on both sides form a minor cutting to an atgrade 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 (2014m 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.

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.

### 2.7. Environment

The area to the north of this area is broadly residential in nature with a particular focus on properties associated with Landan Road. Currently, the rear gardens of these properties about the rail corridor. There are also a number of apartment blocks located to the north as the corridor approaches Sarsfield Road. To the south, the lands are predominantly associated with the Inchicore Works and the functional railway sidings. Residential properties are also present to the south of the railway at this location, particularly at St. Georges Villas Inchicore Parade. 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).

Refer to section **4.1** for further details.







#### 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.

#### 2.9. Drainage

There is not any known track drainage element present in the main lines throughout 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

The specific project requirements for this area are:

- Four tracking Park West to Heuston.
- Electrification of DART+ tracks.
- Electrical clearance for electrification
- Keep current functionality of railway (Inchicore Works).
- Track alignment and drainage requirements (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. There will be a potential requirement to provide 6 additional power substations along the rail line to provide the requisite power for the network demand. 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 radiobased technologies used on the network and for signalling and communication with the existing and future network control centres.

#### 3.3. 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.

OHLE diagrams in this report are for visual information only. Final dimensions, lengths, heights and cantilever types are to be defined in the reference design and subsequent design stages of the project.

The OHLE concept comprises a pre-sagged simple (2-wire) auto-tensioned system, supported on galvanised steel support structures.







In 4 No. track areas, Two Track Cantilevers (TTCs) will generally only be placed on the north side of the line, to support OHLE on the northern two tracks. Supporting the OHLE by utilising structures positioned on the south side of the 4 No. tracks is not considered to be a feasible solution due to the loads involved.



Figure 3-1 Typical OHLE arrangement in four track open route.

Nominal contact wire height is 4.7m, and heights through stations may be slightly higher to achieve minimum protection by clearance distances. Minimum contact wire height without a derogation is 4.4m under all conditions including sag, and it may be necessary at certain bridges to place the contact wire height at 4.2m under all conditions.

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, and maximum half tension length is 800m. 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.









Figure 3-2 Typical anchor structure

The OHLE configuration through the overbridges for each track or civils option is being assessed using a calculator derived from the System Wide OHLE FRS, and a set of configurations agreed with Irish Rail 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.





#### 3.3.1. Substations

In order to facilitate the introduction of the new OHLE scheme across the DART+ network a power supply study has been carried out. There is a requirement to provide 6 new substations at the following locations:

- Islandbridge
- Le Fanu







- Park West
- Kishoge
- Adamstown
- Hazelhatch

### 3.4. Design Standards

Please refer to the Technical Options Introduction Report (Annex 3.2) for the design standards that will be used for the scheme.







## 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.

There is a significant residential development in close proximity to the north of the rail corridor at Landon Road, in many cases within 50m of the existing rail centreline. This includes a residential apartment block. 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.

The railway works themselves include a functioning siding for the cleaning and maintenance of the carriages. A number of the buildings within the Inchicore Railway Works are identified on the National Inventory of Architectural Heritage (NIAH). Key features include a signal box 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 species and bat roost potential, which were identified previously.

#### 4.2. 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		
		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 Figure 4-1) to the nearest rail.		
North Side	Properties at Landed Road	Figure 4-1 Minimum distance of 1.8m from property wall on the north to nearest track.		
North Side	Old Signal Box	<text></text>		







Location	Name	Description of Constraints to four-tracking		
		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. 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.		
North Side	Apartment building and Sarsfield Medical Centre	Seven Oak DartmentsFloraville DartmentPartmentFloraville DartmentPartmentSarsfield Rd DartmentSarsfield Rd DartmentSarsfield Rd DartmentFigure 4-3 Medical Centre and Apartment buildings in the north.		
South Side	Industrial Properties	Figure 4.6 interface of the and Apartment buildings in the north. Property boundary of the Industrial properties east of Kylemore Rd is located at 6.5m to the nearest rail. <b>West Deput Connection West Deput Connection West Deput Connection West Deput Connection Connection</b>		







Г



Name Depot Maintenance Shed	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. 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.
	<text><image/><caption></caption></text>
	Depot Maintenance Shed







Location	Name	Description of Constraints to four-tracking
South Side	Name	<text><text></text></text>
		Figure 4-7 View of the Turret.
		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.







Location	Name	Description of Constraints to four-tracking
		The Track and signal building is on the south side of the tracks. At this point, there are three running lines (Up & 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. A signalling Relocatable Equipment Building (REB) is found between the building and the tracks
		Khyber Pass Footbridge (OBC5) Down Main Down Main
South Side	Track and Signal HQ	<image/> <image/>
		Figure 4-9 HQ Signalling building.Khyber Pass Footbridge (OBC5).







Location	Name	Description of Constraints to four-tracking
		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.
South Side	4 St George´s Villas	Figure 4-10 St George Villas, attenuation Facilities and UBC4.

In addition to the features described in Table 4-1 above, 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 4-11. Room for the installation of the new property walls, the OHLE mast and the walkway is considered. Lateral distance to structures to be increased for curvature and cant as per Track Standard I-PWY-1101.





#### 4.3. Existing Structures

The Khyber Pass Footbridge (OBC5) is a significant feature of this area. Please refer to Technical Options Report DP-04-23-ENG-DM-TTA-55362 for details of this bridge and the proposed treatment options.

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 Annex 3.8 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 Technical Options Report DP-04-23-ENG-DM-TTA-55875 for details of Kylemore Road Bridge (OBC5A).

#### 4.4. 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.

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.

The temporary or permanent acquisition of land is also likely to be required for permanent way widening options to facilitate construction of the track alignment and new permanent boundary retaining structures.

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.

### 4.5. 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 and private water supply 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.

In terms of private water supply mains, historical information indicates shallow pipework between Inchicore and Heuston which provides water supply to train wash facilities within Heuston Yard. This service is not fully documented, but it is likely that alterations or replacement pipework will be required due to the necessity for track widening works.

In summary, all existing utilities pose constraints to the identified design options. Where conflict is apparent, their potential treatment is being discussed with the utility providers.







### 4.6. Historical Buildings

Refer to Section 4.1, where the historical buildings within this area are described.

### 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 culvert under Sarsfield road and a surface water undertrack are crossing the tracks at the western end of the works. 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

#### 5.1. Options Summary

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 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 Main Options is presented in Table 5-1. A detailed description of each Main Option and their Variations is included in Section 5.2.

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.		

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

### 5.2. Options Description

This section describes the Main Options that have been considered for this 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.

#### 5.2.1. 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.







#### 5.2.2. 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.

#### 5.2.3. 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.

#### 5.2.4. 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 at Ch 252+795 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, which is an excerpt from drawing DP-04-23-DWG-PW-TTA-55769).

The final configuration of the sidings would need to be further elaborated to maintain and improve the depot functionality.



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. At this area between Ch 252+500 up to Ch 252+795, 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.

From the Ch 252+500 up to the Maintenance Shed at Ch 252+080, the difference in level between the rail levels and the adjacent properties to the north are less than 1.5m. The northern track will be at 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 Inchicore yards would need to be realigned to connect with the proposed location of the Long Siding. At Ch 252+560, there is a GSM-R tower used for the rail communication system that can be retained (Figure 5-3). The signal gantry at Ch 252+500 is to be replaced as well.









Figure 5-3 Entrance to Inchicore yards and GSM-R communication tower at Ch 252+560.

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 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 realised at Ch 251+880 (see Figure 5-5 extracted from Per Way drawing DP-04-23-DWG-PW-TTA-50771). The tracks leading to the maintenance shed are to be realigned. Final siding configuration to be fixed in the next design stage. Trap points to be included on the east connection to the mainline.









Figure 5-5 Existing siding need to be realigned.

From Ch 251+920 to the east end of the study area at Ch 251+320, land take is required in the north. Over a length of 600m a total of 45 properties would be affected (Houses at Landen Road and Apartment building at Sarsfield Road).

Land take may 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).

Option 3 is described in the drawing DP-04-23-DWG-PW-TTA-55769.







#### 5.2.5. Option 4

The Option 4 is equivalent to Option 3 from the Ch 252+795 up to the western corner of the Maintenance shed at Ch 252+150. 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 larnród 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. The Turret might need to be relocated due to insufficient distance to the main line tracks, considering the maximum speed in these and the safety distance required for derailment. There would be no impact on the north properties throughout this area. See Figure 5-6 (extract from drawing DP-04-23-DWG-PW-TTA-55771).



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):



Figure 5-7 Option 4, impact on Irish Rail facilities and St George's Villas in the South.

Option 4 is described in the drawing DP-04-23-DWG-PW-TTA-55771.

#### 5.3. OHLE Arrangement – All Do-Something Options

This area, in common with the rest of the Glasnevin to Hazelhatch line, will be electrified with a 1500V Direct Current (DC) OHLE system to provide electrical power to the network's new electric train fleet. The OHLE system is being developed by the DART+ West MDC, and this system will be used on this project.

It should be noted that all OHLE diagrams in this report are for visual information only. Final dimensions, lengths, heights and cantilever types are to be defined in the reference design and subsequent design stages of the project.

The OHLE comprises a pre-sagged simple (2-wire) auto-tensioned system, supported on galvanised steel support structures. In four-track sections Two Track Cantilevers (TTCs) will generally only be placed on the north side of the line, to support OHLE on the northern two tracks.









#### Figure 5-8 Typical OHLE arrangement in four-track open route.

The maximum design span length is 63m, although in practice span lengths may be shorter than this to avoid obstacles and service turnouts.

Nominal contact wire height is 4.7m, and heights through stations may be slightly higher to achieve minimum protection by clearance distances. Minimum contact wire height without a derogation is 4.4m under all conditions including sag, and it may be necessary at certain bridges to place the contact wire height at 4.2m under all conditions.

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, and the maximum half tension length is 800m. 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.

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

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.

Locations of the existing retaining structures, buildings and structure affected by the proposed option alignments are shown on the Option drawings DP-04-23-DWG-PW-TTA-50750 to DP-04-23-DWG-PW-TTA-50755







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

Options for the Khyber Pass Footbridge (OBC5) include replacement of the bridge with a new bridge that would have sufficient vertical and horizontal clearance to meet the requirements for 4-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.

Please refer to Technical Options Report DP-04-23-ENG-DM-TTA-55362 for a detailed description of this structure and the proposed Options.

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

Except for Option 0, all Options 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.

### 5.7. Drainage

The existing attenuation tank facilities (see Figure 5-9) 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 5-9 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 5-10 shows the extension of the area that needs to be attenuated by a new drainage system. The approximate length of this renewed layout is 5.4 km. In this area, the track levels are falling towards the east at a gradient of 1%.

![](_page_45_Picture_4.jpeg)

Figure 5-10 Extension of railway corridor where new track drainage may be installed

The only possible outfall of the new track drainage system that has been identified is a culverted stream (Creosote Stream) that crosses the railway at Sarsfield Road. According to the available historical drawings, the culvert has a diameter of 4'9" (Refer to Figure 5-11).

![](_page_45_Picture_7.jpeg)

![](_page_46_Picture_0.jpeg)

![](_page_46_Picture_1.jpeg)

![](_page_46_Figure_2.jpeg)

#### Figure 5-11 Historical detail of existing culvert at Creosote Stream.

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 to the Creosote Stream that flows to the River Liffey. The requirements will be established by the Local Authority.

A preliminary hydraulic model has been undertaken to provide an estimation of the runoff volumes that will be collected by the proposed drainage system implemented in the 4-track area as well as the attenuation requirements needed to comply with the allowable discharge rates.

The size of the new attenuation tank would be related to the allowable discharge flow. Due to the catchment area, the proposed attenuation tank and associated facilities would need to be installed in the most appropriate location. The areas according to the allowable discharge rates into the Creosote Stream are shown in Table 5-2.

![](_page_46_Picture_7.jpeg)

![](_page_47_Picture_0.jpeg)

![](_page_47_Picture_1.jpeg)

#### Table 5-2 Area required for the new track drainage attenuation facilities.

	Discharge rate of 5 I/s	Discharge rate of 2 I/s/Ha 26.6 I/s	Qbar 32.8 l/s	Q100 62.4l/s
Total area in different scenarios	5,500 m²	4,700 m²	4,500 m²	3,700 m².

The area where the new track drainage attenuation facilities are shown appears in Figure 5-12. The required surface is around 3,700 to 5,500m<sup>2</sup>.

![](_page_47_Picture_5.jpeg)

Figure 5-12 Reserve area for the proposed track drainage attenuation facilities.

![](_page_47_Picture_7.jpeg)

![](_page_48_Picture_0.jpeg)

![](_page_48_Picture_1.jpeg)

A possible additional outfall could be an existing surface water pipe that crosses the railway corridor on the west side of the study area. An attenuation tank could be installed in the area shown in

![](_page_48_Picture_3.jpeg)

Figure 5-13 below.

![](_page_48_Picture_5.jpeg)

![](_page_49_Picture_0.jpeg)

![](_page_49_Picture_1.jpeg)

![](_page_49_Picture_2.jpeg)

Figure 5-13 Potential additional outfall and attenuation tank.

![](_page_49_Picture_4.jpeg)

![](_page_50_Picture_0.jpeg)

![](_page_50_Picture_1.jpeg)

## 6. Options Selection Process

#### 6.1. Options Selection Process

A clearly defined appraisal methodology has been used in the selection of the Emerging Preferred Option for the Project. Consistent with other NTA projects, it is based on 'Guidelines on a Common Appraisal Framework for Transport Projects and Programmes' (CAF) published by the Department of Transport, Tourism, and Sport (DTTAS), March 2016 (updated 2020) and informed by TII's Project Management Guidelines (TII PMG 2019).

The Option Selection Process involves a three-stage approach as summarised below:

- Stage 1 Preliminary Assessment (Sifting)
- Stage 2 Multi Criteria Analysis (MCA)
- Stage 3 Emerging Preferred Option

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, it is acknowledged that as the Cork Mainline is an existing operational rail line operating in a pre-defined corridor, the options to accommodate the necessary works at some locations along the route are limited due to spatial constraints.

### 6.2. Stage 1 Preliminary Assessment (Sifting)

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

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

The area under consideration covers approximately 1.5km and extends from the western side of the Sarsfield Road Bridge (UBC4) to the east of the Kylemore Road Bridge (OBC5A). A total of five options were initially developed for this area. 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.

#### 6.2.1. Preliminary Assessment (Sifting)

The table below provides details of the assessment undertaken as part of the Stage 1 Preliminary Assessment (Sifting) Process. Options which were assessed as feasible and fulfilled the project requirements were brought forward to Stage 2 MCA for a more detailed assessment.

![](_page_50_Picture_17.jpeg)

![](_page_51_Picture_0.jpeg)

![](_page_51_Picture_1.jpeg)

#### Table 6-1 Preliminary Assessment (Sifting) Process

Option	Requirements		Description
		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.
	Engineering	Electrification of DART+ tracks	FAIL. No intervention proposed. Electrification of the DART+ tracks not achieved.
0		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 of International significance.
		SIFTING OUTCOME	FAIL. Do not progress to Stage 2 Assessment
		Constructability	PASS. Minor interventions to the rail corridor are possible.
		Geometrical fitness for intervention	PASS. Minor interventions without geometrical fitness concerns are possible.
	Engineering	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.
1		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 of International significance.
		SIFTING OUTCOME	FAIL. Do not progress to Stage 2 Assessment
2		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.
	Engineering	4-tracking Park West-Heuston	PASS. This option achieves the 4 tracking.
	⊏ngineering	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.

![](_page_51_Picture_4.jpeg)

![](_page_52_Picture_0.jpeg)

![](_page_52_Picture_1.jpeg)

![](_page_52_Picture_2.jpeg)

Option	Requirements		Description
		Economy	It would not be aligned with the investment guidelines and programme for DART+
		Environment	No impact on Environmental sites of National of International significance.
		SIFTING OUTCOME	FAIL. Do not progress to Stage 2 Assessment
		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.
	Engineering	Electrification of DART+ tracks	PASS. This option achieves the electrification of DART+ tracks.
3		Vertical electrical clearance in structures	PASS. This option achieves electrical clearance in structures.
5		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		Compatible with the investment guidelines and programme for DART+
		Environment	No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		PASS. Proceed to Stage 2 Assessment
	Engineering	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.
4		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	Compatible with the investment guidelines and programme for DART+
		Environment	No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		PASS. Proceed to Stage 2 Assessment

#### Summary of the Preliminary Assessment (Sifting) 6.2.2.

Of the 4 no. Main Options 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 will progress to Stage 2 (MCA) of the assessment process. The table below provides a summary of the sifting process results.

![](_page_52_Picture_6.jpeg)

![](_page_53_Picture_0.jpeg)

![](_page_53_Picture_1.jpeg)

#### Table 6-2 Summary of Sift Process Results

Main Option	Sifting Process Result
Option 0: Do Nothing	FAIL
Option 1: Do Minimum	FAIL
Option 2	FAIL
Option 3	PASS
Option 4	PASS

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 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.

![](_page_53_Picture_12.jpeg)

![](_page_54_Picture_0.jpeg)

![](_page_54_Picture_1.jpeg)

• **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.

#### 6.3. Stage 2 Detailed Assessment (MCA Process)

#### 6.3.1. Multi-Criteria Analysis Process

Stage 2 of the optioneering process comprises a detailed multi-disciplinary comparative analysis of those options which passed through Stage 1 Preliminary Assessment. 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).

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 an Emerging Preferred Option.

Relevant considerations include:

- This is a comparative analysis between options presented, not an impact assessment of each option. The impact from the Emerging Preferred Option will be assessed in the Environmental Impact Assessment Report 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 Emerging 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. General arrangement drawings were developed for all options, focusing on key design aspects, e.g. permanent way.

These arrangement drawings were overlain to identify an overall spatial envelope for each option identifying the likely extent of permanent and temporary works required. The spatial envelope and GIS software was used to run queries in relation to environmental and other data sets to assist the specialists in undertaking the Multi-Criteria Analysis (MCA) (also refer to Technical Appendices Volume 2.1 'Environmental Constraints Reporting' for details of the constraints datasets used).

Due to the operational requirements and horizontal space constraints at Inchicore Works and sidings, assessments were carried out to determine the impact of the various options on operations for both the railway and maintenance facility, during the construction phase and also the longer term impacts of the proposed solution.

Preliminary cost estimates were prepared for each of the Options, incorporating the construction costs and potential land acquisition costs. The MCA Process involved assessing the performance of each option against

![](_page_54_Picture_17.jpeg)

![](_page_55_Picture_0.jpeg)

![](_page_55_Picture_1.jpeg)

relevant quantitative and qualitative indicators, the assessment was carried out at dedicated MCA workshops 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 '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 6-3 Comparison Criteria

![](_page_55_Figure_5.jpeg)

#### 6.3.2. Multi-Criteria Analysis Summary

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

#### Table 6-4 MCA Summary (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 In	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 emerging 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 '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

![](_page_55_Picture_13.jpeg)

![](_page_56_Picture_0.jpeg)

![](_page_56_Picture_1.jpeg)

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 'Some Comparative 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.

Due to the removal of both the Signal Box and Turret, Option 3 was found to have 'Some Comparative Advantage' in respect of Cultural Heritage and Architectural Heritage and Biodiversity (potential for bat roosts); however, this did not change the overall assessment findings. *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 comparable.

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

**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 comparable.

### 6.4. Emerging Preferred Option

The Emerging Preferred Option focuses the necessary enhancement of the rail corridor to the south requiring the demolition / relocation of some larnród Éireann facilities within the Inchicore Depot, but minimising third party properties and land to be affected. However, there will be potential interference to property rights.

Based on the level of information and design available at this time for Public Consultation No. 1, the extent of permanent works that may potentially interfere with property rights relate to:

- The 3m strip between the existing railway corridor and the rear of properties along Landen Road.
- Part of the garden of No. 4 George's Villas.
- The yard area and plant/attachments to the rear of commercial units in Westlink Industrial Estate and at the end of Jamestown Road.

There may also be temporary interference of these and other property rights during construction of the permanent works along the rail corridor however technical and construction related solutions will seek to minimise these. Construction requirements (including potential temporary interference of property rights) and methodologies will be presented at Public Consultation No. 2.

![](_page_56_Picture_15.jpeg)

![](_page_57_Picture_0.jpeg)

![](_page_57_Picture_1.jpeg)

## Appendix A – Sifting Process Backup

![](_page_57_Picture_3.jpeg)

![](_page_58_Picture_0.jpeg)

![](_page_58_Picture_1.jpeg)

# Appendix B – MCA Process Backup

![](_page_58_Picture_3.jpeg)

![](_page_59_Picture_0.jpeg)

![](_page_59_Picture_1.jpeg)

# Appendix C – Drawings

The following drawings accompany this Technical Report:

Permanent Way Drawings DP-04-23-DWG-PW-TTA-55769 DP-04-23-DWG-PW-TTA-55771 DP-04-23-DWG-PW-TTA-55772

![](_page_59_Picture_5.jpeg)

![](_page_60_Picture_0.jpeg)

![](_page_60_Picture_1.jpeg)

![](_page_60_Picture_2.jpeg)