



DART+ South West

Technical Optioneering Report Park West to Heuston Station Area around Heuston Station and Yard Iarnród Éireann







Contents

Cha	pter	Page	
Glos	sary of Terms	5	
1. 1.1. 1.2. 1.3. 1.4. 1.5.	Introduction Purpose of the Report DART+ Programme Overview DART+ South West Project Capacity Increases Associated with DART+ South West Key infrastructure elements of DART+ South West Project	8 8 9 10 10 11	
1.6.	Route Description	11	
 2.1. 2.2. 2.3. 2.4. 2.5. 2.6. 2.7. 2.8. 	Existing Situation Overview Challenges Structures Permanent Way and Tracks Other Railway Facilities Ground Conditions Environment Utilities	14 14 15 17 19 19 20 20	
3.	Requirements	22	
3.1. 3.2. 3.3.	Specific requirements Systems Infrastructure and Integration Design Standards	22 22 25	
4.	Constraints	26	
4.1. 4.2. 4.3. 4.4. 4.5.	Environment Permanent Way Existing Structures Geotechnical Existing Utilities	26 27 27 27 27 28	
5.	Options 29		
5.1. 5.2. 5.3. 5.4. 5.5. 5.6. 5.7. 5.8. 5.9.	Options summary Options Description OHLE Arrangement Permanent Way Geotechnical Roads Cable and Containments Structures Drainage	29 29 30 31 31 31 31 31 31	
6.	Options Selection Process	32	
6.1. 6.2. 6.3. 6.4.	Options Selection Process Stage 1 Preliminary Assessment (Sifting) Preliminary Assessment (Sifting) Stage 2: MCA Process – Emerging Preferred Option	32 32 32 33	









Appendix A - Sifting process backup 3					
Appendix B – Supporting Drawings					
Tables					
Table 1-1 Route Breakdown	11				
Table 2-1 Existing Retaining Walls	17				
Table 5-1 Options Summary	29				
Table 6-1 Sifting Process	32				
Table 6-2 Summary of Sift Process Results					







Figures

DART+ Programme	9
DART+ South West Route Map	10
Aerial view of Heuston Station and Sidings	14
Valeting Plant Subway (UBC1A) under the railway tracks	15
Valeting Plant Subway (UBC1A) north entrance	16
Valeting Plant Subway (UBC1A) south entrance	16
Existing Track Layout (from Route Information Book)	18
Train Wash Road and Valet Sidings	19
Typical OHLE arrangement in two track open route	23
Typical anchor structure	24
Typical arrangement on approach to a low bridge	24
Route to be electrified sketch	30
	DART+ Programme DART+ South West Route Map Aerial view of Heuston Station and Sidings Valeting Plant Subway (UBC1A) under the railway tracks Valeting Plant Subway (UBC1A) north entrance Valeting Plant Subway (UBC1A) south entrance Existing Track Layout (from Route Information Book) Train Wash Road and Valet Sidings Typical OHLE arrangement in two track open route Typical anchor structure Typical arrangement on approach to a low bridge Route to be electrified sketch







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 lompair Éireann
Contact wire	Carriers the electricity which is supplied to the train by its pantograph.
СРО	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
СТС	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 (DC)	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









Reference	Description
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
IA	Independent Assessor
IÉ	larnród 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
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









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









1. Introduction

1.1. Purpose of the Report

The purpose of this report is to provide technical input to the 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 Heuston Station and Yard. 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, Telecommunications (SET) and Low Voltage Power
- Overhead Line Equipment (OHLE)
- 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, leading to the identification of the Emerging Preferred Option, including the Sifting process and the Multi-Criteria Analysis process (not required for this Area).







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

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

1.3. 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 infrastructure elements of DART+ South West Project

The key elements of DART+ South West includes:

- 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 of bridges to achieve vertical and horizontal clearances.
- Remove rail constraints along the Phoenix Park Tunnel Branch Line.
- Feasibility report and concept design for a new Heuston West Station.

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

1.6. Route Description

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

Area Name	Sub-area Description	Extents	Main Features
Hazelhatch to Park	Area from Hazelhatch to	West side of Hazelhatch & Celbridge Station to 50m to	Hazelhatch & Celbridge Station Adamstown Station Clondalkin / Fonthill Station
west	Park West	Footbridge (OBC8B) Park West Orchard S	Park West & Cherry Orchard Station
			Cherry Orchard Footbridge (OBC8B)
	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)
Park West to Heuston Station	st to Station Area around Kylemore 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)

Table 1-1 Route Breakdown









Area Name Sub-area Description		Extents	Main Features
	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 Bridge (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)
			South Circular Road Junction
	Area around South Circular Road Junction	East of Memorial Road Bridge (OBC3) East of St John's Road Bridge (OBC0A)	South Circular Road Bridge (OBC1)
			St Johns Road Bridge (OBC0A)
	Area around Heuston Station and Yard	Area at Heuston Station Yard, including all platforms and sidings	Heuston Station Sidings around Heuston Station
			Potential new Heuston West Station
	Area from East of St John's Road Bridge	East of St John's Road Bridge (OBC0A) to East of Phoenix	Liffey Bridge (UBO1).
	Phoenix Park Tunnel	Park Tunnel	Conyngham Road Bridge (OBO2)
St.John's Road			Phoenix Park Tunnel
Bridge to Glasnevin Junction			McKee Barracks Bridge (OBO3)
		East of Phoenix Park Tunnel to South of Glasnevin	Blackhorse Avenue Bridge (OBO4)
	Area from Phoenix Park Tunnel to Glasnevin Junction		Old Cabra Road Bridge (OBO5)
			Cabra Road Bridge (OBO6)
			Fassaugh Avenue Bridge (OBO7)









Area Name	Sub-area Description	Extents	Main Features
			Royal Canal and LUAS Twin Arches (OBO8)
			Maynooth Line Twin Arch (OB09)
			Glasnevin Cemetery Road Bridge (OBO10)







2. Existing Situation

2.1. Overview

This area encompasses Heuston Station, including the associated servicing sidings, and extends to the east side of St John's Road (OBC0A). The Permanent Way in this area consists of tracks serving platforms 1 to 8, valet sidings, carriage sidings, carriage wash siding, in close proximity to adjacent running lines on either side. There is a subway (UBC1A), providing access for IE personnel to the valeting plant at Heuston Yard.

There are several retaining walls in this area, as detailed in Section 2.3.

The topography is at grade and the local road network is not intersected in this self-contained open plan area. Signal structures are numerous, controlling all of the passenger services and operational/service requirements in the station area. The area does not currently have any provisions for electrification.

Major infrastructure features are illustrated in Figure 2-1 below:



Figure 2-1 Aerial view of Heuston Station and Sidings

All platforms, except Platform 10 (which is covered by the East of St John's Road Bridge (OBC0A) to Glasnevin Junction – Technical Optioneering Report), have fuelling and servicing facilities.

There are a number of existing Environmental features in this area (see section 4.1).

Heuston Station itself is a tourist/visitor attraction and has a number of heritage designations and biodiversity constraints (invasive species).

2.2. Challenges

Within the Heuston Station area, platforms 6, 7 and 8, as well as additional sidings to the North, are to be electrified to receive the DART+ rolling stock, with one of the sidings needing lengthening, whilst retaining the existing functionality of Heuston Station Yard.







There are significant challenges in this area that constrain the options available to achieve the Permanent Way and Overhead Line Electrification (OHLE) project requirements. Maintaining the length of the Maintenance Sidings (Guinness Sidings) and maximising the headshunt length of the carriage sidings will require modification of the layout, as well as the connections with the line coming from Phoenix Park Tunnel, which are crucial to ensure the continuity of existing services. These issues are discussed further throughout the report.

2.3. Structures

2.3.1. Valeting Plant Subway (UBC1A)

The Valeting Plant Subway (UBC1A) is a subway structure consisting of precast concrete rectangular box units. The subway provides access for IE personnel to the valeting plant at Heuston Yard. According to the 2016 principal inspection report, the subway was installed early '00s.



Figure 2-2 Valeting Plant Subway (UBC1A) under the railway tracks









Figure 2-3 Valeting Plant Subway (UBC1A) north entrance



Figure 2-4 Valeting Plant Subway (UBC1A) south entrance

2.3.2. National Train Control Centre

A new National Train Control Centre (NTCC) at Heuston Station is currently under development. The NTCC will be IE's centre for the management and regulation of train movements on their network and will also provide real-







time customer information at stations on IE's website and social media platforms. The NTCC will replace the existing Centralised Traffic Control centre (CTC), which is now operating at capacity and with aged technology.

A series of enabling works in preparation for the construction of the main NTCC building were completed in late 2019/early 2020, including the removal of existing sidings and installation of new ducting routes. It is planned that the construction of the facility will be complete early 2022.

2.3.3. Retaining Walls

According to existing IE database records, the following retaining walls are recorded at the following locations:

Track Section	Asset ID	Start Mileage	End Mileage	Side	Wall Type	Wall Height	Description
Heuston - Hazelhatch	RWC000U	0m 0650yrds	0m 0815yrds	Up	Mass Concrete	1.0m to 3.5m	N/A
Heuston - Hazelhatch	RWC000UA	0m 0815yrds	0m 0850yrds	Up	Rail/Sleeper Wall	1.5m	N/A

Table 2-1 Existing Retaining Walls

2.4. Permanent Way and Tracks

Heuston Station comprises 9 Platforms, Platforms 1 to 8 formed in a block of parallel tracks at the terminus end of the mainlines, and Platform 10 situated alongside the Down Loop on the Phoenix Park Tunnel Branch Line. To the south of Platform 1 there are multiple sidings, as well as further sidings around the Valeting Depot and the Wash Road. Numerous P&C's provide the operational capability necessary to access all of the platforms and train servicing facilities. Additionally, to the north of Platform 8 there are the Guinness Sidings and the Carriage Sidings.

All tracks fall in level from west to east towards Heuston Station, platforms being on flat gradients.

Line speed is predominantly limited to 30 kph in the platforms.

The existing layout is illustrated in Figure 2-5 (next page):









Figure 2-5 Existing Track Layout (from Route Information Book)







2.5. Other Railway Facilities

Primary train servicing infrastructure includes the Train Wash and Valet Sidings, illustrated in the figure below. These key items are to be retained.



Figure 2-6 Train Wash Road and Valet Sidings

2.6. Ground Conditions

The topography of the site is flat, sloping gently to the north towards the River Liffey. St Johns Road immediately is at an elevated level sloping east towards Heuston Station. The western approach of the railway into Heuston Yard is in cutting and this cutting reduces on entry into the yard. All rail lines within the yard are at similar elevations.

The general superficial geology in the area is anticipated to comprise urban (made ground) deposits. It is expected that a layer of till will exist below the made ground deposits overlying bedrock (limestone and shale). Historical ground investigation records show the ground conditions at Heuston Station generally consist of significant thicknesses of made ground, silt, clays and gravels underlain limestone.

From the historical ground investigation information, made ground was described as sandy gravely clay with gravels or cobbles of brick, concrete or slate, to maximum depth of 6.10m bgl. The superficial deposits underlying the made ground are variable and were generally recorded as firm to stiff gravelly clay and silt, above dense to very dense gravels and occasional sand and gravel layers. However, in the north east of this area, a local pocket of soft to firm silt was recorded.

Bedrock was recorded as moderately strong to very strong limestone with thinly laminated mudstone and shale. Rockhead was encountered at depths between 17.5m bgl (12.97m AOD) and 22.65m bgl (16.92m AOD). Bedrock was not proven within any of the exploratory holes in the previous investigations.

The majority of exploratory holes in this area were recorded as being dry or contained no groundwater information. Where groundwater was recorded in exploratory holes, it ranged from between 4.4m bgl to 9.8m bgl.

Hazardous and non-hazardous material within soil samples was identified near to the current location of the proposed National Train Control Centre in 2019, which is now under construction and due for completion in early 2022.









2.7. Environment

This area will encompass the 'Slow/DART' lines within Heuston, i.e. platforms 6, 7 and 8 and all sidings north of these lines. Much of this area comprises the sidings as well as the carpark for the train station. There are a number of outbuildings in this area associated with the operation of the station/ rail line. There are a number of utilities in this area, including electricity substations, underground electricity lines and gas pipelines.

The presence of the existing rail line has reduced biodiversity potential along the route to a large degree, however there remain hotspots of interest in relation to hedgerows and treelines for bats in particular, and there is potential for spreading invasive species as the scheme progresses. This area is bounded by the River Liffey (known to host salmonid species) and is also classed as an Annex I Habitat. Otters have also been sighted downstream of the Liffey Bridge (UBO1).

The Clancy Quay area is one of Ireland's largest private sector rented residential developments and has a number of apartment blocks. The Heuston South Quarter is a modern office, retail and apartment complex and to the south of Heuston Station is St Patrick's University Hospital. The Kilmainham Square area is a modern mixed use development comprising apartment blocks, offices and Hilton Dublin Kilmainham Hotel, in proximity to the rail centreline. There is also a line of old houses at the edge of the square with heritage designations.

This area is within one of Dublin City Council's (DCC) Zones of Archaeological Potential which encompasses the historic core of the city, extending generally out northwards to Stoneybatter, east towards Dublin Connolly and the docklands, southwards to Mount Brown and westwards encompassing Islandbridge and Kilmainham. The whole of the Phoenix Park, the area south of St John's West Road and east of the South Circular Road encompassing the Royal Hospital Kilmainham, St Patrick's University Hospital and Dr Steeven's Hospital, and the Heuston Station main building is part of a DCC Conservation Area also.

Heuston Station itself is a tourist/visitor attraction and has a number of heritage designations. South of St John's Road West (R148) are further designated heritage features. The area between St John's West Road and Kilmainham Lane to the south are the grounds of the Royal Hospital Kilmainham which as many designated heritage features; the more open grounds/ green areas associated with the Royal Hospital Kilmainham have a designated landscape protection objective. Adjacent to the South Circular Road is Bully's Acre, an area of archaeological potential, and site of the private soldiers' burial ground. There is also a burial site on St John's West Road just before its junction with the South Circular Road.

As the rail corridor follows the bend past Clancy Quay, it traverses a historic gravel quarry. Much of this area is urban in nature, however alluvial subsoils are found along the River Liffey and the area south (Royal Hospital Kilmainham) is underlain by tills derived from limestones. The groundwater vulnerability is generally classed as low to moderate.

Refer to Section 4.1 (Environment Constraints) for further details.

2.8. Utilities

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

- Aurora Telecom
- EIR
- ESB Networks
- Virgin Media







- Gas Networks Ireland
- Dublin City Council Road Drainage (Storm Water Sewers)
- Dublin City Council / Irish Water (Foul Water Sewers)
- Dublin City Council / Irish Water (Water Supply)
- Dublin City Council Traffic Department (Traffic Signals & Communications)
- Dublin City Council Public Lighting

Data in the form of utility service records have been gathered from all providers in the area. The majority of services are located within existing streets and railyard. Hence, where modifications are required in the immediate vicinity of existing structures, impacts on utilities will be inevitable.

A number of key network infrastructure elements for particular utility providers are present and will be challenging to deal with given that only limited service outage time (if any) will be permissible to the service and its customers. Significant forward planning and coordination will be necessary for such instances where modifications are necessary.







3. Requirements

3.1. Specific requirements

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

- Provide access to platforms and sidings within the Heuston area, as required for the DART+ services.
- Modification of the connections to running lines due to 4-Tracking modifications.
- Provide Electrification of platforms and sidings within the Heuston area, as required for the DART+ services (Platform 6, 7 and 8, and sidings to the north).
- Keep current functionality of the other platforms and station services.
- Track alignment and drainage requirements.

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.

Significant 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 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.

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









Figure 3-1 Typical OHLE arrangement in two 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 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.





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

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

3.2.2. Substations

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







- Islandbridge
- Le Fanu
- Park West
- Kishoge
- Adamstown
- Hazelhatch

3.3. Design Standards

Please refer to Annex 3.2 for the design standards that will be used for the scheme.







4. Constraints

4.1. Environment

This area is part of one of Dublin City Council's (DCC) Zones of Archaeological Potential which encompasses the historic core of the city. There are a number of outbuildings in this area associated with the operation of the station/ rail line. The area backs onto south side of the River Liffey, which is known to host salmonid fish species, with this section also classed as an Annex I Habitat for being part of the uppermost part of the Liffey Estuary. There is a National Biodiversity Data Centre (NBDC) record of a live otter sighting downstream of Heuston (grid Ref. O136343) in June 2017.

To the west as the rail corridor (joining the line coming from Glasnevin) follows the bend past Clancy Quay, it traverses the area of a historic gravel quarry, dating from the early to mid-20th century. The Clancy Quay area is one of Ireland's largest private sector rented residential developments with a number of apartment blocks. The 2020 ecology survey also noted a significant linear stand of Japanese knotweed running adjacent to the rail corridor from the Liffey Bridge (UBO1), past Platform 10, as far as the South Circular Road. Some Japanese knotweed was also found on the southern side of the South Circular Road.

Heuston train station itself is listed by Fáilte Ireland as a visitor/tourist attraction in its own right. Several features in the vicinity are listed on the National Inventory of Architectural Heritage (NIAH): a post box; train shed; the quay/wharf adjacent to platform 5 and the River Liffey; and two aspects of the train station itself (platform 2 side) – the station building dating from 1840-50 and the station building dating from 1850-55. This later building is also listed on the Record of Protected Structures (RPS).

Approx. 120m to the south of the existing rail centreline on the south side of St John's Road West (R148) are a line of four archaeological features on the Record of Monuments and Places (RMP) and their associated Sites and Monuments Record Zones of Notification (SMRZ): St Steeven's Hospital (now the headquarters for the Health Service Executive [HSE]); a mill; another historic hospital on the east side of Military Road; and a pit burial to the west of Military road. There is a 38 kV substation adjacent to St Steeven's Hospital. Underground 38 kV and 110 kV electricity lines, as well as low and medium pressure gas pipelines run along St John's Road West. A low pressure gas pipeline traverses the rail corridor at the South Circular Road.

This area around Military Road is the Heuston South Quarter which is a modern office, retail and apartment complex. Approx. 170m to the south of the rail centreline in Heuston Station is St Patrick's University Hospital.

Heading west, in between St John's West Road and Kilmainham Lane to the south are the grounds of the Royal Hospital Kilmainham. The main building of the former hospital is an RPS and an RMP with an associated SMRZ. Another smaller residential building between the main hospital building and the gardens is listed as an RPS. The building also holds an RMP designation for being a religious house (Knights Hospitallers). The building is a tourist attraction and is also home to the Irish Museum of Modern Art, as well as being venue for events such as weddings. There is a designed landscape area (the Formal Gardens), which is also an RPS, associated with the main building and which backs on to St John's Road West (within approx. 60m of the rail corridor). There is also a 110 kV substation between the Formal Gardens and the road. Near this substation is a 18th/19th century house which is an RMP; next to this are miscellaneous garden structures which are listed as both an NIAH and an RPS.

Heading further west towards the South Circular Road are the more open grounds/ green areas associated with the Royal Hospital Kilmainham. DCC have a landscape protection objective for this area (Z9) "to preserve, provide for and improve recreational amenity and open space/ green networks." Adjacent to the South Circular Road is Bully's Acre, an area of archaeological potential, and site of the private soldiers' burial ground; this graveyard/ cemetery is an NIAH site. There is also an ecclesiastical site and a cross, both of which are RMPs







and have an associated SMRZ in the Bully's Acre grounds. At bottom left-hand corner of the hospital grounds there is a gate lodge (Richmond Tower), which is an NIAH and RPS. A little further north on St John's West Road just before its junction with the South Circular Road is a burial ground which is a site on the Record of Monuments and Places (RMP) and has an associated Sites and Monuments Record Zone of Notification (SMRZ).

On the opposite side of the South Circular Road from the hospital grounds, there is a row of seven houses which are NIAH. These are on the edge of Kilmainham Square, which is a modern mixed use development comprising apartment blocks, offices and Hilton Dublin Kilmainham Hotel, all within 100m of the rail centreline.

Alluvial subsoil deposits are found along the River Liffey with the remainder, towards the south (Royal Hospital Kilmainham) underlain by tills derived from limestones. The groundwater vulnerability in the area around the River Liffey is generally classed as moderate, while moving south it is generally classed as low.

4.2. Permanent Way

The constraints on track work in Heuston Station are predominantly those posed by the need to maintain the operational capability of the existing station platforms and servicing infrastructure (such as the Train wash, service and stabling sidings), as well as the existing drainage and signalling. The sheer number of tracks, their configuration and connectivity through existing P&C's mean that any modifications must be carefully considered to tie in with the aforementioned platforms and service facilities.

In particular the headshunt length for the train wash may be reduced due to the requirements of reconfiguring the layout and also the need for a signalling overlap. The report for the area around the South Circular Road provides detail on the bufferstop end of the headshunt.

Consideration must be given to the need of locating P&C's on curved mainline track, due to the existing layout of Heuston Station Yard and the need to tie-in to the surrounding infrastructure. Care must be given to ensure geometric and speed parameters are compliant for any reconfiguration proposals. A diamond crossover will be needed as well, which will need particular attention from a maintenance perspective.

Another major consideration will be the existing track condition - i.e. extents of installing new track and componentry may be dependent on whether existing P&C's or plain line is life-expired or is fit for purpose.

4.3. Existing Structures

The Valeting Plant Subway (UBC1A) at Heuston Yard would constraint the track alignment atop of the structure, particularly with regards to vertical levels. The structure should not significantly affect the horizontal realignment of tracks.

Based on the current proposals, it is likely that the existing retaining wall assets noted in Table 2-1 will be unaffected.

4.4. Geotechnical

No onerous ground or groundwater conditions are anticipated in this area based on the existing information. Hazardous and non-hazardous material has been identified in soil samples close to the proposed National Train Control Centre location.

Demolition of the southern extents of Platform 10 will be required to create space for the new proposed alignments for the proposed Guiness Sidings, however it is already proposed that this platform is entirely demolished and re-built slightly to the west to serve a potential new station at this location.







4.5. Existing Utilities

The various utilities in this area are concentrated on the eastern side of Heuston Station, with few services beneath the railyard. Any option that requires track lowering has the potential to require diversions to these utilities. The options for this area do not require any major civil works or modifications to structures that contain services. As such, the utilities are not deemed as major constraints for this area.







5. Options

5.1. Options summary

Permanent way options comprise realignments to provide standard clearances, both vertically and horizontally.

2 no. 'Main Options' have been considered 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 the Main Options is presented in the table below. A detailed description of each Main Option is included Section 5.2 below.

Table 5-1 Options Summary

Option	Description
Option 0: Do Nothing	Leave as is.
Option 1: Do Minimum	Electrification and track rearrangement to provide access to new DART Platforms and update access to inter-city tracks.

5.2. Options Description

This section describes the main options that have been considered and option variations are elaborated within the main option text.

5.2.1. Option 0: Do Nothing

Do-Nothing represents the scenario of leaving the area as is without any intervention from IE.

5.2.2. Option 1: Do Minimum

This option assumes the electrification and use of the existing Platforms and sidings with some minimal P&C additions to facilitate operational requirements.

5.3. OHLE Arrangement

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

Option 1 has been considered for electrification to meet project requirements. New OHLE structures shall be positioned in the space between the track and railway boundary. Electrification will comprise STC structures in two track area and TTC in four track area as detailed in section 3.2.1.

In the station, the requirement is to electrify Platform 6, 7 & 8, as well as the carriage sidings.

The area through Heuston station for Platforms 6, 7 & 8 and the sidings will be provided with portals spanning over the platforms and the tracks or with a 'Back to Back' arrangement on the assumption that Platform 6, 7 & 8 lines are in same electrical section. If they are in different electrical section, individual OHLE structure for each line will be required. The type of support will need to be determined after the topo survey. For portal option, OHLE structures shall be positioned in space between the line side equipments. An assessment will need to be







undertaken with topo survey for canopy clearance. If clearance is available with canopy, 'Back to Back' cantilevers on the platform through the canopy to support wires every 30-50m shall be designed.

Similar approach shall be applied for other lines if other sidings to be electrified.



Figure 5-1 Route to be electrified sketch

Above sketch is based on the current understanding scope of lines to be wired. This will need to be updated once the lines to be wired and siding requirements are confirmed.

5.4. Permanent Way

The single 'Do-Minimum' option proposed for the track layout follows the existing station footprint as far as possible, remaining within the existing rail corridor and retaining the existing functionality of the station platforms and train servicing facilities. The proposed layout can be seen in drawing DP-04-23-DWG-PW-TTA-30750.

The geometrically constrained area requires the track alignment to consist of tight track radii and the P&Cs to be installed on curves. The use of appropriate turnouts to suit the equivalent contraflexure (sited on the outside of a mainline curve) or similar flexure (sited on the inside of a mainline curve) radii to achieve the linespeed of 20mph (30 km/h) in Heuston Station. For example this means using a P10/10 turnout on a mainline curve to ensure that the turnout radius remains above 200m (whereas a P8/8 turnout would suffice on a mainline straight). It is important to try and keep track radii above 200m in order to remove the need for gauge widening with accompanying check rails, and, high rail wear. The design proposal includes some contraflexure turnouts.

For the Valeting Sidings and Train Washing the design proposal considers the tie-in outside their extents in order to keep the existing structures without the need of modification on the slab or structure.

For Platforms 6, 7 and 8 there may be a need for coper adjustments due to end throw of vehicles approaching through the new scissors crossover that is proposed. The existing slab track to these platforms should be able to be retained by tying-in outside its extents.







5.5. Geotechnical

New track alignments and electrification interventions and will require detailed geotechnical design for the following elements:

- Earthworks and track bed formation design for new slews, alignments and verticallity for the proposals and as a consequence of track lowering run out from South Circular Road Bridge (OBC1) and St John's Road Bridge (OBC1A).
- Overhead Line Equipment foundation.

Appropriate testing, classification, handling and disposal of hazardous and non-hazardous soils is likely to be required for any works in this area.

Existing retaining walls noted along the Guinness Sidings are unlikely to be impacted by the proposals as the proposed rail alignments are similar to the existing alignments at these two locations.

The southern extents of the existing platform on the Phoenix Park Tunnel Branch Line is affected by the proposed alignment, however it is expected this entire existing platform will be demolished and rebuilt as part of the proposals for a new station at this location.

5.6. Roads

No road intervention is anticipated in this area.

5.7. Cable and Containments

Existing containment routes consist of buried duct, surface troughing and ladder rack/tray. The "Do minimum" option will require the relocation of various cables and containments.

Where new containment is required to interface with proposed SET installation these shall be interfaced appropriately with the existing containment runs. Where cable ducts are required to pass under the railway track they shall be contained by a suitable under track crossing

Where there is a required change of direction for cabling draw-chambers shall be installed (surface or otherwise). Draw-pits will be of adequate size to enable cables to be drawn in without damage and accommodating the cable bending radius.

These containment solutions shall be utilised for all SET cabling requirements with services separated as far as is reasonably practical.

5.8. Structures

No changes to the Valeting Plant Subway (UBC1A) at Heuston are anticipated.

5.9. Drainage

No relevant changes in the current drainage system are expected within the Heuston Yard. Therefore, no specific analysis has been carried out at this stage.











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 and Heuston Station are existing operational rail facilities 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, Economic and Environmental criteria.

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

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

6.3. Preliminary Assessment (Sifting)

Table 6-1 Sifting Process

Option	Requirements		Description
		Constructability	Not applicable. No intervention proposed.
		Geometrical fitness for intervention	Not applicable. No intervention proposed.
Safety		Safety	Not applicable. No intervention proposed.
0	Engineering	Access to DART Platforms 7&8 from DART Lines	FAIL. No intervention proposed. Will not provide direct link between DART lines and platforms.
		Modification of the connection to running lines due to 4-Tracking modifications.	FAIL. No intervention proposed. Will not provide direct link between DART lines and platforms.
		Keep current functionality of the other platforms	FAIL. No intervention proposed. Will not provide direct link between DART lines and platforms.







Option	Requirements		Description
		Track alignment and drainage (standards)	FAIL. No intervention proposed. Will not provide direct link between DART lines and platforms.
	Economy		Compatible with the investment guidelines and programme for DART+
	Environment		No impact on Environmental sites of National of International significance.
	SIFTING OUTCOME		FAIL. Do not progress to Stage 2 Assessment
1	Engineering	Constructability	PASS. Minor interventions to the rail corridor are possible.
		Geometrical fitness for intervention	PASS. Minor interventions without geometrical fitness concerns are possible.
		Safety	PASS. Minor interventions that pose no safety concerns are possible.
		Access to DART Platforms 7&8 from DART Lines	PASS. Track re-arrangement to provide access to new DART Platforms.
		Modification of the connection to running lines due to 4-Tracking modifications.	PASS. Track re-arrangement to update access to inter-city tracks.
		Keep current functionality of the other platforms	PASS.
		Track alignment and drainage (standards)	PASS. Minor interventions to the rail corridor in accordance with standards are possible.
	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

6.3.1. Summary of Sift Process Results

The single Main Option developed for this area has passed the sift process will be brought forward to Stage 2: MCA.

Table 6-2 Summary of Sift Process Results

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

6.4. Stage 2: MCA Process – Emerging Preferred Option

Heuston Station currently does not have any existing provision for electrification. Platforms and sidings within the Heuston area are to be electrified to receive the DART+ rolling stock. These works will require rearrangement to provide access to new DART platforms and to update access to inter-city tracks.

In terms of Permanent Way works, the constraints on track work in Heuston Station are predominantly those posed by the need to maintain the operational capability of the existing freight routes, station platforms and servicing infrastructure (such as the train wash, service and stabling sidings), as well as the existing drainage and signalling. The sheer number of tracks, their configuration and connectivity through existing Points & Crossings (P&C's) mean that any modifications must be carefully considered to tie in with the platforms and service facilities.







In the station area, platforms and sidings will be electrified as required for the DART+ programme, the definition of which will be fully concluded at Public Consultation No. 2.

All works within this Area can be undertaken within land owned by larnród Éireann.







Appendix A - Sifting Process Backup











Appendix B – Supporting Drawings

The following drawings accompany this report:

Permanent Way Drawings DP-04-23-DWG-PW-TTA-30750

