DART+ South West

Volume 3H: Technical Optioneering Report – Heuston Station and Yard

Iarnród Éireann

November 2021

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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
CIÉ	Córas Iompair Éireann
Contact wire	Carriers the electricity which is supplied to the train by its pantograph.
CPO	Compulsory Purchase Order
Cross overs	A set of railway parts at the crossing of several tracks which helps trains change tracks to other directions.
CRR	Commission for Rail Regulation (formerly RSC – Railway Safety Commission)
CSM RA	Common Safety Method for Risk Evaluation and Assessment
CSS	Construction Support Site, Interchangeable with Construction Compound
CTC	Central Traffic Control
Cutting	A railway in cutting means the rail level is below the surrounding ground level.
D&B	Design & Build (contractor)
DART	Dublin Area Rapid Transit (IÉ's Electrified Network)

Reference	Description
DART+	DART Expansion Programme
DeBo	Designated Body
DC	Direct Current, electrical current that flows in one direction, like that from a battery.
DCC	Dublin City Council
DRR	Design Review Report
DSR	Design Statement Report
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement
Electrification	Electrification is the term used in supplying electric power to the train fleet without the use of an on-board prime mover or local fuel supply.
EMC	Electromagnetic Compatibility
EMU	Electric Multiple Unit (DART train)
EN	European Engineering Standard
EPA	Environmental Protection Agency
EPO	Emerging Preferred Option
ERTMS	European Rail Traffic Management System
ESB	Electricity Supply Board
Four-tracking	Four-tracking is a railway line consisting of four parallel tracks with two tracks used in each direction. Four track railways can handle large amounts of traffic and are often used on busy routes.
FRS	Functional Requirements Specification
FSP	Final Supply Points
GDA	Greater Dublin Area
GI	Ground Investigation
HAZID	Hazard Identification
Horizontal Clearance	The horizontal distance between a bridge support and the nearest railway track is referred to as horizontal clearance. Bridge supports include abutments (at the ends of the bridge) and piers (at intermediate locations).
HV	High Voltage
IA	Independent Assessor
IÉ	Iarnród Éireann
IM	Infrastructure Manager (IÉ)
IMSAP	Infrastructure Manager Safety Approval Panel

Reference	Description
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

Reference	Description
RC	Reinforced Concrete
Re-signalling	Re-signalling of train lines will regulate the sage movement of trains and increase the capacity of train services along the route.
RMP	Record of Monuments and Places
RO	Railway Order
RPS	Record of Protected Structures
RSC-G	Railway Safety Commission Guideline
RU	Railway Undertaking (IÉ)
SAM	Safety Assurance Manager
SAP	Safety Approval Panel
SDCC	South Dublin County Council
SDZ	Strategic Development Zone
SET	Signalling, Electrical and Telecommunications
Sidings	A siding is a short stretch of railway track used to store rolling stock or enable trains on the same line to pass
SMR	Sites and Monuments Records
SMS	IÉ Safety Management System
TII	Transport Infrastructure Ireland
TMS	Train Management System
TPH	Trains per Hour
TPHPD	Trains per Hour per Direction
TPS	Train Protection System
Track Alignment	Refers to the direction and position given to the centre line of the railway track on the ground in the horizontal and vertical planes. Horizontal alignment means the direction of the railway track in the plan including the straight path and the curves it follows.
TSI	Technical Specifications for Interoperability
TSS	Train Service Specification
TTAJV	TYPSA, TUC RAIL and ATKINS Design Joint Venture (also referred to as TTA)
Underbridge (UB)	A bridge that allows traffic to pass under a road, river, railway etc. The underneath of a bridge.
VDC	Direct Current Voltage
Vertical Clearance	For overbridges, an adequate vertical distance between railway tracks and the underside of the bridge deck (soffit) must be provided in order to safely accommodate the rail vehicles and the OHLE. This distance is known as vertical clearance and it is measured from the highest rail level.
WFD	Water Framework Directive

1. Introduction

1.1. Purpose of the Report

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

The report provides:

- An area overview and a detailed description of the existing railway infrastructure and challenges.
- The Project Requirements for this area.
- The technical and environmental constraints, including the horizontal and vertical clearances at structures.
- The options considered for this area.
- The option selection process, leading to the identification of the Preferred Option, including the Sifting process and the Multi-Criteria Analysis process (not required for this Area).
- A summary of the feedback received from the first public consultation which was held in May and June 2021
- An update on the design development
- An overview of the proposed construction methodology and requirements in terms of construction compounds.

1.2. DART+ Programme Overview

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

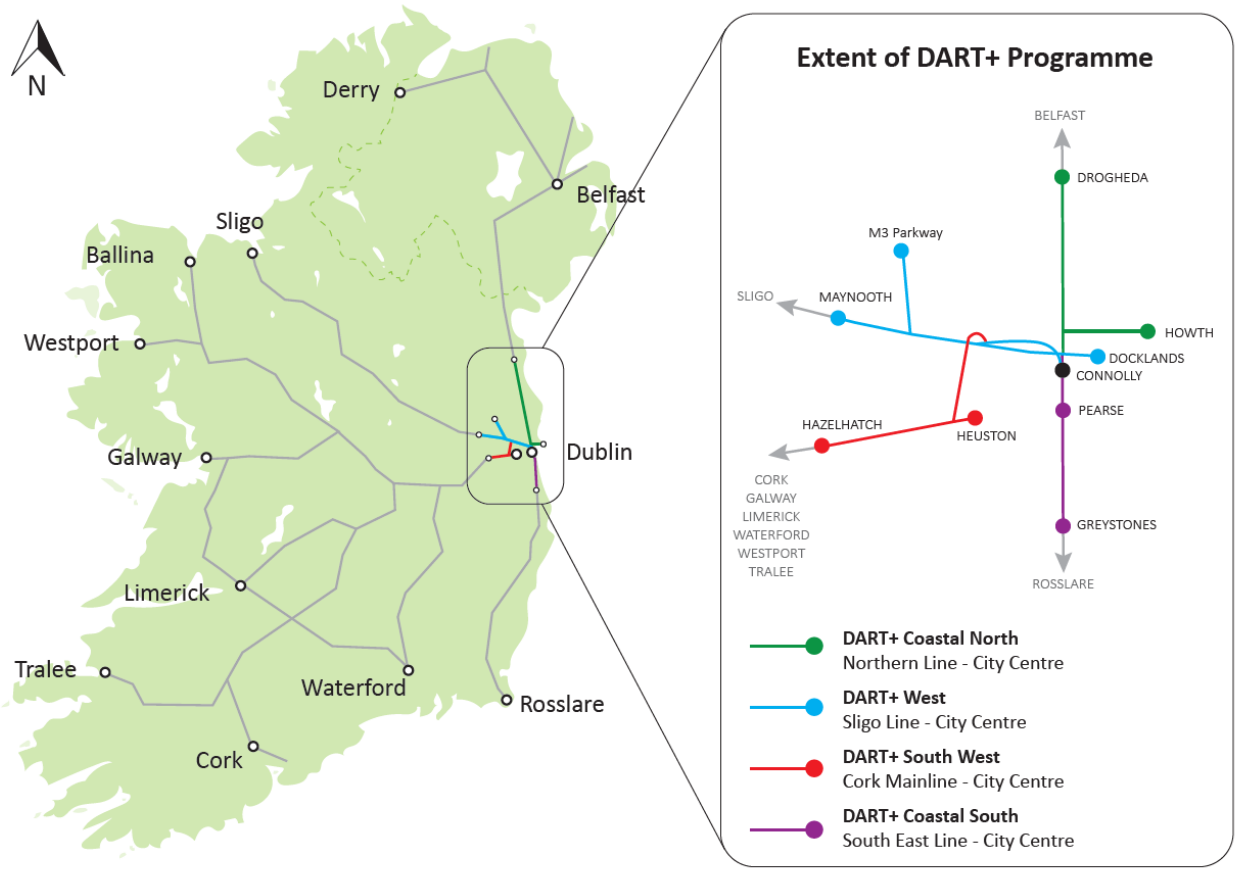

Figure 1-1 DART+ Programme

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

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

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

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

Delivery of the 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.

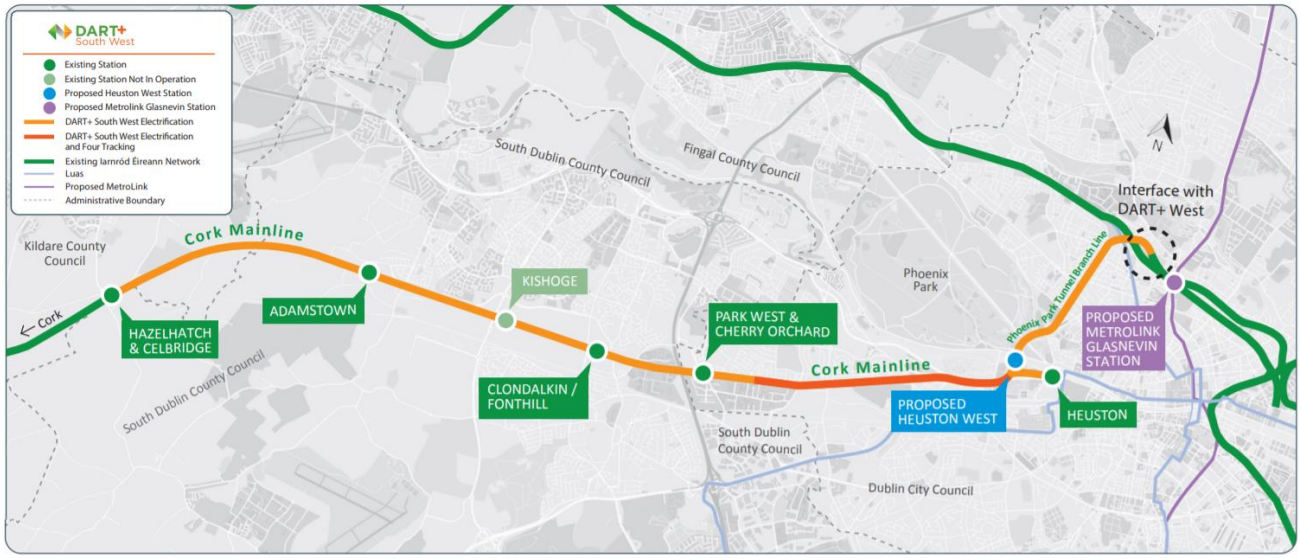

Figure 1-2 DART+ South West Route Map

1.4. Capacity Increase Delivered by DART+ South West

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

11 train services provided by DART+ South West). This will increase passenger capacity from the current peak capacity of approximately 5,000 passengers per hour per direction to approximately 20,000 passengers per hour per direction. Upon completion of the DART+ South West Project, train services will be increased according to passenger demand.

1.5. Key Infrastructural Elements of DART+ South West Project

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

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

1.6. Route Description

The existing rail corridor extends from Heuston Station to Hazelhatch & 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**.

Table 1-1 Route Breakdown

Area Name	Sub-area Description	Extents	Main Features
Hazelhatch to Park West	Area from Hazelhatch to Park West (Volume 3A)	West side of Hazelhatch & Celbridge Station to 50m to west of Cherry Orchard Footbridge (OBC8B)	Hazelhatch & Celbridge Station Adamstown Station Clondalkin/Fonthill Station Park West & Cherry Orchard Station
Park West to Heuston Station	Area from Park West to Le Fanu (Volume 3B)	West of Cherry Orchard Footbridge (OBC8B) to the East of the proposed Le Fanu Road Bridge (OBC7)	Cherry Orchard Footbridge (OBC8B) Le Fanu Road Bridge (OBC7)
	Area from Le Fanu to Kylemore (Volume 3C)	East of the proposed Le Fanu Road Bridge (OBC7) to the East of IE700B (i.e. the points for the Inchicore headshunt turnout)	Kylemore Road Bridge (OBC5A)

Area Name	Sub-area Description	Extents	Main Features
	Area from Kylemore to Sarsfield (Volume 3D)	East of IE700B (i.e. the points for the Inchicore headshunt turnout to the west of Sarsfield Road Bridge (UBC4)	Inchicore Works Depot Khyber Pass Footbridge (OBC5)
	Area from Sarsfield to Memorial (Volume 3E)	West of Sarsfield Road Bridge (UBC4) to the West of Memorial Road Bridge (OBC3)	Sarsfield Road Bridge (UBC4)
	Memorial Road (Volume 3F)	Area around Memorial Road Bridge	Memorial Road Bridge (OBC3)
	Area from Memorial Road to South Circular Road Junction (Volume 3G)	East of Memorial Road Bridge (OBC3) to East of St John's Road Bridge (OBC0A)	South Circular Road Junction South Circular Road Bridge (OBC1) St Johns Road Bridge (OBC0A)
	Area around Heuston Station and Yard (Volume 3H)	Area at the South side of the Heuston Station Yard (non-DART+ tracks)	Heuston Station Sidings around Heuston Station
Heuston West Station	New Heuston West Station (Volume 3I)	Area to the West of Heuston Station, adjacent to Liffey Bridge (UBO1)	Heuston West Station
St John's Road Bridge (Islandbridge) to Glasnevin Junction	East of St John's Road Bridge (OBC0A) (Islandbridge) to North of Phoenix Park Tunnel (Volume 3J)	East of St John's Road Bridge (OBC0A) (Islandbridge) to North of Phoenix Park Tunnel	Liffey Bridge (UBO1). Conyngham Road Bridge (OBO2) Phoenix Park Tunnel
St John's Road Bridge to Glasnevin Junction	North of the Phoenix Park Tunnel to Glasnevin Junction (Volume 3K)	North of Phoenix Park Tunnel to South of Glasnevin Junction	McKee Barracks Bridge (OBO3) Blackhorse Avenue Bridge (OBO4) Old Cabra Road Bridge (OBO5) Cabra Road Bridge (OBO6) Fassaugh Avenue Bridge (OBO7)

Area Name	Sub-area Description	Extents	Main Features
			Royal Canal and LUAS Twin Arches (OBO8) Maynooth Line Twin Arch (OBO9) Glasnevin Cemetery Road Bridge (OBO10)

1.7. Stakeholder Feedback

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

All submissions received as part of the first round of public consultation have fed into the design process and the selection of the Preferred Option. The project team has analysed the submissions and considered all relevant information in re-evaluation and further development of design options leading to the selection of the Preferred Option.

Further details of the Stakeholder Feedback can be found in the **Public Consultation No. 1: Findings Report, Volume 4**.

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

2. Existing Situation

2.1. Overview

This 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.There are a number of signalling structures controlling all of the passenger services and operational/ service requirements in the station area. The area does not currently provide for electrification.

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

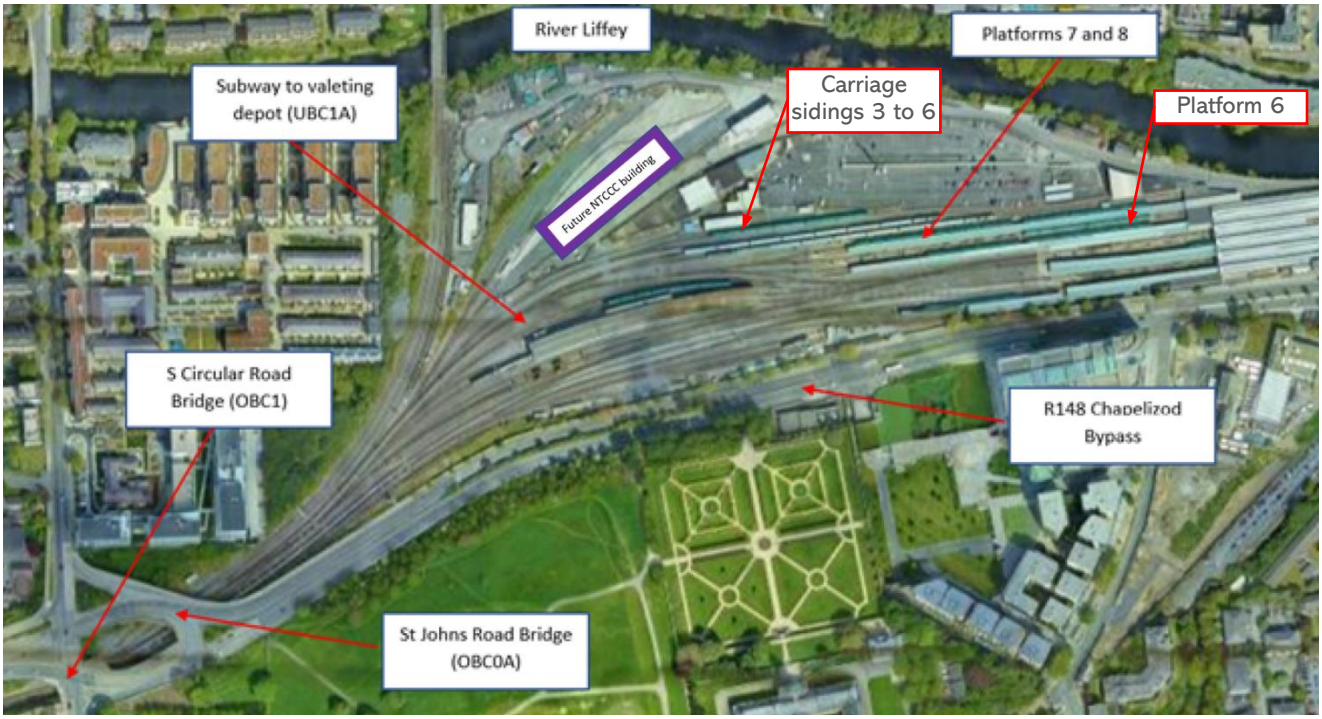

Figure 2-1 Aerial view of Heuston Station and Sidings

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**).

2.2. Challenges

Within the Heuston Station area, platforms 6, 7 and 8, as well as additional carriage sidings 3 to 6 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.

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

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. The subway was constructed in the 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.

. It is planned that the construction of the facility will be complete early 2022.

2.3.3. Retaining Walls

Retaining walls are located at the following locations:

Table 2-1 Existing Retaining Walls

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

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 km/h (20 mph) in the platforms.

The existing layout is illustrated in **Figure 2-5**:

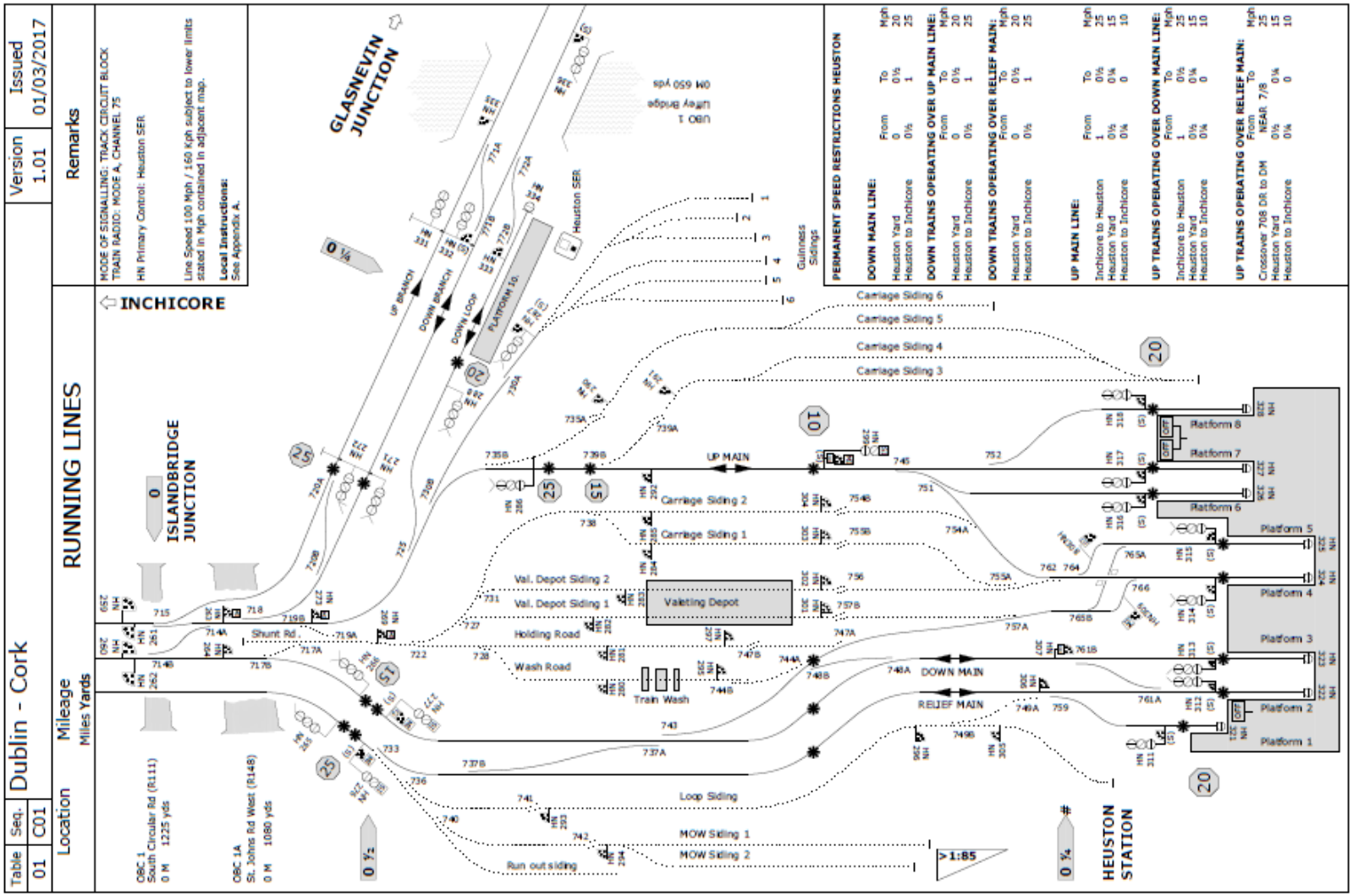

Figure 2-5 Existing Track Layout (from Route Information Book)

2.5. Other Railway Facilities

Primary train servicing infrastructure includes the Train Wash and Valet Sidings, illustrated in **Figure2-6** 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 east towards Heuston Station and 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.

A detailed Ground Investigation is currently ongoing to verify the data obtained in the historical investigations.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 within the Made Ground encountered near to the current location of the proposed National Train Control Centre in 2019.

2.7. Environment

This area will encompass the 'Slow/DART' lines within Heuston, i.e. platforms 6, 7 and 8 and carriage sidings 3 to 6, located 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 backs onto the south side of the River Liffey (known to host salmonid species) and is also classed as an Annex I Habitat for being part of the uppermost part of the Liffey Estuary. Otters have also been sighted downstream of the Liffey Bridge (UBO1). There is a National Biodiversity Data Centre (NBDC) record of a live otter sighting downstream of Heuston (grid Ref. O136343) in June 2017. 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.

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 (within 100m of the rail centreline). There is a row of seven houses with heritage designations, which are NIAH, they are located at the edge of Kilmainham square.

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 listed by Fáilte Ireland as a tourist/visitor attraction in its own right and has a number of heritage designations. 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).

South of St John's Road West (R148) are further designated heritage features. Heading west, in between St John's West Road and Kilmainham Lane to the south are the grounds of the Royal Hospital Kilmainham which has many designated heritage features. 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.

The more open grounds/ green areas associated with the Royal Hospital Kilmainham have a designated 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).

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.

As the rail corridor follows the bend past Clancy Quay, it traverses a historic gravel quarry dating from the early to mid-20th century. 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 in the area around the River Liffey is generally classed as moderate, while moving south it is generally classed as low.

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
- BT
- 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.

Heuston Yard contains few utilities that would affect any works in the area. Notable utilities in the area include BT fibre optic cables and a combined sewer vitrified clay pipe, both of which cross the rail corridor in the location. Required works in this area for the Heuston West Station will result in diversions for these services. Thr group of BT fibre optic cables (ID: BT-01a), cross under the tracks in the location of the proposed Heuston West Station and run trhough the Heuston Yard. This utility is for signalling and communication data and continues parallel to the tracks until Hazelhatch and Celbridge; and is used by Irish Rail to manage the rail network. This utility will need to be diverted because of the railyway upgrade works in the line between Heuston Station Junction and Glasnevin as well as for the proposed Heuston West station works, but not expressly because of the Yard Works in this section.

It will be challenging to deal with these utilities 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.

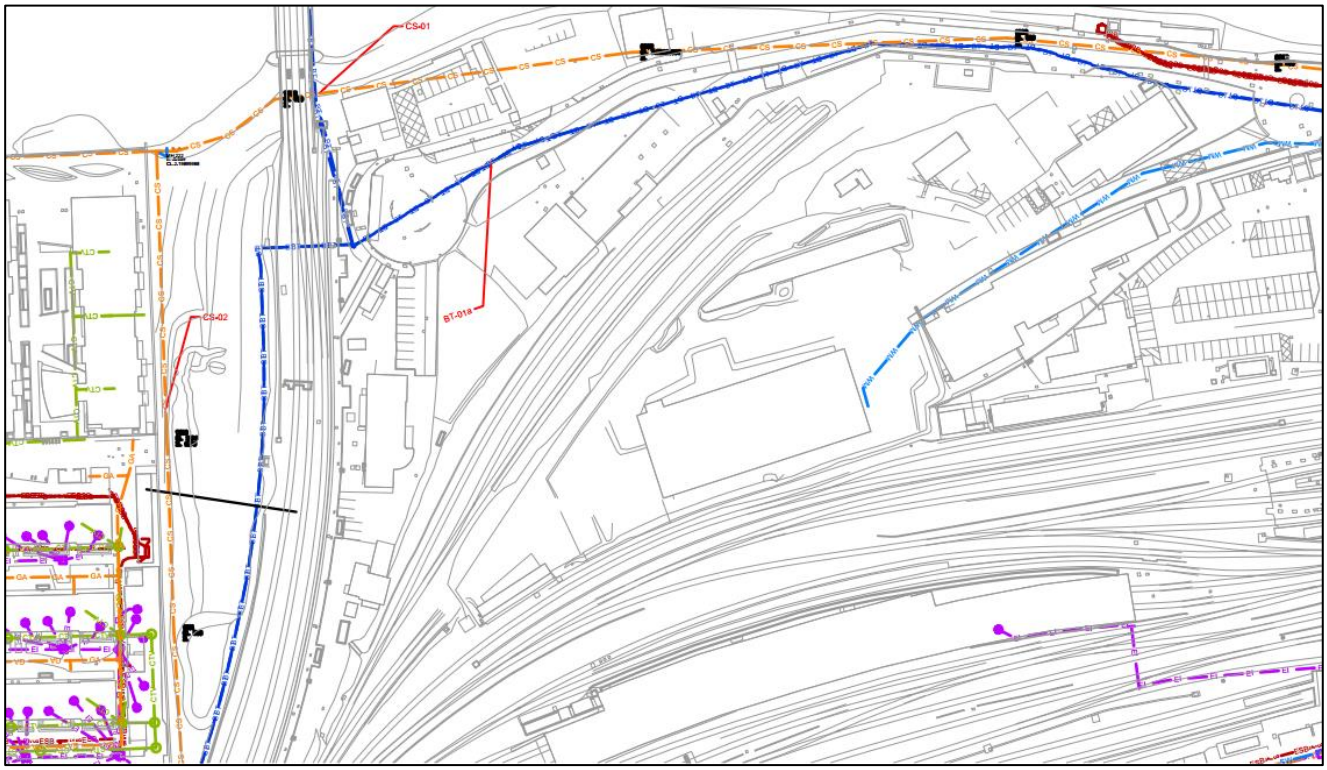

Figure 2-7 - Existing Utilities in Heuston Station Yard and Heuston Westt

There is also an existing EIR duct present in south east the yard (identifiable in **Figures 2-7** and **2-8;** this utility serves Heuston Yard but has not as yet been identifed for diversion. In the event this changes, as the design developes; it will noted as requiring diversion accordingly.

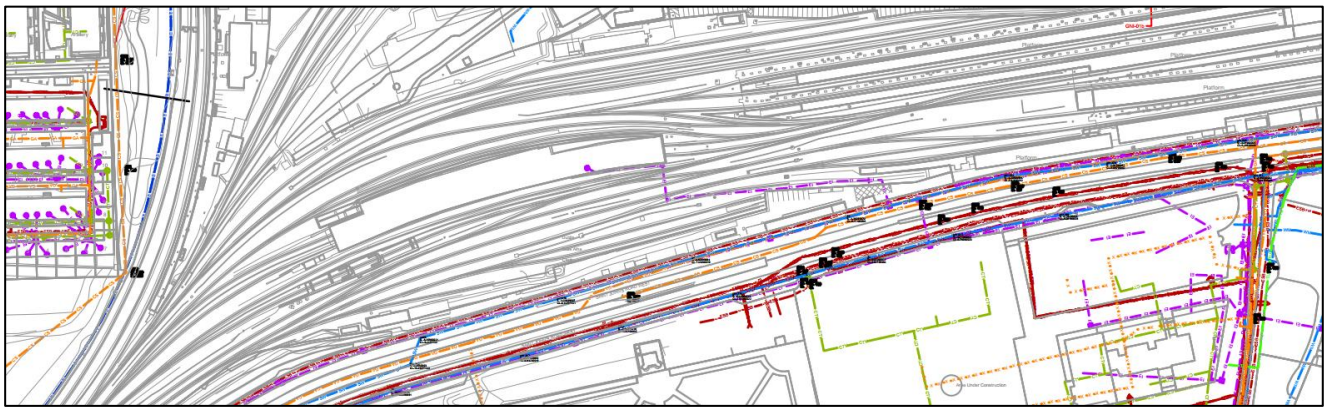

Figure 2-8 - Existing Utilities along St Johnn's Road and in Heuston Yard

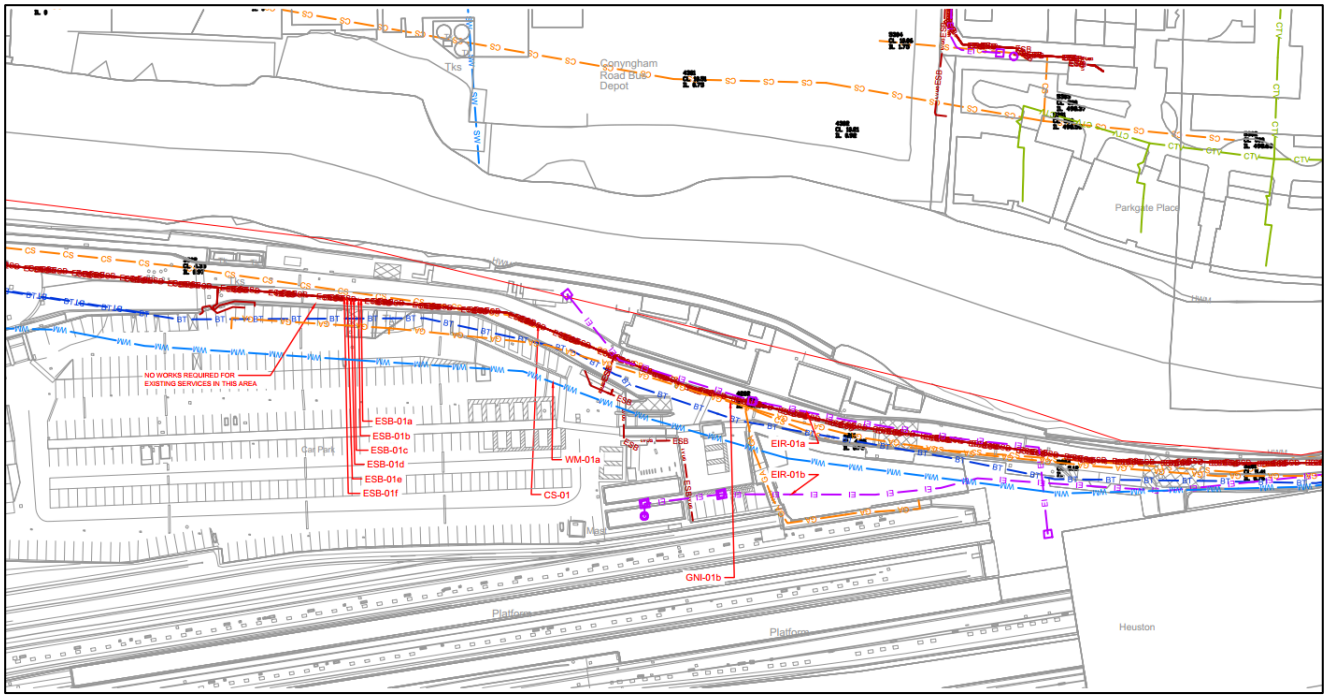

Figure 2-9 - Existing Utilities along Heuston Station Access Road (north of Platforms)

2.9. Track Drainage

There is no existing track drainage in Heuston Station and Yard.

3. Project Requirements

3.1. Area - Specific requirements

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

- 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 carriage sidings 3-6) and electrical power substations.
- Maintain current functionality of the other platforms and station services/utilities.
- 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. One new electrical power substation will be provided along this segment of 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 that area and asset-specific interventions will also be required.

The Low Voltage and Telecommunications networks required for Signalling will be 'global systems' and are unlikely to vary significantly between or within the various areas. In order to achieve the necessary capacity enhancements and performance required for the introduction of the new DART fleet, it will be necessary to upgrade the existing signalling system as well as replacing some of the legacy signalling system. This will include provision of equipment rooms, including Relocatable Equipment Buildings (REB) to accommodate signalling equipment and associated power supplies and backup.

Upgrades to the existing telecommunications infrastructure will be required to facilitate improvements to the radio-based technologies used on the network and for signalling and communication with the existing and future network control centres.

3.2.1. Electrification System

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

It should be noted that all OHLE diagrams in this report are for visual information only. Construction details will be determined during Detail Design.

The OHLE concept comprises a simple (2-wire) auto-tensioned system, supported on galvanised steel support structures. See **Figure 3-1** and **Figure 3-2** for typical OHLE arrangements.

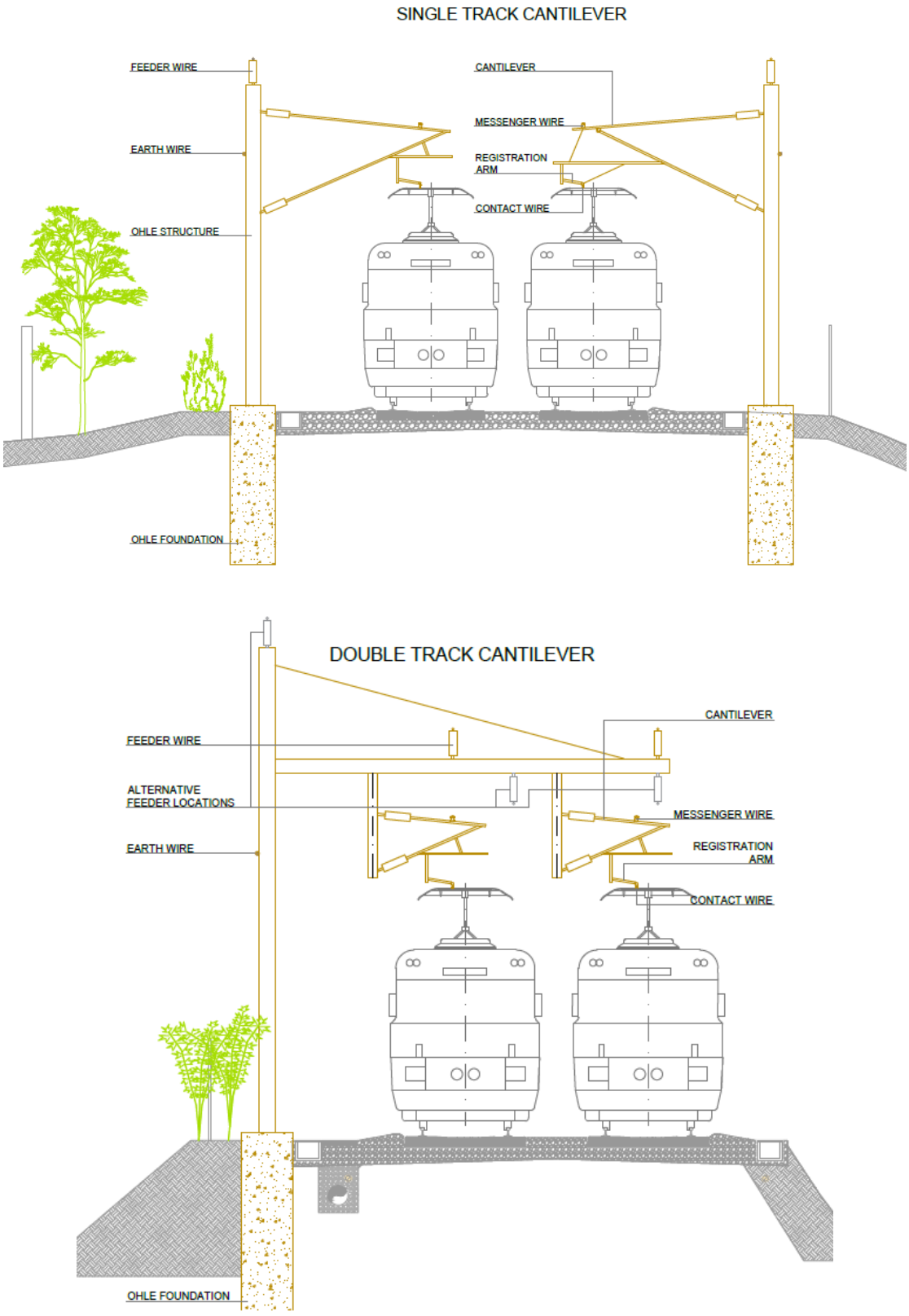

Figure 3-1 Typical OHLE arrangements in two track open route

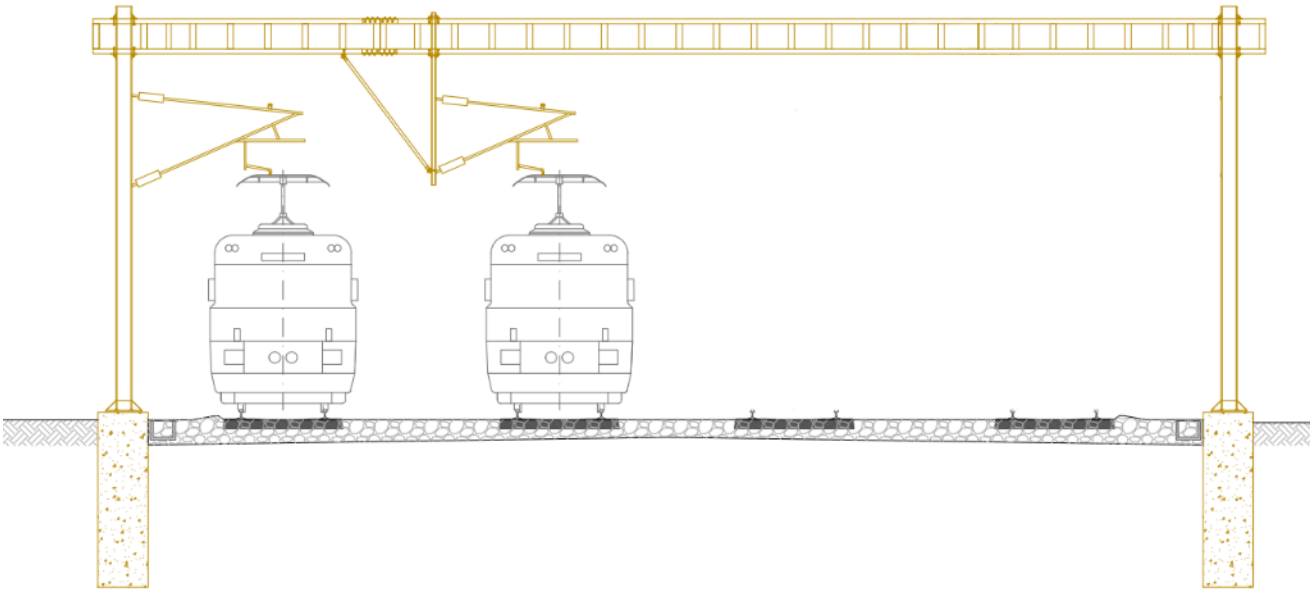

Figure 3-2 Typical OHLE portal arrangement – Facing East

In the four track areas, Two Track Cantilevers (TTCs) will generally be placed on the north side of the line, to support OHLE on the northern two tracks.

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

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

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

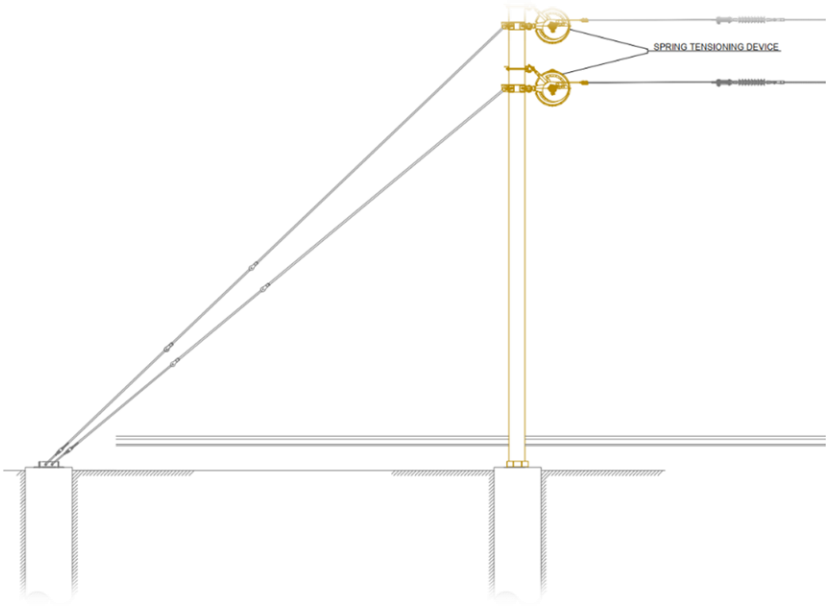

Figure 3-3 Typical anchor structure

The OHLE configuration through the overbridges for each track or civils option is being assessed using a clearance assessment tool derived from the System Wide Functional Requirement Specification (FRS) relating to Overhead Line Equipment (OHLE). This includes level and graded free running options, as well as level and graded options with elastic bridge arms fitted to the bridge. See **Figure 3-4** for a typical arrangement on approach to a low bridge.

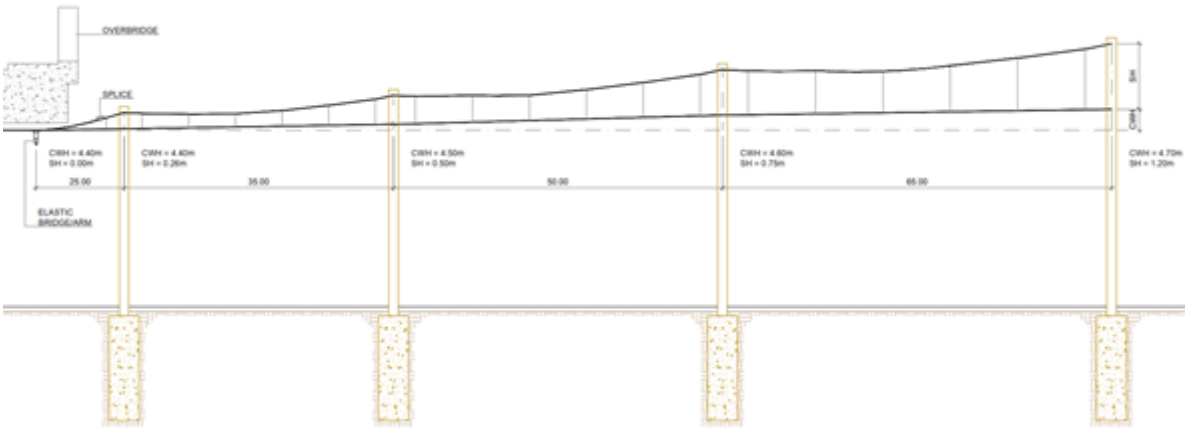

Figure 3-4 Typical arrangement on approach to a low bridge

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

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

3.2.2. Substations

In order to facilitate the introduction of the new OHLE scheme across the DART+ network a power supply study has been carried out. There is a requirement to provide 6 new substations along the route and the Islandbridge substation is located in this area.

3.3. Design Standards

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

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

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4. Constraints

4.1. Environment

Ecological field surveys of the route have been carried out to establish the baseline ecological conditions. Surveys for mammals (badger, bats), amphibians, invasive alien species, birds and terrestrial and freshwater habitats have been carried out to date.

In relation to Built Heritage, a comprehensive desktop assessment of built heritage assets within 50m either side of the railway centreline has been undertaken by a Heritage Specialist. This assessment confirmed the designated status of the features of heritage interest i.e. Protected Structure status and/or inclusion in the NIAH record, and/or inclusion in the Industrial Heritage Record. A meeting with Dublin City Council noted that a new City Development Plan for 2022-2028 is being prepared. The new City Development Plan for 2022-2028 may contain modifications (additions/deletions) to the Record of Protected Structures (RPS). A structure must be listed on the planning authority's RPS to qualify for protected status under the Planning and Development Act 2000 (as amended). The RPS will be monitored on an on-going basis by the Heritage Specialist. Further details in relation to environmental contraints are outlined in **Section 2.7 Environment**.

The River Liffey crosses the railway line near Heuston Station. The ECFRAM maps indicate the risk of fluvial and coastal flooding. The ECFRAM maps indicate the River Liffey is impacted by river and coastal flooding in the 0.1% fluvial and 0.1% tidal Annual Exceedance Probability (AEP). The location is also influenced by the River Camac catchment, a tributary of the River Liffey.

A Flood Risk Assessment (FRA) is currently under preparation. The FRA will be completed in accordance with "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" (DOEHLG, 2009). Detailed mitigation measures will be specified in the final FRA and will inform the EIAR which will be submitted to An Bord Pleanála for Railway Order approval.

Stakeholder feedback from PC1 has noted concerns about noise levels and acoustic disturbances. Further issues or concerns raised during PC1 are described in the Public Consultation No. 1 Findings Report, Volume 4.1.

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 Points and Crossings (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 has been considered 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 has been 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, ensuring that 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 has been the existing track condition - i.e. extents of installing new track and componentry which is dependent on whether existing P&C's or plain line track is life-expired or is fit for purpose.

4.3. Existing Structures

The Valeting Plant Subway (UBC1A) at Heuston Yard is a constraint in relation to the track alignment directly over the structure, particularly with regards to vertical levels. The structure should not significantly affect the horizontal realignment of tracks. The PC2 design doesn't affect the existing retaining wall assets in **Table 2-1**.

4.4. Geotechnical

As noted earlier, detailed ground investigations are currently underway, no onerous ground or groundwater conditions are anticipated in this area, based on the existing GI data carried out to-date. Hazardous and non-hazardous material has been identified in soil samples close to the proposed National Train Control Centre location at Heuston station and if the same is found lcoal to this sections works it could potentially impact depth of construction and disposal contol and impose additional health and safety controls.

4.5. Utilities

The various existing utilities in this area as decribed in **Section 2.8** are concentrated on the eastern side of the proposed Heuston West Station, or along the Heuston Station Access Road. There are no utilities that pose major constaints to the proposed track works in the yard. Where the utilities in the area pose a constraint to works relating to the proposed Heuston West Station and or the Heuston to Glasnevin railway electrification upgade, these can be reviewed in **Technical Optioneering Report - Volumes 3I and 3J** respectively

4.6. Property

All works in this section are those associated directly with the rail corridor from St John's Road Bridge (OBC0A) and the Phoenix Park Tunnel and is proposed within the boundaries of Irish Rail land.

No third party lands are affected by the works directly associated with this section. However the proposed new Heuston West Station does impact the Clancy Quay Develeopment more directly; the details of which are articulated in **Volume 3I - Technical Optioneering report – Heuston West Station**.

The Irish Rail lands in this section are bounded by the River Liffey (to the North) and St John's Road West (to the south). In between St John's West Road and Kilmainham Lane to the south are the grounds of the Royal Hospital Kilmainham The Royal Hospital Kilmainham is a designated conservation area and has a designated landscape protection objective (Z9) "to preserve provide for and improve recreational amenity and open space/ green networks. Adjacent to the St John's Road Bridge and the South Circular Road Junction is Bully's Acre, an area of archaeological potential in the grounds of the Royal Hospital Kilmainham.

4.7. Drainage

The proposed drainage system for the new tracking section along Heuston West presents an attenuation tank between Heuston West Station and Clancy Barracks Development with its outfall at Liffey River. In order to avoid any backflow issues, the proposed discharge point needs to be fixed above the 1 in 100-year water level of Liffey River, which is set at level 3.47m AOD.

This level requirement constraints the proposed drainage network in terms of maximum pipe depths and tank invert levels, which are also based on the proposed low points along the track alignment.

5. Options

This section presents the options associated with the following elements at Heuston Station and Yard:

- Civil and OHLE infrastructure solutions
- Construction Compounds

5.1. Civil and OHLE

5.1.1. Heuston Station and Yard

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

2 no. 'Main Options' were developed for the area and presented at PC1, including a 'Do-Nothing' Option and a 'Do-Minimum' Option.

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

A summary of the Main Options presented at PC1 as part of the Emerging Preferred Option Selection process in the Heuston Station and Yard area is presented in the **Table 5-1**.

As noted in **Section 5.10 Substations** and **Section 5.11 Construction Compound Sites**, Substations and Construction compound sites options are covered at **Volume 3J Option Selection - East of St. John's Road Bridge to North of the Phoenix Park Tunnel** given that the location of Islandbridge Substation and Heuston West Construction compound overlap between several technical option reports: **Volume 3H Option Selection - Heuston Station and Yard**, **Volume 3I Option Selection - Heuston West Station** and **Volume 3J Option Selection - East of St. John's Road Bridge to North of the Phoenix Park Tunnel**.

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.

5.1.1.1. Option 0: Do Nothing

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

5.1.1.2. Option 1: Do Minimum

This option assumes the electrification and use of the existing Platforms and carriage sidings 3 to 6 with some minimal P&C additions to facilitate operational requirements.

5.1.2. 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 Electrification System**.

In the station, the requirement is to electrify Platform 6, 7 & 8, as well as the carriage sidings 3 to 6.

The area through Heuston station for Platforms 6, 7 & 8 and the carriage sidings 3 to 6 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 structures for each line will be required. The type of support will need to be determined during subsequent design phases. For the portal option, OHLE strcutures shall be positioned in space between the line side equipment.

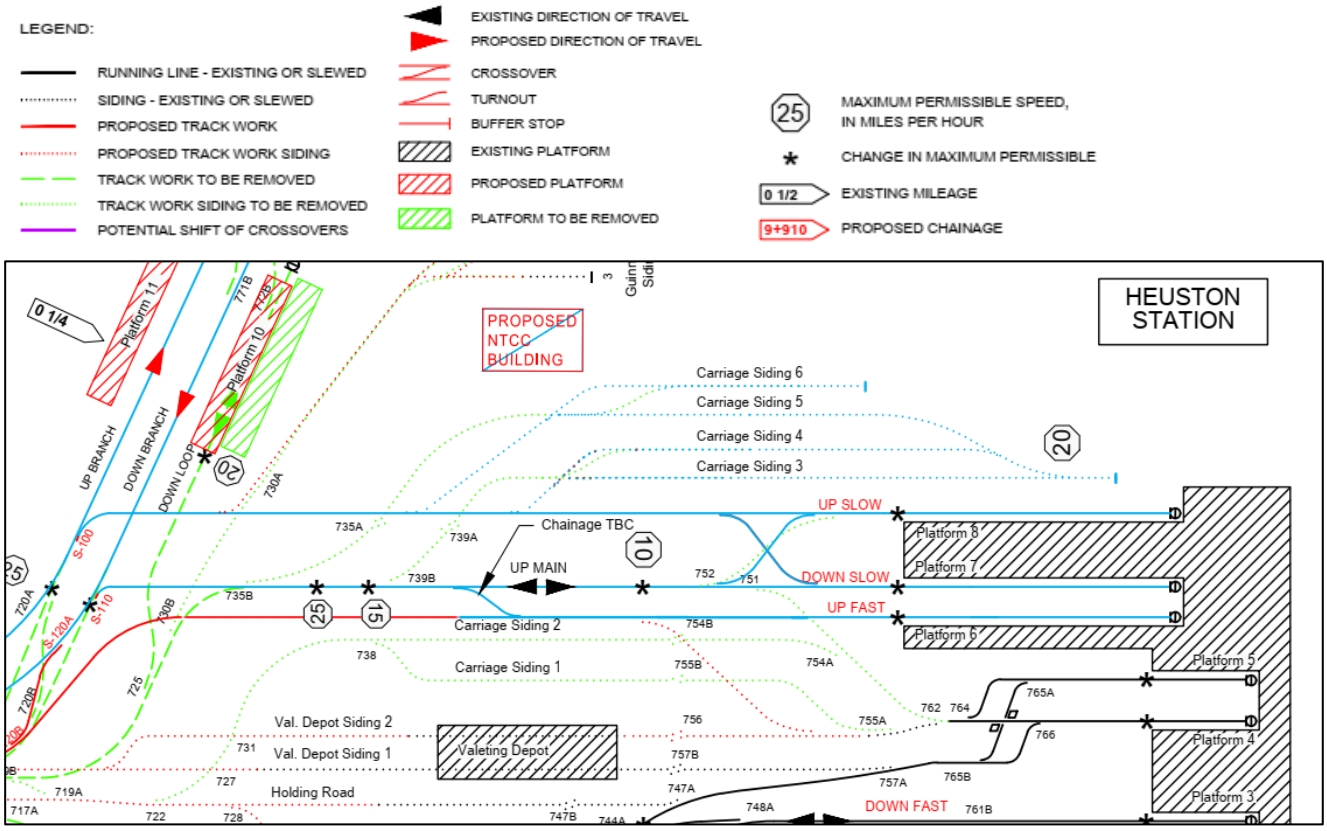

Figure 5-1 Track to be electrified sketch

Figure 5-1 shows the track to be electrified (Blue) in Heuston.

5.1.3. 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-31990 included in Appendix B.

This 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.

There is a requirement to provide a new crossover between the Platform 7 and 6 lines, for electrification purposes (OHLE will extend into Platform 6).

5.1.4. Geotechnical

New track alignments and electrification interventions 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 plaftorm will be demolished and rebuilt as part of the proposals for a new station at this location.

5.1.5. Roads

No road intervention is anticipated in this area.

5.1.6. 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.

5.1.7. Structures

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

Localised platform canopy modifications will be required to accommodate the OHLE masts but only if further design developement finds it necessary to position some masts on the platforms. The canopy structure in such instances poses no impediment to the platform line electrification.

5.1.8. Drainage

No relevant changes in the current drainage system are expected within the existing Heuston Station and Yard.

However, the proposed track section along Heuston West includes a new track drainage network with an attenuation tank. For further details on this proposal, please refer to **Volume 3J Option Selection - East of St. John's Road Bridge to North of the Phoenix Park Tunnel and Volume 3I Option Selection – Heuston West Station**.

5.2. Substations

There is one substation located in this area, Islandbridge Substation. Please refer to **Volume 3J Option Selection - East of St. John's Road Bridge to North of the Phoenix Park Tunnel** for the description of options for this substation, as well as any sifting requirements and considerations which inform the option selection process.

5.3. Construction Compounds

One Construction compound is required at the Heuston Station and Yard area. The Construction compound proposed is:

- Heuston West

This compound will also be used for the sections from St John's Road Bridge to the Phoenix Park Tunnel and beyond.

5.3.1. Heuston West

A construction compound is required to the west of Heuston Station, adjacent to the existing platform 10, for works to be undertaken to the Phoenix Park Tunnel and the construction of the new Heuston West Station. These same compounds will be used for the Heuston Yard works to varying degrees and subject to the detailed construction programming imperatives.

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

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

Outbound access to the main road network would be via the Heuston Station access road to Parkgate Street, Conyngham Road, Islandbridge Road and on to Con Colbert Road to the M50. Inbound traffic could use the Chapelizod Bypass (Con Colbert Road and St John's Road West) and access directly to the Heuston Station access road (adjacent to the River Liffey).

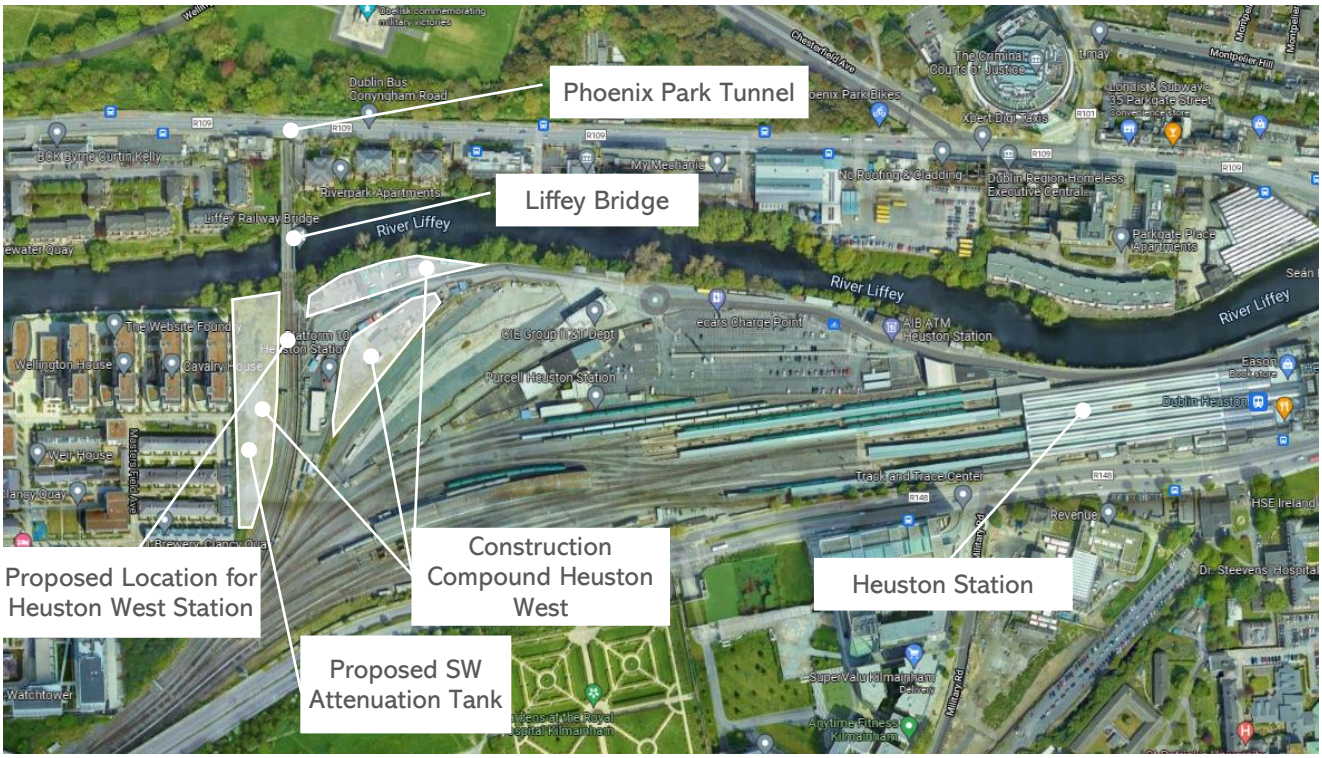

Figure 5-2 Construction Compound Heuston West Site Location

The proposed construction compound is located on Irish Rail property adjacent to platform 10 and the Clancy Quay residential development. Due to the proposed location of the new station and the presence of existing rail lines to the east and south, no other suitable construction compound locations were identified in this very constrained area of the route. As a result, the selected construction compound location did not require multi-criteria analysis.

6. Options Selection Process

6.1. Options Selection Process Summary

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

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

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

This volume covers the option selection report for the Heuston Station and Yard area. The option selection processes for Construction compounds and substations are not covered in this chapter. Please refer to **Volume 3J Option Selection - East of St. John's Road Bridge to North of the Phoenix Park Tunnel.**

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.

6.1.1. Stage 1 Preliminary Assessment Process (Sifting)

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

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

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

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

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

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

The options are assessed against the criteria of Economy, Safety, Environment, Accessibility and Social Inclusion, Integration and Physical Activity in line with the criteria required for multi-criteria analysis under the Department of Transport, Tourism and Sport (DTTAS), Common Appraisal Framework (CAF) for Transport Project and Programmes (March 2016).

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

Relevant considerations include:

- This is a comparative analysis between the various options, not an impact assessment of each option. The impact from the Preferred Option will be assessed in the Environmental Impact Assessment Report in the next phase of the development.
- Not all sub-criteria and qualitative and/or quantitative indices may be relevant in every case.
- For each option there are potential design variations. In due course design variations will be subject to detailed technical analysis (in respect of the Preferred Option).
- For each option, an indicative envelope was identified for permanent and temporary works, property and/or land take; a worst-case scenario was considered. Detailed design, technical and construction related solutions will seek to minimise land take in respect of the Preferred Option.
- The envelope around each Option was used to spatially represent environmental constraints within / proximate to the options.

The options which were brought forward from the Preliminary Screening were developed further to facilitate the more detailed Stage 2 Multi Criteria Analysis. General arrangement drawings were developed for all options, focusing on key design aspects – bridges, roads, and 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 Stage 2: Multi-Criteria Analysis (MCA) (also refer to Technical Appendices Volume 2.1 ‘Environmental Constraints Reporting’.

The stage adopted for the Stage 2 MCA involved assessing the performance of each option against relevant quantitative and qualitative indicators, the assessment was carried out by a multi-disciplinary team including commercial, technical, safety and environmental specialists.

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

Table 6-1 Comparison Criteria

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

6.2. Civil and OHLE Option Selection

6.2.1. Stage 1 Sifting

Table 6-2 provide details of the assessment undertaken as part of the Stage 1 Preliminary Assessment (Sifting) Process, used in the selection of the Preferred Option for the Heuston Station and Yard.

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

Table 6-2 Sifting Process

Option	Requirements		Description
0	Engineering	Constructability	Not applicable. No intervention proposed.
		Geometrical fitness for intervention	Not applicable. No intervention proposed.
		Safety	Not applicable. No intervention proposed.
		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.
		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**

Option	Requirements		Description
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**

Option 0 fails to meet the necessary Engineering Feasibility and Project Requirements by providing a direct link between the DART lines and platforms, it also fails to provide electrification of the associated lines, platforms or sidings.

Options 1 meets the necessary Engineering Feasibility and Project Requirements and is the Preferred Option, therefore Stage 2: MCA is not necessary.

The single Main Option developed for this area has passed the sift process, as there are no other options, it is not necessary to be brought forward to Stage 2: MCA.

Table 6-3 Summary of Sift Process Results

Main Option	Result	Comments	Brought forward to MCA
Option 0: 'Do Nothing'	**FAIL**	Electrification, new track configuration, access to DART platforms and lines, and maintain track functionality not achieved	**No**
Option 1: Do Minimum	**PASS**	Feasible	**N/A**

6.2.2. Stage 2: Detailed Assessment Process (MCA)

Stage 2 of the optioneering process comprises a detailed multi-disciplinary comparative analysis of those feasible options that passed through Stage 1: Preliminary Sifting

6.2.3. Heuston Station and Yard – Preferred Option

As the “Do-Minimum” Option has been identified as feasible, no other options are required and hence a detailed assessment (MCA) is not required for this area.

As there are no other suitable alternative locations for the Construction Compound in this area, multi-criteria analysis was not required. Please refer to **Section 8** for further details in relation to the Construction Compounds

6.3. Construction Compounds

As there are no other suitable alternative locations for the Construction Compound in this area, multi-criteria analysis was not required. Please refer to **Section 8** for further details in relation to the Construction Compounds.

7. Preferred Option Design Development

7.1. Review of Heuston Station and Yard Preferred Option

Heuston Station, currently does not have any existing provision for electrification, platforms and sidings within the Heuston area will need to be electrified to receive the new DART+ fleet.

The baseline information or outcomes of design development since PC1 (inclusive of stakeholder input) have not materially impacted the optioneering and MCA outcomes that resulted in the selection of Option 1 as the Preferred Option for the Heuston Station and Yard.

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

7.2. Review of Stakeholder Feedback

Stakeholder feedback relating to the new station at Heuston West which is dealt with in **Volume 3I – Tehcnical Optioneering Report – Heuston West Station.**

The works within the Heuston Station Yard are necessitatesd as part of the project upgrade as a whoel to improve journey and turnaround times. Works will be carried out in the most efficient manner possibel to limit the impact on existing station operations.

Construction activities are generally located a substation distance from major receptors of visual and noise pollution but this can be further reviewed in **Section 8** of the report.

Further issues or concerns raised during PC1 are described in the **Public Consultation No. 1 Findings Report, Volume 4.1**.

7.3. Design Development

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

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

7.3.1. Structures

There are no new or modified bridge or retaining wall structures anticipated in this section.

Some specific structures are anticipated for the develelopment of the new Heuston West station. Please refer to Volume 3I – Option Selection – Heuston West Station for further details in relation to these structures, not related with the Permanent Way and bridge but those needed for the station development and the access from the Clancy Quay area.

Localised platform canopy modifications will be required to accommodate the OHLE masts but only if further design developement finds it necessary to position some masts on the platforms. The canopy structure in such instances poses no impediment to the platform line electrification.

7.3.2. 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 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. A crossover has been added between Platforms 6 and 7 as part of the electrification requirements:

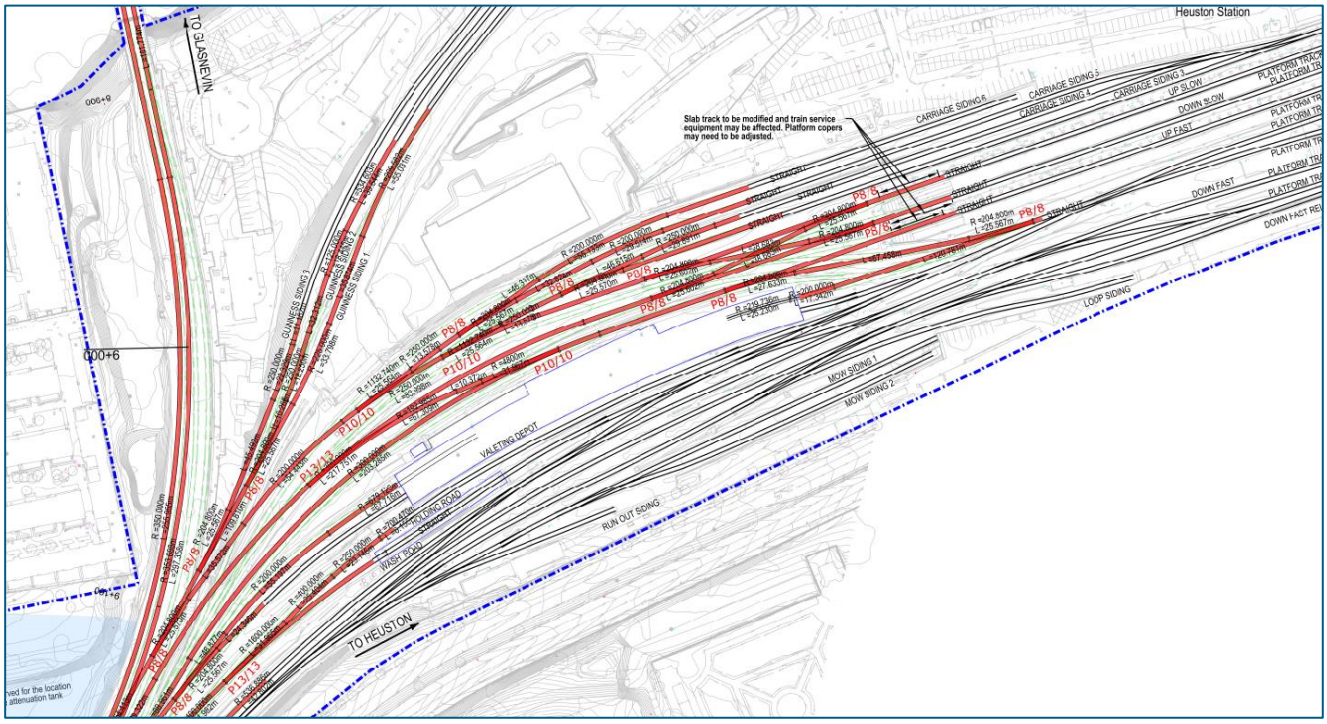

Figure 7-1 Heuston Station Yard – Track Plan Layout

7.3.3. Signalling, Electrical and Telecommunications (SET)

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

7.3.3.1. Signalling

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

A Signalling scheme plan has been developed for the entire route, the section pertaining to this area is detailed in **Figure 7-2**. The scheme plan shows the number and type of signals that will be allocated on this section of the route and the points and crossings that they interface with. The following section details the physical signalling infrastructure that will be installed.

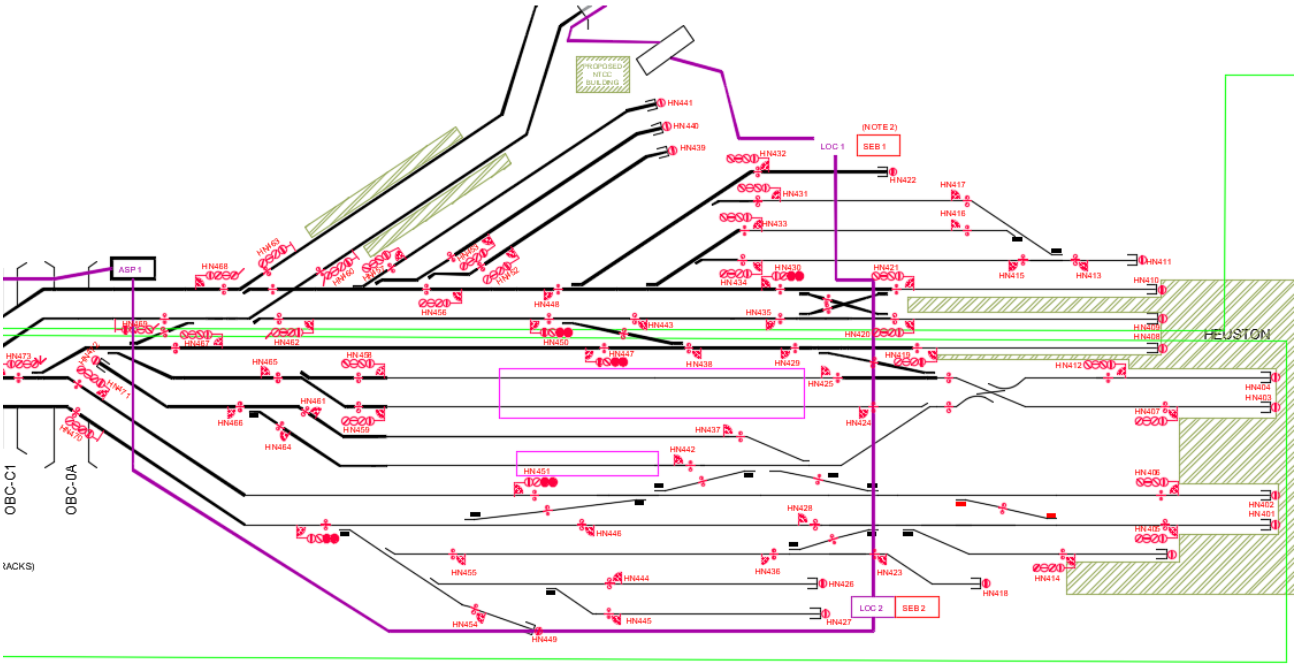

Figure 7-2 Signalling Scheme Plan (Heuston Station)

Legend:

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

The physical signalling infrastructure has been developed and is indicated in **Figure 7-3**. This figure shows the LV and signalling housing equipment in the area. All equipment is expected to be located within the existing CIÉ property boundary to minimise the impact to the public.

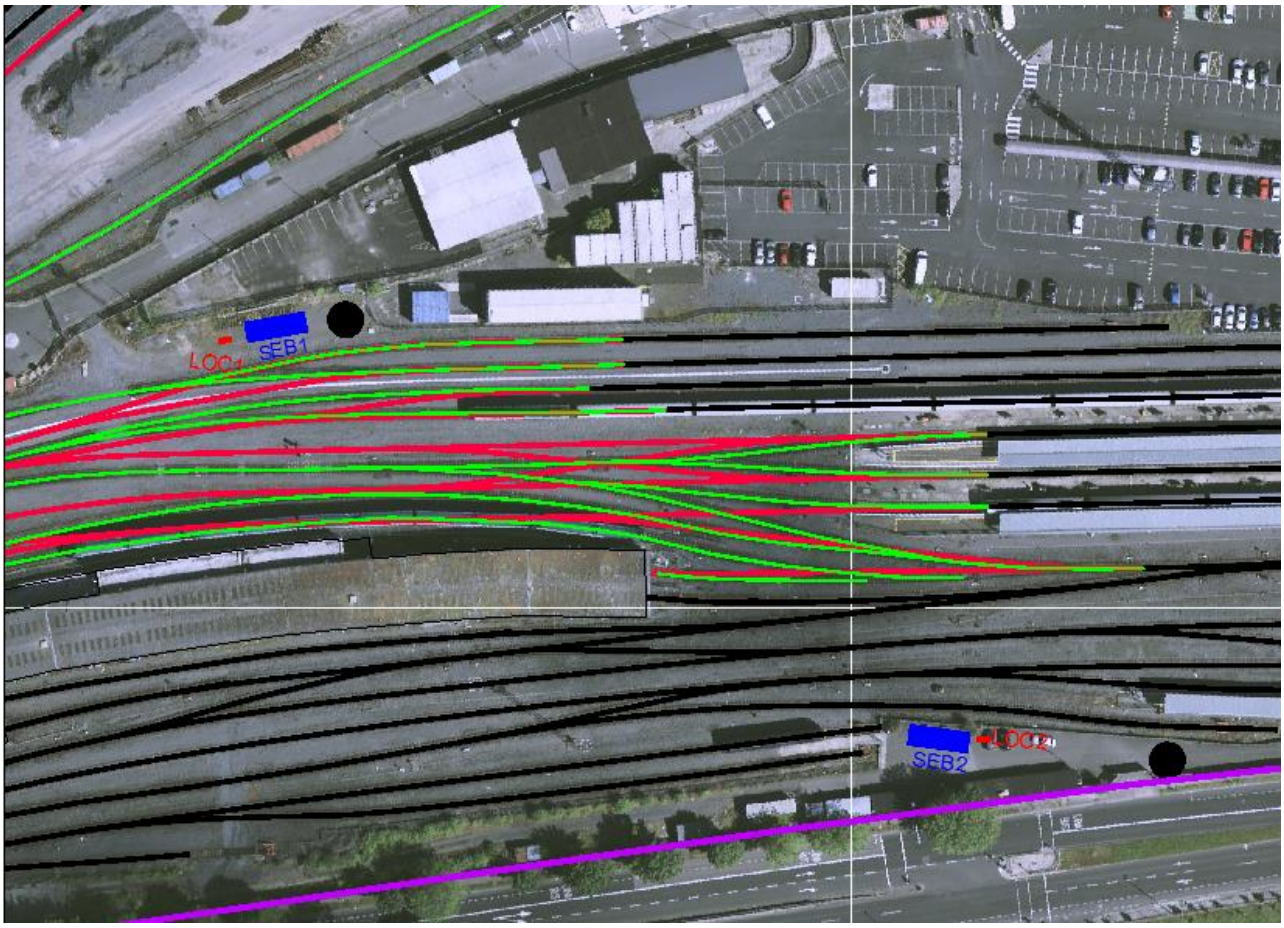

Figure 7-3 Signalling main Infrastructure: SER and LOC's

Infrastructure highlighted as follows:

- Blue box – Signalling equipment buliding
- Red box – Location case
- Black lines – Tracks and signalling equipment that will remain
- Red lines - New tracks with new signalling equipment
- Green lines - Tracks to be removed
- Purple line - IÉ boundary

7.3.3.2. Signalling Post

There are currently no proposed signalling cantilevers or gantries in this section and trackside signals would be located on signal posts adjacent to trackside. A typical signalling post is shown in **Figure 7-4.**

Figure 7-4 Typical Signalling Post

7.3.3.3. Object Controller Cabinet (OBJ)

In the railway system, the movement of the train is controlled by an interlocking system. Such an interlocking system consists of different parts. From a logical perspective, there is a central device (computer) that controls and senses the condition of important equipment such as switches, signals, track circuits, etc. This equipment is collectively referred to as an object or rail side object. The equipment that handles the interface between the central device and the object is referred to as an object controller. A typical Object Controller Cabinet is shown in **Figure 7-5**.

Figure 7-5 Typical Object Controller Cabinet

7.3.3.4. Location Case

Location Cases (Locs) accommodate railway signalling equipment to detect the location of trains, control the trackside signals and switch the points. They link the physical asset to the control equipment within. Additionally, they are used to accommodate the required power distribution to the signalling equipment. A typical Location Case is in **Figure 7-6**.

Figure 7-6 Typical Location Cases

7.3.3.5. Cable Containment

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

Figure 7-7 Containment walkway

Cable containment route will run adjacent to the track in accordance with standard railway practice and will cross under the track where required using under track crossings (UTX) and secure turning chamber. Type of containment at each stage of the track will be highlighted in the design drawings.

7.3.3.6. Telecommunications

The PC2 design has confirmed that no Telecom Equipment Building (TER) is required for this area.

7.3.3.7. Electrification

In the area between the station and main route, new OHLE structures shall be positioned in the space between the track and railway boundary. The type of strcutures will typically be STC or TTC depending on the space between the tracks as detailed in **Section 3.2.1**.

Figure 7-8 shows a typical OHLE arrangement with TTC strcuture in the four track area.

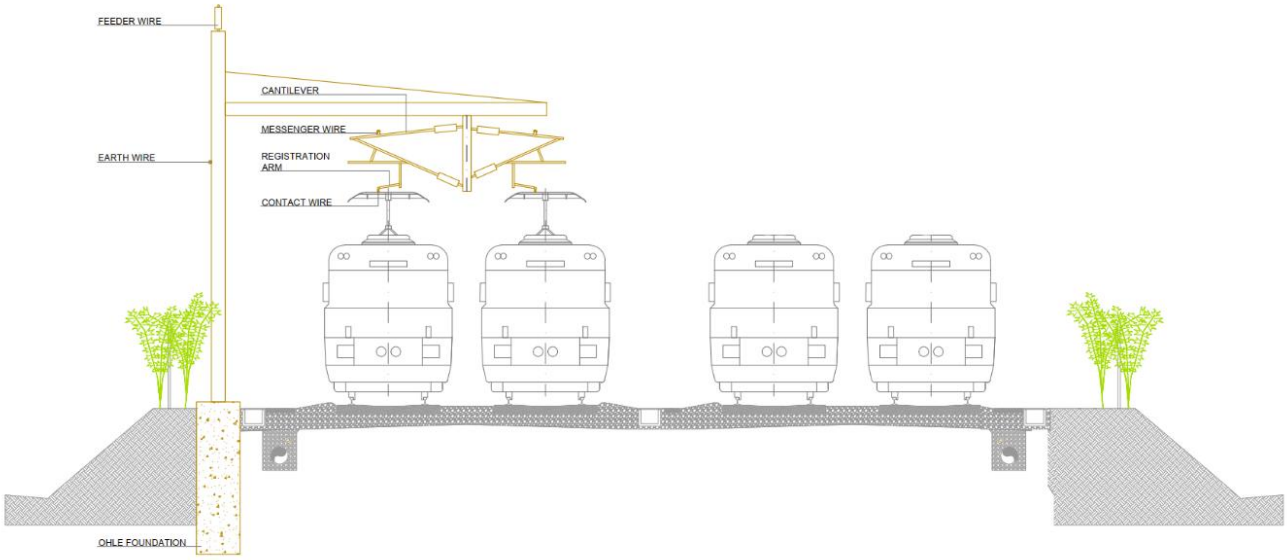

Figure 7-8 Typical OHLE arrangement in four track open route.

As noted earlier, there is a requirement is to electrify the Platform 6, 7 & 8 and Carriage Sidings 3 to 6.

The area through Heuston station to Platforms 6, 7 & 8 and the sidings will be provided with portals or headspands spanning over the platforms and the sidings. The OHLE structures shall be positioned in the space between the line side equipments.It is proposed that portal structures shall be positioned on the platforms through the canopy to support the OHLE wires with 30-50m spacing.

Clearance assessment shall be undertaken with the pantograph and the canopy. If adequate electrical clearance is not available, the canopy will need to be cut back to provide the required electrical clearance.

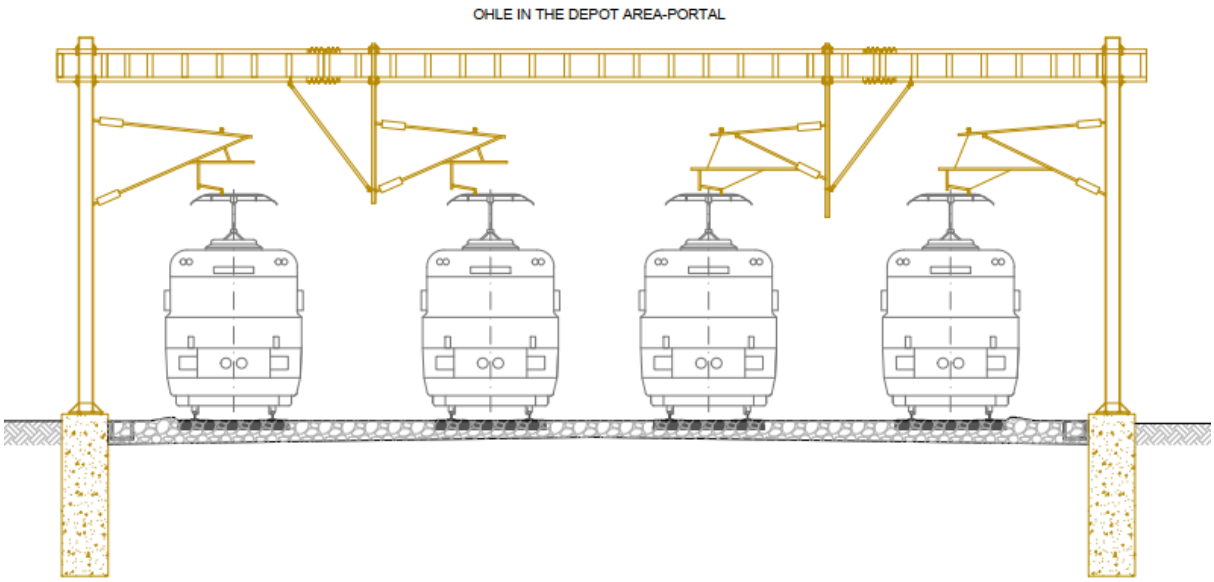

Figure 7-9 Typical OHLE portal arrangement in station area

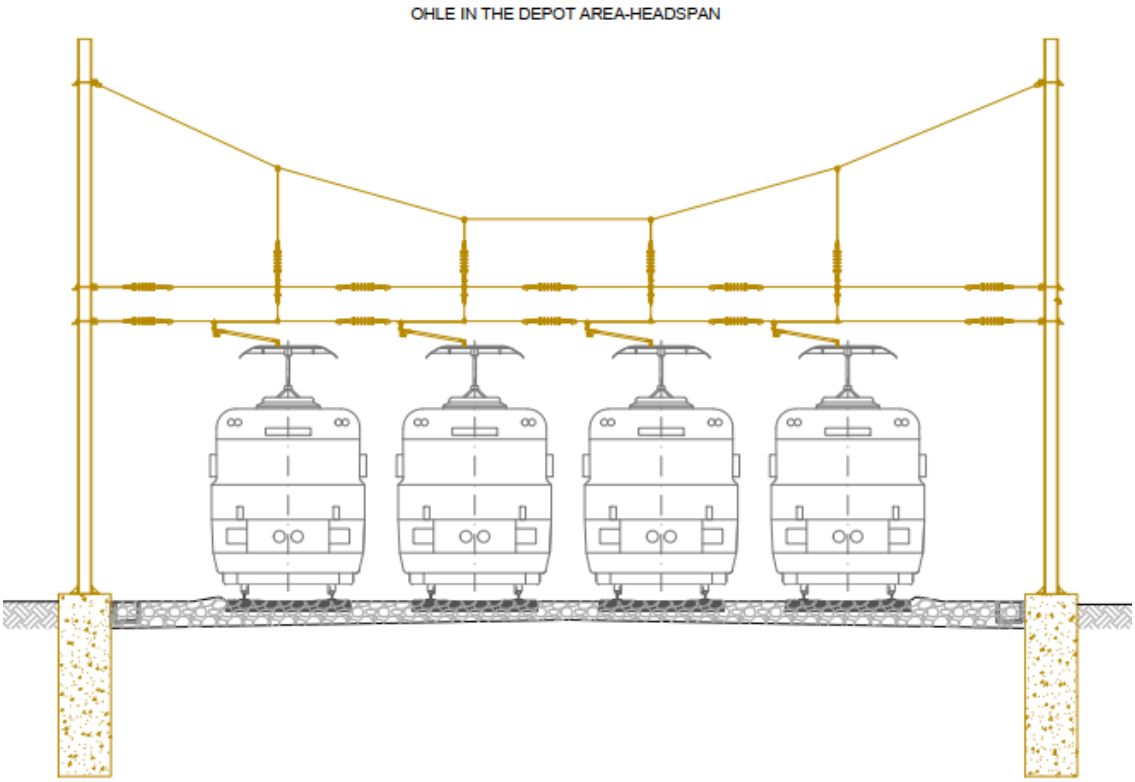

Figure 7-10 Typical OHLE headspan arrangement in station area.

7.3.3.8. Substations

Refer to Volume 3J Option Selection - East of St. John's Road Bridge to North of the Phoenix Park Tunnel for the current status of design for optioneering.

7.3.4. Roads

No road works have been identified for this section.

7.3.5. Drainage Requirements

No additional track drainage elements are proposed within the existing Heuston Station and Yard; as the current drainage catchment on these sections will not be modified.

Regarding Heuston West, as a consequence of the proposed track works along this section, a new drainage system will be implemented with an attenuation tank between the proposed Heuston West Station and Clancy Barracks Development, for further details refer to **Volume 3I Option Selection – Heuston West Station**.

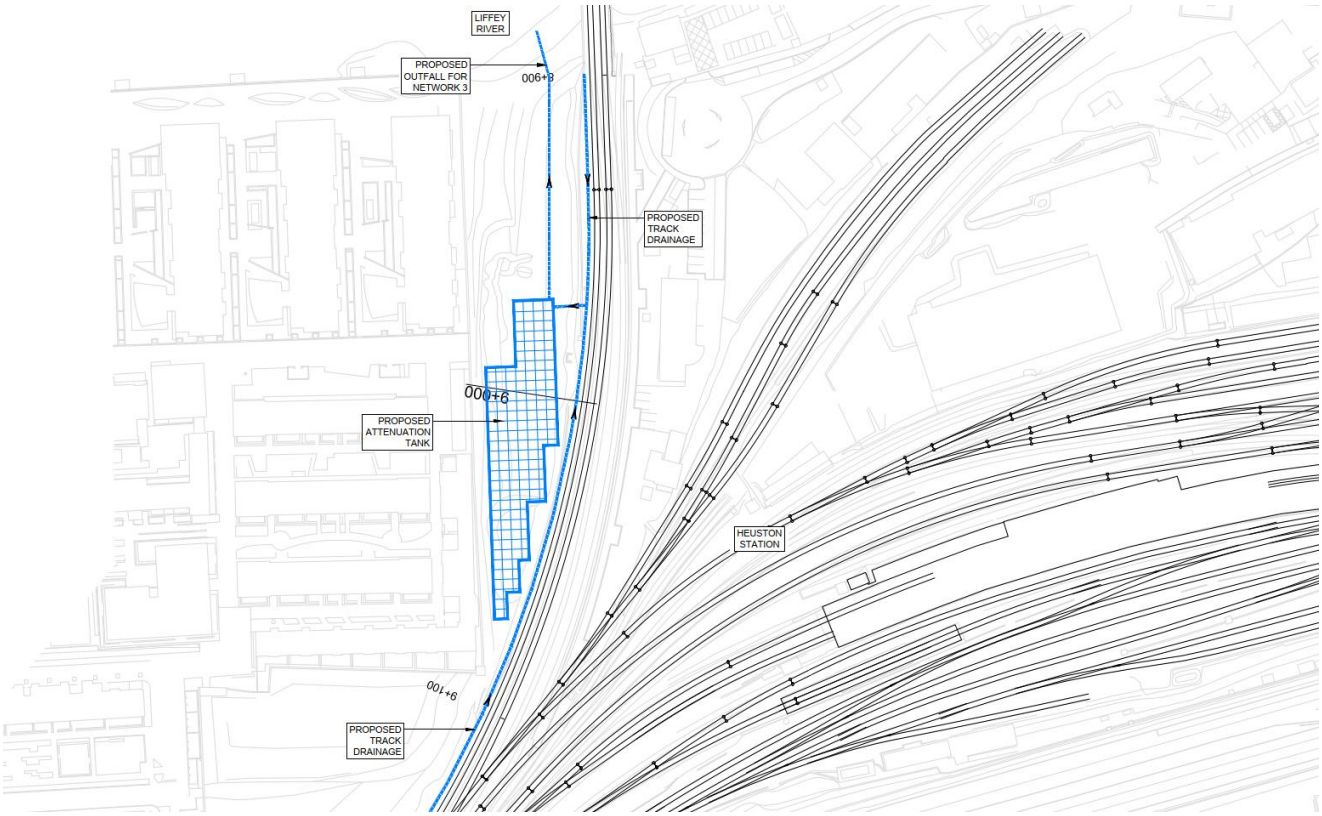

Figure 7-11 Proposed attenuation tank at Heuston West Station.

8. Construction

This section of the report sets out the approach in relation to the construction methodology for the works in the area of Heuston Station and Yard, which encompasses Heuston Station, including the associated servicing sidings, and extends to the east side of St John's Road (OBC0A). Platforms and carriage sidings 3 to 6 within the Heuston area are to be electrified to receive the DART+ rolling stock. These works will require re-arrangement of the track layout to provide access to the new DART platforms and to modify access to inter-city tracks.

8.1. Bridges

No bridge work nor associated road closures are currently anticipated in this section of the project.

8.2. Permanent Way

Works will comprise:

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

8.3. OHLE Infrastructure

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

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

It is envisaged that the OHLE will be constructed in safe zones adjacent to the live railway or in night-time possessions.

8.4. Construction Compounds

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

The construction compounds are required at specific construction sub-sites and they are also distributed along the scheme by geographical features. For example, compounds will be required at each of the bridge reconstruction locations plus will be required to for material processing and storage of construction components. The construction compounds will be used to support earthworks, ecological clearances, enabling works, site

clearance, utility diversions work, civil works, the demolition of bridges, OHLE, track installation, signalling and telecoms equipment and all ancillary works.

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

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

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

The proposed location for the construction compound at Heuston West is required to facilitate the localised works, it is also the proposed location for the new Heuston West station. It is located on Irish Rail property adjacent to platform 10 and the Clancy Quay residential development. **Figure 8-1** shows the preferred indicative site layout for Heuston West construction compound.

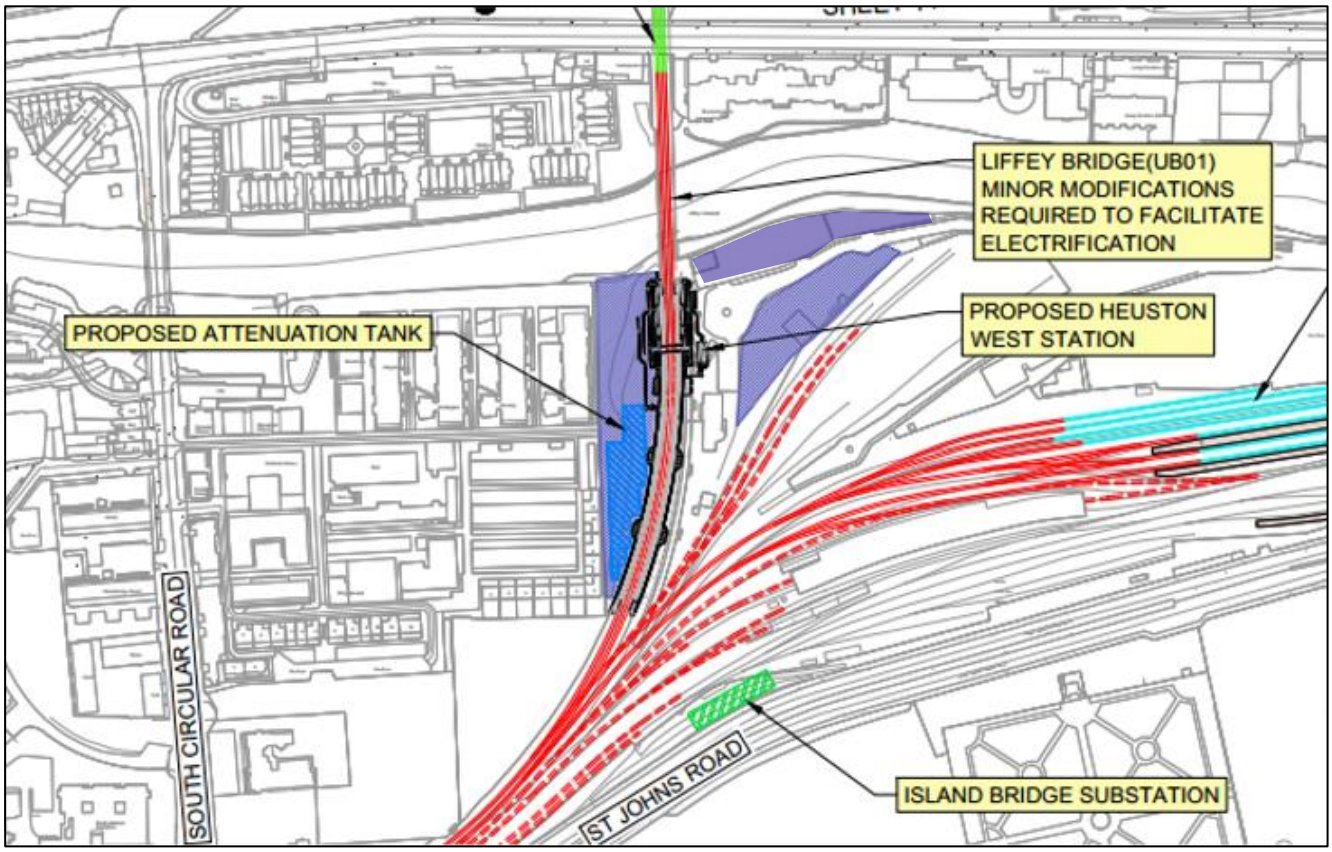

Figure 8-1 Construction Compound Heuston Yard – Preferred Option Indicative Site Layout

8.4.1. Temporary Traffic Management

No temporary traffic management diversions have been defined as necessary along this section of the project; nevertheless the following recommendation for access to and egress from the site is as follows:

Outbound access to the main road network would be via the Hueston Station access road to Parkgate Street, Conyngham Road, Islandbridge Road and on to Chapelizod Bypass (Con Colbert Road) and onwards to the M50. Inbound traffic could use the Chapelizod Bypass (Con Colbert Road & St John's Road West) and gain access directly to the Heuston Station access road (adjacent to the River Liffey).

8.5. Restrictions

There are restrictions associated with working on or adjacent to the live railway line. Irish Rail will mandate a safe system of work which will invariably include barriers between the live tracks and the working area or full possession of the railway (no trains running).

Materials delivery times will predominantly be outside peak traffic hours; particularly for construction HGV's known to restrict natural flow of traffic; this is also governed by the Dublin City HGV Cordon for vehicles above 5 axles for the project areas east of South Circular Road. Special Permitting will be required for departures from this in accordance with the City Cordon conditions of access. In addition, where possible, long duration night works will be limited in areas close residential units unless appropriate noise mitigation can be provided.

A full methodology of the setup and construction methods will need to be sympathetic to both the railway operations, as well as local residents and/or employers in the area. The methodologies will be fully reviewed by the Irish Rail team before the works are given approval to proceed (taking account of all stakeholder concerns from the public consultation phases as well as planning compliance criteria stipulated in the Railway Order).

Appendix A – Sifting Process Backup

A1. Sifting Process Backup - Heuston Station and Yard

Appendix B – Supporting Drawings

The following drawings accompany this report:

Permanent Way Drawings

DP-04-23-DWG-PW-TTA-31990: Heuston Yard – Track Plan Layout