DART+ South West

Technical Optioneering Report

Hazelhatch to Park West

Iarnród Éireann

Contents

Tables

Figures

Glossary of Terms

Reference	Description
ABP	An Bord Pleanála
ACA	Architectural Conservation Area
APIS	Authorisation for Placing in Service
ASA	Application for Safety Approval
AsBo	Assessment Body
ASPSC	Application Specific Project Safety Case
ATP	Automatic Train Protection
CAF	Common Appraisal Framework
Cantilever	OHLE structure comprising horizontal or near horizontal members supporting the catenary projecting from a single mast on one side of the track.
Catenary	The longitudinal wire that supports the contact wire.
CAWS	Continuous Automatic Warning System
CBI	Computer-Based Interlocking
CCE	Chief Civils Engineers Department of IE
CCRP	City Centre Re-signalling Project
CCTV	Closed Circuit Television
CDP	County Development Plan
CIE	Córas Iompair Éireann
Contact wire	Carriers the electricity which is supplied to the train by its pantograph.
CPO	Compulsory Purchase Order
Cross overs	A set of railway parts at the crossing of several tracks which helps trains change tracks to other directions.
CRR	Commission for Rail Regulation (formerly RSC – Railway Safety Commission)
CSM RA	Common Safety Method for Risk Evaluation and Assessment
CTC	Central Traffic Control
Cutting	A railway in cutting means the rail level is below the surrounding ground level.
D&B	Design & Build (contractor)
DART	Dublin Area Rapid Transit (IÉ's Electrified Network)
DART+	DART Expansion Programme
DeBo	Designated Body
Direct Current (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
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

Reference	Description
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
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
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

Reference	Description
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 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 from Hazelhatch to Park West This report presents the approach to option development, options assessment, and options selection. This optioneering process incorporates assessment by the following Design Workstreams and specialist Project Teams:

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

The report provides:

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

1.2. DART+ Programme Overview

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

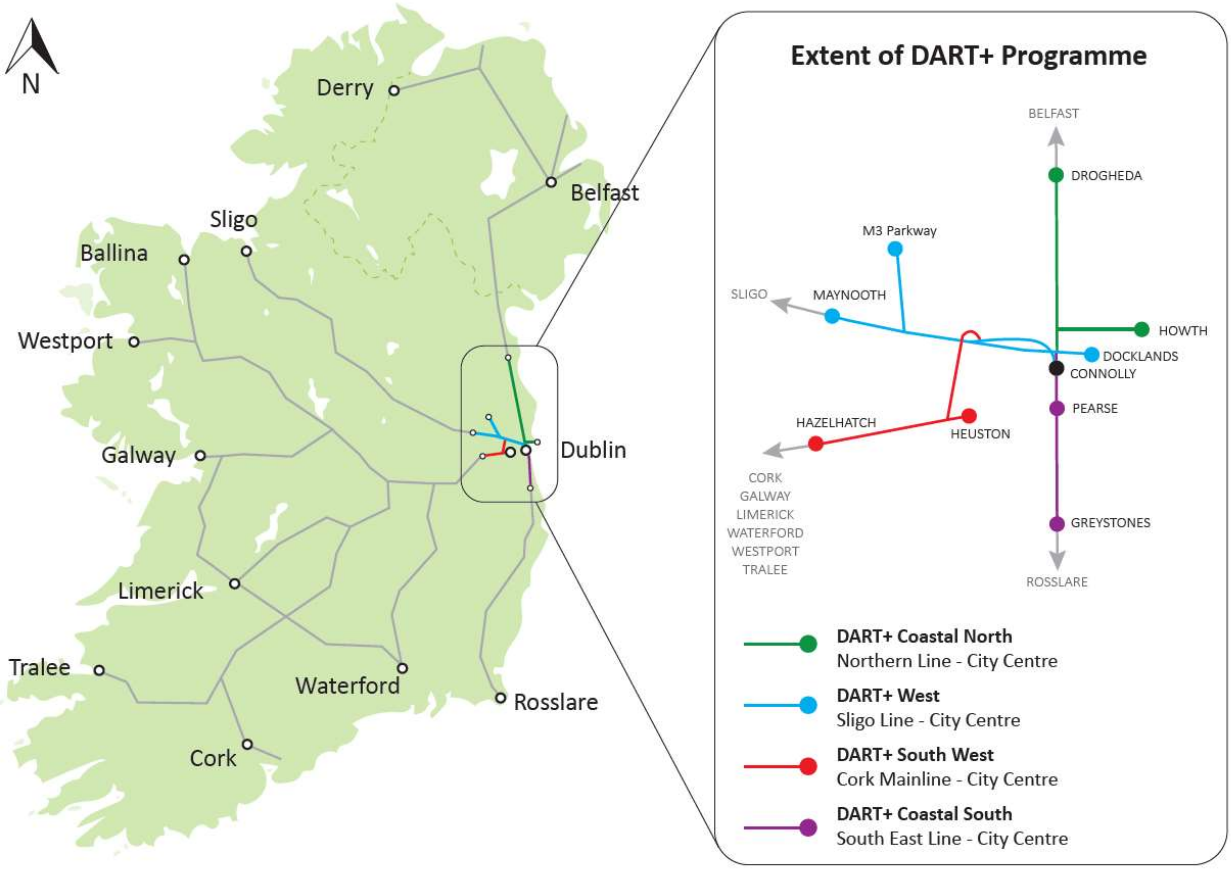


Figure 1-1 DART+ Programme

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

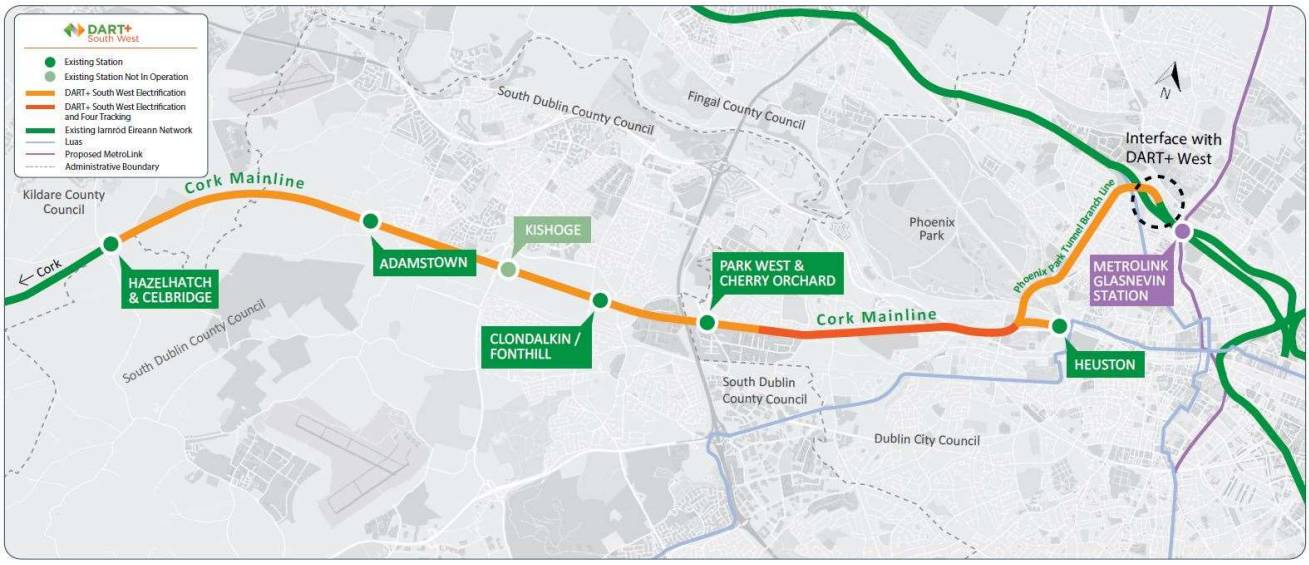


Figure 1-2 DART+ South West Route Map

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 are as follows:

- 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 and Figure 1-2 below.

Table 1-1 Route Breakdown

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

Area Name	Sub-area Description	Extents	Main Features
		turnout to the west of Sarsfield Road Bridge (UBC4)	
	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)
	Area around South Circular Road Junction	East of Memorial Road Bridge (OBC3) East of St John's Road Bridge (OBC0A)	South Circular Road Junction South Circular Road Bridge (OBC1) St Johns Road Bridge (OBC0A)
	Area around Heuston Station and Yard	Area at Heuston Station Yard, including all platforms and sidings	Heuston Station Sidings around Heuston Station
St John's Road Bridge to Glasnevin Junction	Area from East of St John's Road Bridge (OBC0A) to East of Phoenix Park Tunnel	East of St John's Road Bridge (OBC0A) to East of Phoenix Park Tunnel	Potential new Heuston West Station Liffey Bridge (UBO1). Conyngham Road Bridge (OBO2) Phoenix Park Tunnel
	Area from Phoenix Park Tunnel to Glasnevin Junction	East of Phoenix Park Tunnel to South of Glasnevin Junction	McKee Barracks Bridge (OBO3) Blackhorse Avenue Bridge (OBO4) Old Cabra Road Bridge (OBO5) Cabra Road Bridge (OBO6) Fassaugh Avenue Bridge (OBO7) Royal Canal and LUAS Twin Arches (OBO8) Maynooth Line Twin Arch (OB09)

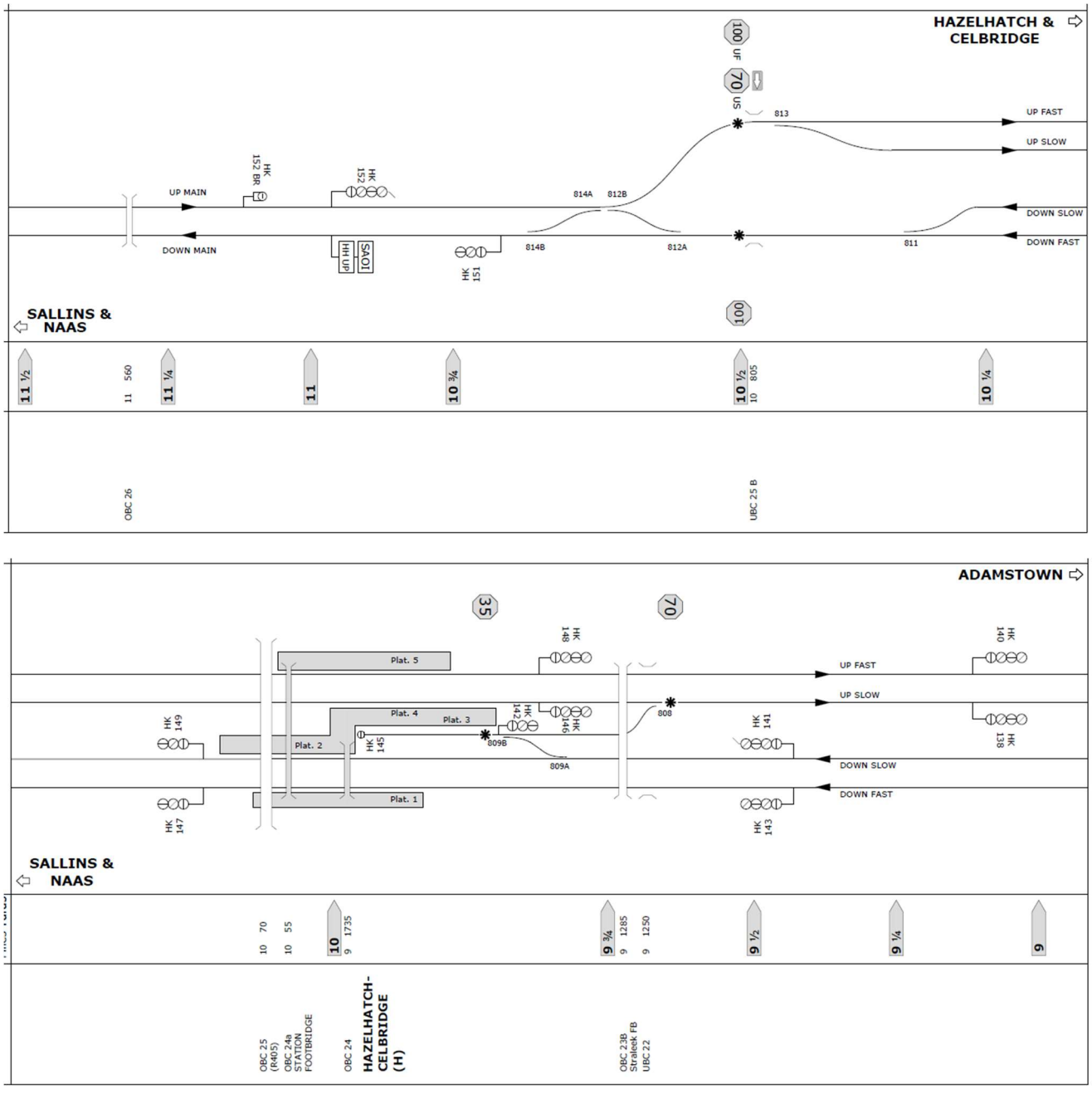
Area Name	Sub-area Description	Extents	Main Features
			Glasnevin Cemetery Road Bridge (OBO10)

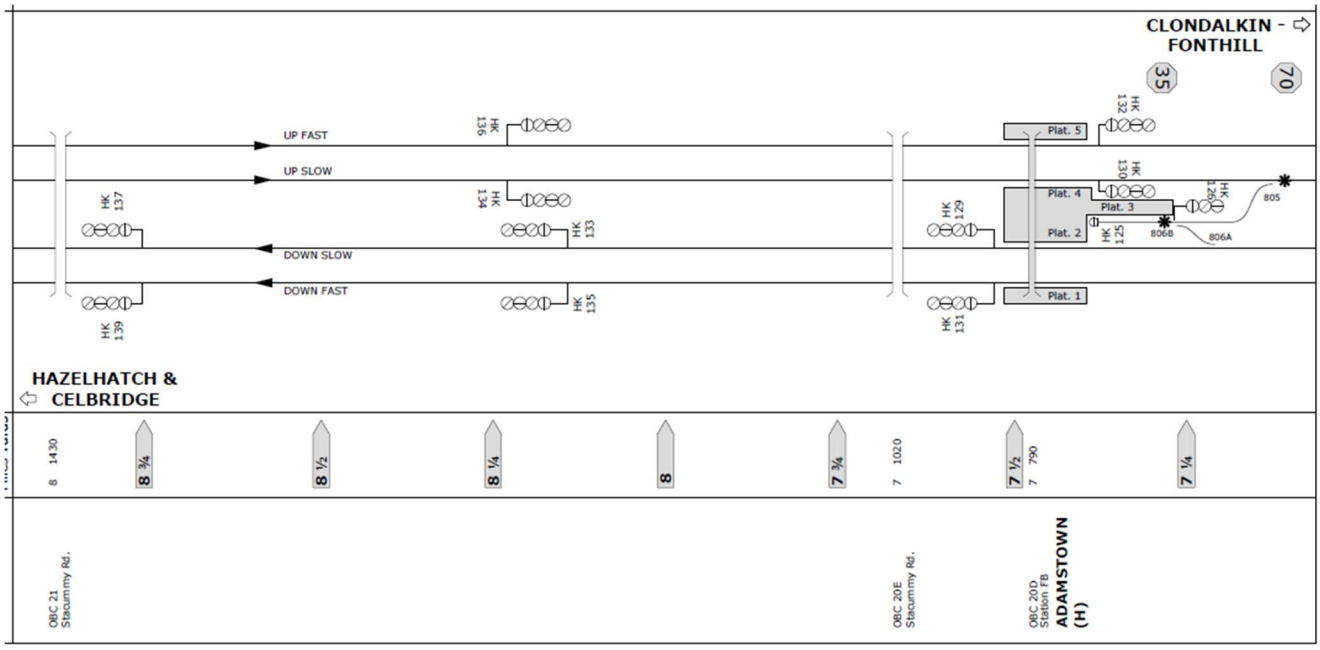
2. Existing Situation

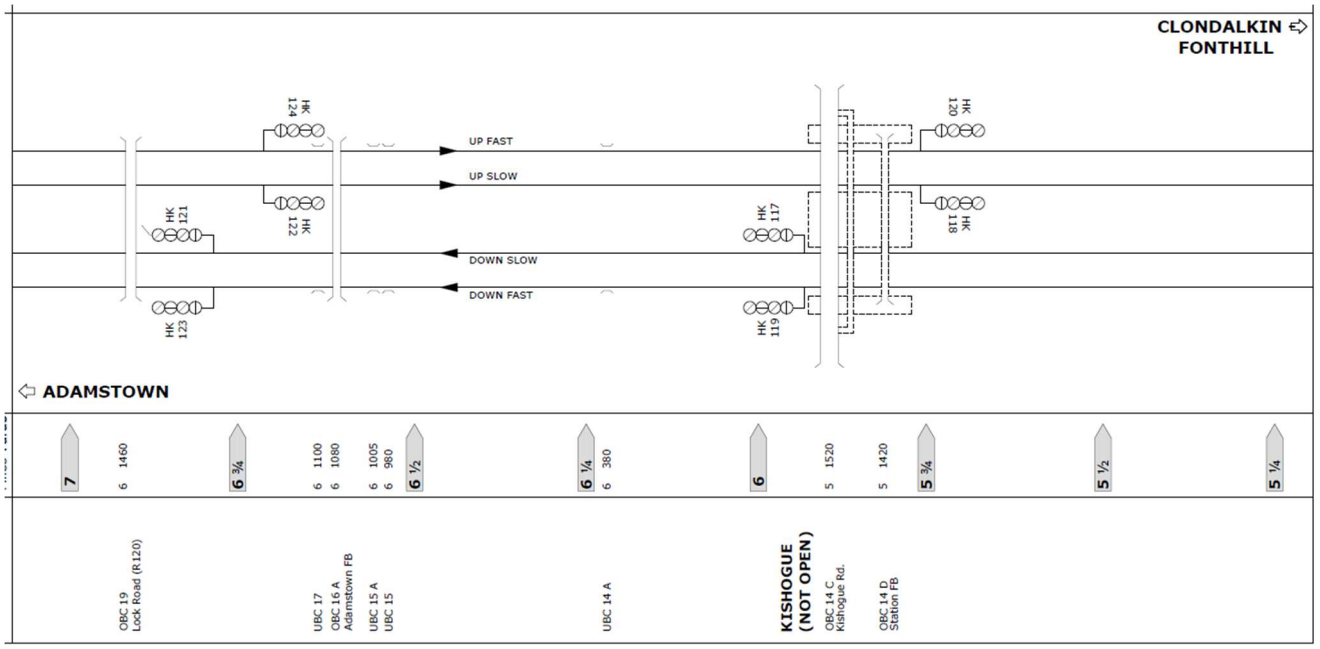
2.1. Overview

The subject area extends from the west side of Hazelhatch & Celbridge Station to Park West Station – approximately 9 km. Currently, the four-track section on the Cork Mainline commences on the south side of Hazelhatch Station where the two running lines, Up Main and Down Main, diverge into four lines – Up Fast, Up Slow, Down Slow and Down Fast. These continue on through Park West Station, west of Le Fanu Road Bridge (OBC7) before converging to two lines before reaching the location for the proposed future station at Kylemore Road Bridge (OBC5A) (Not part of the scope of this project). At Kylemore Road Bridge (OBC5A), the two tracks are joined by an additional siding, and the three tracks continue until they pass Inchicore works where the configuration is then three running lines.

The existing track layout schematic is shown in Figure 2.1.




CLONDALKIN - FONTHILL
35
70
UP FAST
UP SLOW
DOWN SLOW
DOWN FAST
HK 139
HK 137
HK 134
HK 133
HK 135
HK 139
HK 132
HK 130
HK 129
HK 126
HK 125
HK 131
Plat. 5
Plat. 4
Plat. 3
Plat. 2
Plat. 1
805
806B
806A
HAZELHATCH & CELBRIDGE
8 1430
8 ¾
8 ½
8 ¼
8
7 ¾
7 1020
7 ½
7 790
7 ¼
OBC 21 Stacumny Rd.
OBC 20E Stacumny Rd.
OBC 20D Station FB
ADAMSTOWN (H)


CLONDALKIN FONTHILL
HK 124
HK 121
HK 122
HK 123
UP FAST
UP SLOW
DOWN SLOW
DOWN FAST
HK 117
HK 119
HK 120
HK 118
ADAMSTOWN
7
6 1460
6 ¾
6 1100
6 1080
6 1005
6 980
6 ½
6 ¼
6 380
6
5 1520
5 1420
5 ¾
5 ½
5 ¼
OBC 19 Lock Road (R120)
UBC 17
OBC 16 A Adamstown FB
UBC 15 A
UBC 15
UBC 14 A
KISHOGUE (NOT OPEN)
OBC 14 C Kishogue Rd.
OBC 14 D Station FB

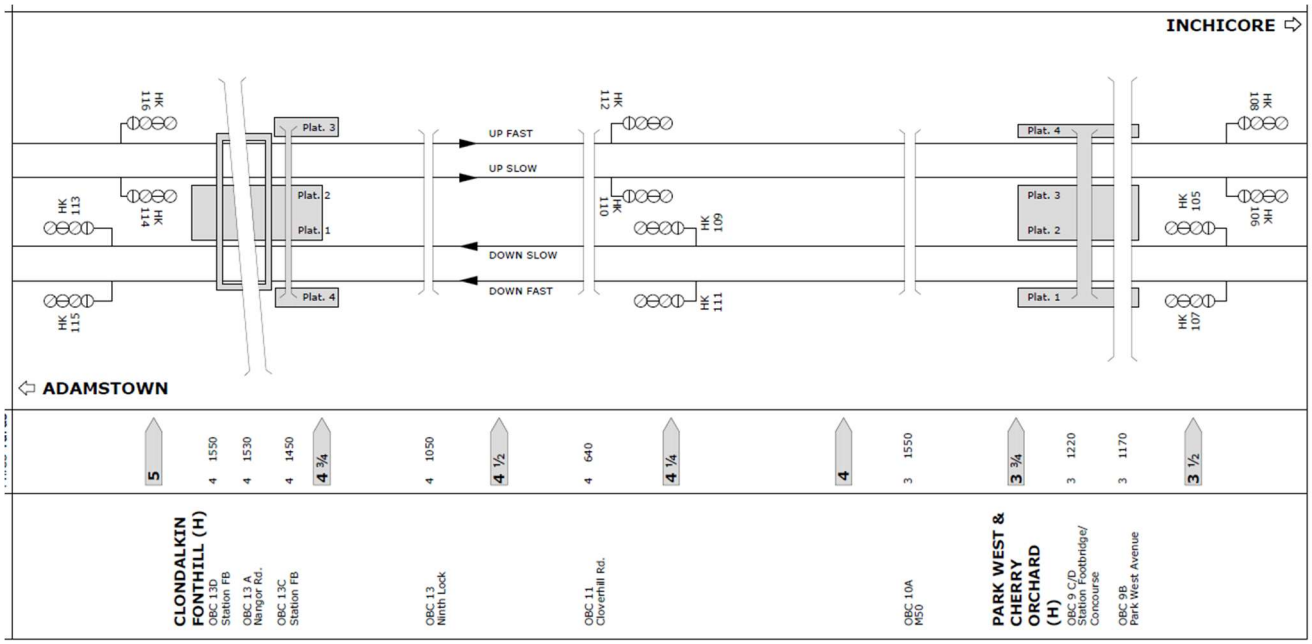


Figure 2-1 Existing track layout (Extracted from Route Information Book 1)

The project scope in this area is to reconfigure the 4 running lines to Up Slow, Down Slow, Up Fast, Down Fast and to electrify the two tracks on the north side (Slow tracks) for the DART services. New P&C layouts will be required in order to achieve the operational requirements, which will be explained in Section 5.

Additionally, four tracking will continue on through the railway corridor heading east towards Heuston Station.

The study area has numerous notable structures within its extents, including 10 road overbridges, plus footbridges and station concourses – all detailed in Section 2.3 “Structures” of this document. The study area does not currently have any provisions for electrification. The major infrastructure features are illustrated in the figure below.


OBC23B
N
Hazelhatch Station
OBC24
Hazelhatch Rd Bridge OBC25
OBC24A
Google


N
OBC2OE
OBC21

Figure 2-2 Aerial view of study area Hazelhatch – Park West

The rail corridor is predominantly at grade (i.e. the rail level is at the surrounding ground level) – though there are several retaining wall structures in the vicinity of Park West Station between 3 ¼ MP (Milepost) and 4 MP.

There are a number of existing Environmental features present. These include a mix of residential and commercial properties, community facilities, designated landscape areas, a heritage site and biodiversity constraints (e.g. invasive species).

2.2. Challenges

The project objectives for the Hazelhatch to Park West area are as follows:

- Reconfiguration of the four-tracking between Hazelhatch and Park West (DART Slow lines to the north, Intercity services on the Fast lines to the south).
- Electrification of DART+, i.e. 2 slow tracks to the North.
- Electrical clearance to structures for electrification.
- Keep current functionality of the existing network and Public roads.
- Track alignment and drainage requirements (in accordance with their respective standards).

2.3. Structures

The following text describes the various structures present along this section of the route, presented in sequence commencing in a westerly direction from Park West to Hazelhatch.

2.3.1. Park West Avenue Road Bridge (OBC9B)

Park West Avenue Road Bridge (OBC9B) is a single span bridge that carries Park West Avenue over four railway tracks and the Park West Station platforms. The bridge is located at mileage 3-1170. The deck is constructed with precast concrete beams.

Figure 2-3 Park West Avenue Road Bridge (OBC9B) East Elevation

2.3.2. Park West Station Concourse Bridge (OBC9C)

Park West Station Concourse Bridge (OBC9C) is a three span bridge that supports the Park West Station concourse over four railway tracks and the Park West Station platforms. The bridge is located at mileage 3-1200. The deck is constructed with precast concrete beams.

Figure 2-4 Park West Station Concourse Bridge (OBC9C) East Elevation

2.3.3. Park West Station Building Bridge (OBC9D)

Park West Station Building Bridge (OBC9D) is a two-span bridge that supports the Park West Station building over four railway tracks and the Park West Station platforms. The bridge is located at mileage 3-1240. The deck is constructed with steel girders.

Figure 2-5 Park West Station Building Bridge (OBC9D) West Elevation

2.3.4. M50 Motorway Bridge (OBC10A)

M50 Motorway Bridge (OBC10A) is a single span bridge that carries the M50 motorway over four railway tracks. The bridge is located at mileage 3-1550. The deck is constructed with precast concrete beams.

Figure 2-6 M50 Motorway Bridge (OBC10A) East Elevation

2.3.5. Cloverhill Road Bridge (OBC11)

Cloverhill Road Bridge (OBC11) is a single span bridge that carries the Station Road over four railway tracks. The bridge is located at mileage 4-0644. The deck is constructed with precast concrete beams.

Figure 2-7 Cloverhill Road Bridge (OBC11) East Elevation

2.3.6. Ninth Lock Bridge (OBC13)

Ninth Lock Bridge (OBC13) is a single span bridge that carries the Ninth Lock Road over four railway tracks. The bridge is located at mileage 4-1055. The deck is constructed with precast concrete beams.

Figure 2-8 Ninth Lock Bridge (OBC13) East Elevation

2.3.7. Clondalkin / Fonthill Station Building East (OBC13C)

Clondalkin / Fonthill Station Building East (OBC13C) is two span structure that supports the Clondalkin / Fonthill Station East building over four railway tracks and the station platforms. The bridge is located at mileage 4-1450. The deck is constructed with precast concrete beams.

Figure 2-9 Clondalkin / Fonthill Station Building East (OBC13C) East Elevation

2.3.8. Nangor Road Bridge (OBC13A)

Nangor Road Bridge (OBC13A) is a single span bridge that carries the Nangor Road over four railway tracks and the Clondalkin / Fonthill Station platforms. The bridge is located at mileage 4-1525. The deck is constructed with precast concrete beams.

Figure 2-10 Nangor Road Bridge (OBC13A) West Elevation

2.3.9. Clondalkin / Fonthill Station Building West (OBC13D)

Clondalkin / Fonthill Station Building West (OBC13D) is a two span structure that supports the Clondalkin / Fonthill West Station building over four railway tracks and the station platforms. The bridge is located at mileage 4-1550. The deck is constructed with precast concrete beams.

Figure 2-11 Clondalkin / Fonthill Station Building West (OBC13D) East Elevation

2.3.10. Kishoge Station Bridge (OBC14D)

Kishoge Station Bridge (OBC14D) is a two span structure that supports the Kishoge Station building over four railway tracks and the station platforms. The bridge is located at mileage 5-1419. The deck is constructed with precast concrete beams.

Figure 2-12 Kishoge Station Bridge (OBC14D) East Elevation

2.3.11. Kishoge Road Bridge (OBC14C)

Kishoge Road Bridge (OBC14C) is a single span bridge that carries the Kishoge Road over four railway tracks and the Kishoge Station platforms. The bridge is located at mileage 5-1514. The deck is constructed with precast concrete beams.

Figure 2-13 Kishoge Road Bridge (OBC14C) West Elevation

2.3.12. Adamstown Footbridge (OBC16A)

Adamstown Footbridge (OBC16A) is a two-span footbridge that carries Haydens Lane over four railway tracks and Adamstown Avenue. The bridge is located at mileage 6-1002. The deck is constructed with precast concrete beams.

Figure 2-14 Adamstown Footbridge (OBC16A) West Elevation

2.3.13. Finnstown R120 Road Bridge (OBC19)

Finnstown R120 Road Bridge (OBC19) is a two span bridge that carries the R120 road over four railway tracks and Adamstown Avenue. The bridge is located at mileage 6-1464. The deck is constructed with precast concrete beams.

Figure 2-15 Finnstown R120 Road Bridge (OBC19) East Elevation

2.3.14. Adamstown Station Building (OBC20D)

Adamstown Station Building (OBC20D) is a two span bridge that supports the Adamstown Station building over four railway tracks and the station platforms. The bridge is located at mileage 7-0790. The deck is constructed with steel beams.

Figure 2-16 Adamstown Station Building (OBC20D) East Elevation

2.3.15. Crowley's Bridge (OBC20E)

Crowley's Bridge (OBC20E) is a four span bridge that carries a third-party road over four railway tracks and Adamstown Avenue. The bridge is located at mileage 7-1018. The deck for spans 1 and 2 is constructed with precast concrete beams. The deck for spans 3 and 4 is constructed with steel girders.

Figure 2-17 Crowley's Bridge (OBC20E) East Elevation

2.3.16. Stacumny Bridge (OBC21)

Stacumny Bridge (OBC21) is a single span bridge that carries Tubber Lane over four railway tracks. The bridge is located at mileage 8-1419. The deck is constructed with precast concrete beams.

Figure 2-18 Stacumny Bridge (OBC21) West Elevation

2.3.17. Straleek Footbridge (OBC23B)

Straleek Footbridge (OBC23B) is a single span footbridge over four railway tracks in the townland of Straleek. The bridge is located at mileage 9-1285. The superstructure consists of a steel truss on steel bearings.

Figure 2-19 Straleek Footbridge (OBC23B) West Elevation

2.3.18. Hazelhatch Footbridge (OBC24)

Hazelhatch Footbridge (OBC24) is a single span footbridge over two railway tracks, from the central platform of Hazelhatch & Celbridge Station to the downside platform. The bridge is located at mileage 10-0050, approximately 90m north of Hazelhatch R405 Road Bridge (OBC25). The superstructure consists of a lattice truss supported on cast iron columns and trimmers, which also support the access stairs. This is a protected structure (RPS) and is closed off to public access. The bridge will not be impacted by the electrification works since the two tracks under are to serve intercity services only (non-electrified tracks).

Figure 2-20 Hazelhatch Footbridge (OBC24) West Elevation

2.3.19. Hazelhatch Footbridge (OBC24A)

Hazelhatch Footbridge (OBC24A) is a two span footbridge over four railway tracks and the Hazelhatch & Celbridge Station platforms. The bridge is located at mileage 8-1419. The superstructure consists of a warren truss and steel floor panels. The substructure consists of steel columns, access stairs and lift shafts.

Figure 2-21 Hazelhatch Footbridge (OBC24A) East Elevation

2.3.20. Hazelhatch R405 Road Bridge (OBC25)

Hazelhatch R405 Road Bridge (OBC25) is a two span bridge that carries the R405 Road over four railway tracks and the Hazelhatch & Celbridge station platforms. The bridge is located at mileage 10-0439. The deck is constructed with precast concrete beams.

Figure 2-22 Hazelhatch R405 Road Bridge (OBC25) East Elevation

2.3.21. Retaining Walls

According to existing IE database records, the following retaining walls are recorded 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 (East of Park West & Cherry Orchard Station)	RWC008UC	3mls 0158yrds	3mls 0401yrds	Up (North of Track)	Gabions	2.5m	Earth Retaining
Heuston – Hazelhatch (East of Park West & Cherry Orchard Station)	RWC008UD	3mls 0854yrds	3mls 1115yrds	Up (North of Track)	Gabions	2.5m	Earth Retaining
Heuston – Hazelhatch (East of Park West & Cherry Orchard Station)	RWC008UE	3mls 1115yrds	3mls 1205yrds	Up (North of Track)	Mass Concrete	2.5m	N/A

2.4. Permanent Way and Tracks

As described in Section 2.1 there are 4 tracks in this area - Up Fast, Up Slow, Down Slow and Down Fast - with the Fast lines operating at 100mph (160km/h) and the Slow lines at 70mph (110 km/h). **N.B.** Speeds quoted are maximums for the respective Fast and Slow lines.

The track gradient at Hazelhatch is nominally flat before rising at 1 in 323 to a crest at the mid-point between Hazelhatch & Celbridge Station and Adamstown Station, before falling at 1 in 243 on the approach to Adamstown Station. The track gradient is then nominally flat to a point east of Park West & Cherry Orchard Station near Park West Avenue Road Bridge (OBC 9B).

Ballasted track with concrete sleepers is found in the area. The P&Cs are normally with wooden / timber sleepers but also some units with concrete bearers. The P&Cs are normally protected by adjustment switches.

2.5. Other Railway Facilities: Stations

There are 5 stations located in this area, in a four-track corridor, currently with a Fast-Slow-Slow-Fast configuration. The stations are, from east to west:

- Park West & Cherry Orchard
- Clondalkin / Fonthill
- Kishoge
- Adamstown

- Hazelhatch & Celbridge

Figure 2-23 below shows the location of the existing stations.

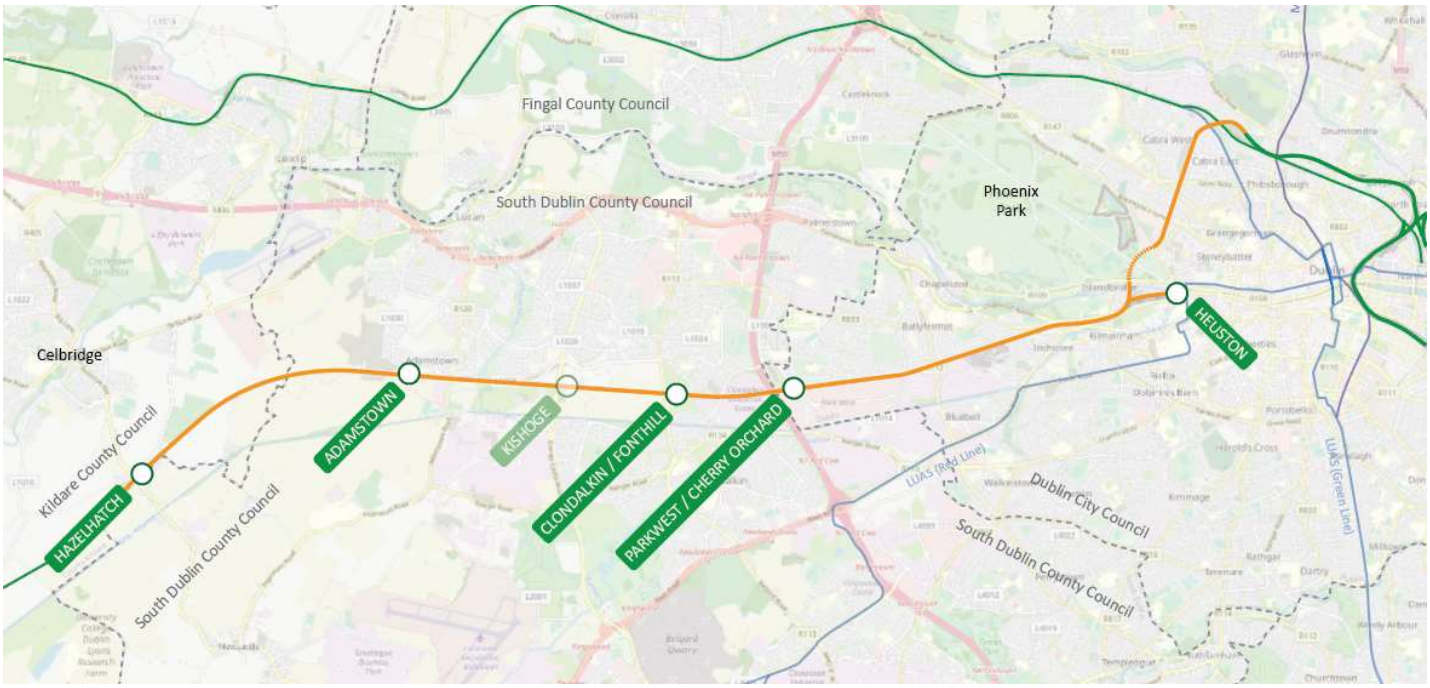


Figure 2-23 Cork Mainline - Existing Stations.

All stations have a similar arrangement, with a central island platform providing up and down side platforms. The passengers are distributed from the station building that crosses above the tracks. The only exception to this scheme is Hazelhatch, which has an entrance building north of the tracks and provides access to platforms through a footbridge, having also the central island / up and down side platforms arrangement.

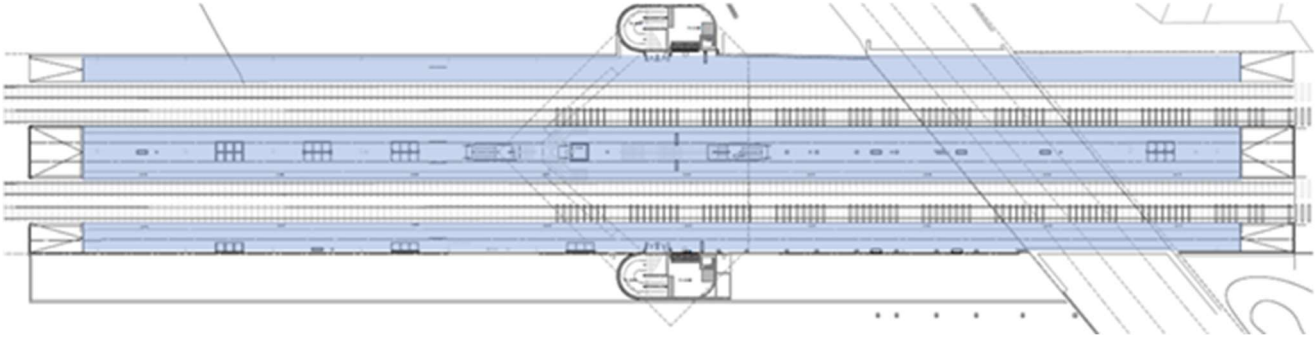


Figure 2-24 Typical platform arrangement. Park West & Cherry Ordchard Station. Platform level plan.

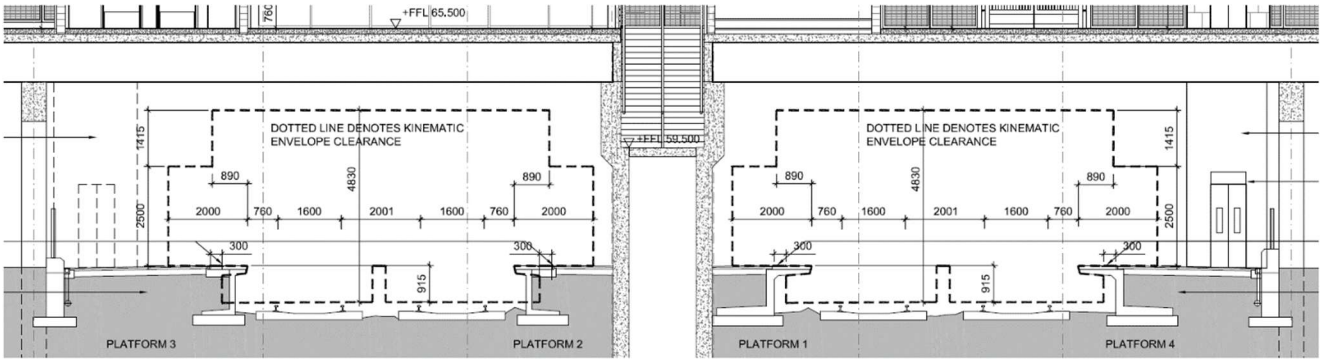


Figure 2-25 Typical platform arrangement at Clondalkin / Fonthill station

According to the project´s objectives the service will change to Slow-Slow-Fast-Fast (north to south), see Figure 2-26 below, which is feasible by the symmetric arrangement the stations typically have.

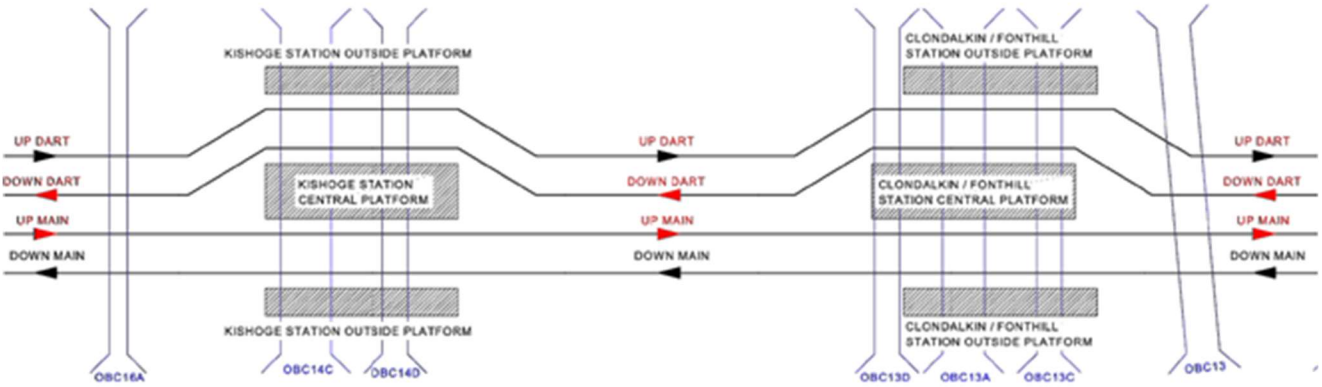


Figure 2-26 Future Line diagram. Kishoge and Clondalkin / Fonthill stations

The change of the operation scheme to Slow-Slow-Fast-Fast and the future increase in passenger demand requires the analysis of the station sizing and the accesses to the platforms. Typically, the north (Up) platforms are not currently in use in these stations.

As indicated in section 2.3 of this report, the structure clearances in the station buildings are suitable for the electrification of the future DART tracks.

2.5.1. Park West & Cherry Orchard

Park West & Cherry Orchard Station is an existing bridge-type station, adjacent to the Park West Avenue bridge.

Public access is provided from the bridge and a covered concourse distributes the access to the central and side platforms.

A new turn-back platform is provided, added to the central platform, for operational purposes as part of the scope of this project. Similar arrangements already exist in Adamstown and Hazelhatch & Celbridge Stations.

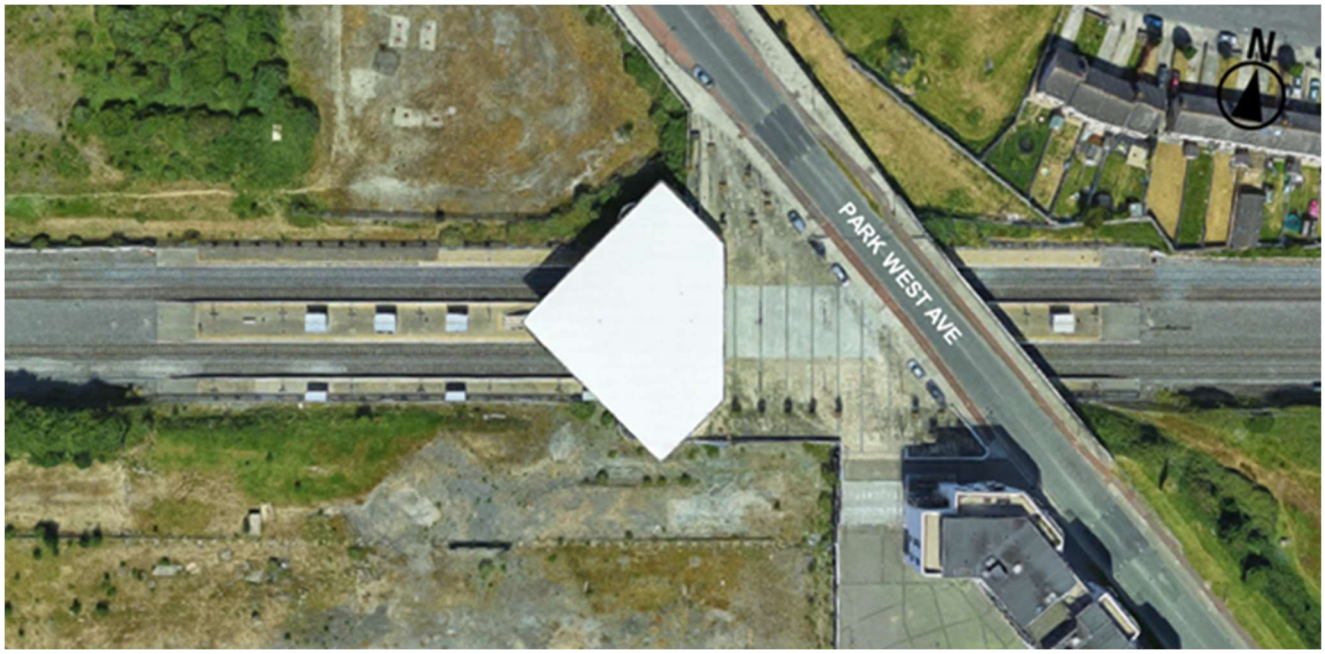


Figure 2-27 Park West & Cherry Orchard Station. Aerial view.

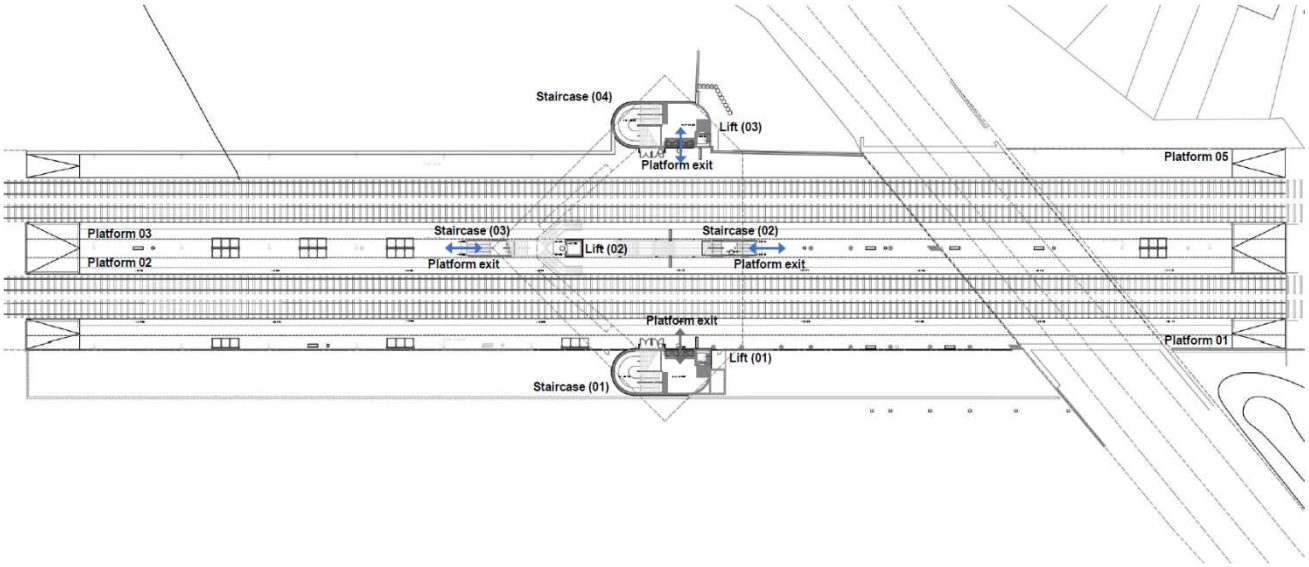


Figure 2-28 Park West & Cherry Orchard Station. Platform level plan.

2.5.2. Clondalkin / Fonthill

Clondalkin / Fonthill station has two concourse buildings, located either side of regional road R113.

The side platforms are located on the eastern side of the bridge only, while the central platform is continuous throughout and covers both station buildings.

The west building was designed to provide access to the central platform, and is currently closed. The east building currently provides access to all platforms. An operational car park is located to the south..

In the east building, public access is both provided to the platforms and a car park to the south.

Figure 2-29 Clondalkin / Fonthill station. Aerial view

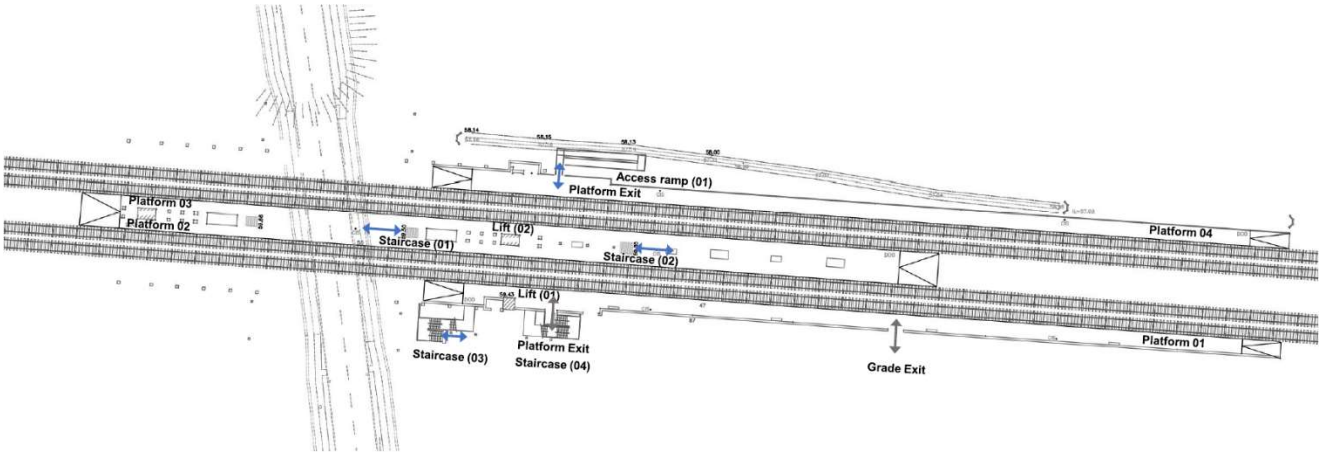


Figure 2-30 Clondalkin / Fonthill station. E & W buildings. Platform level plan

2.5.3. Kishoge

Kishoge station building is adjacent to the eastern side of Kishoge bridge (OBC14C). It is similar in layout to the east concourse building at Clondalkin / Fonthill. The three platforms are aligned, centred below the building. The station is not currently operational.

Access to concourse is provided from the R136 via two footbridges.

A new car park has been developed to the south of the station, similar to the one at Clondalkin / Fonthill Station.

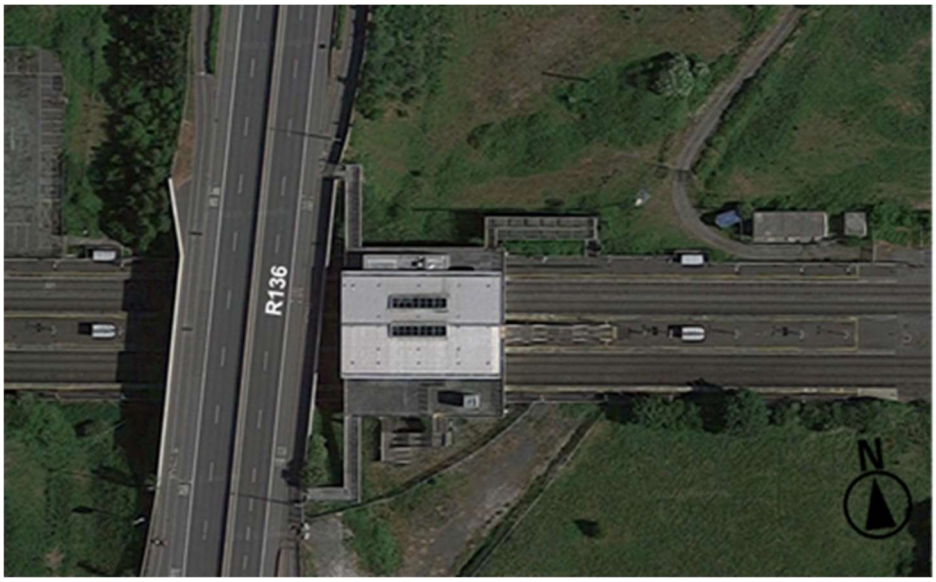


Figure 2-31 Kishoge station. Aerial view.

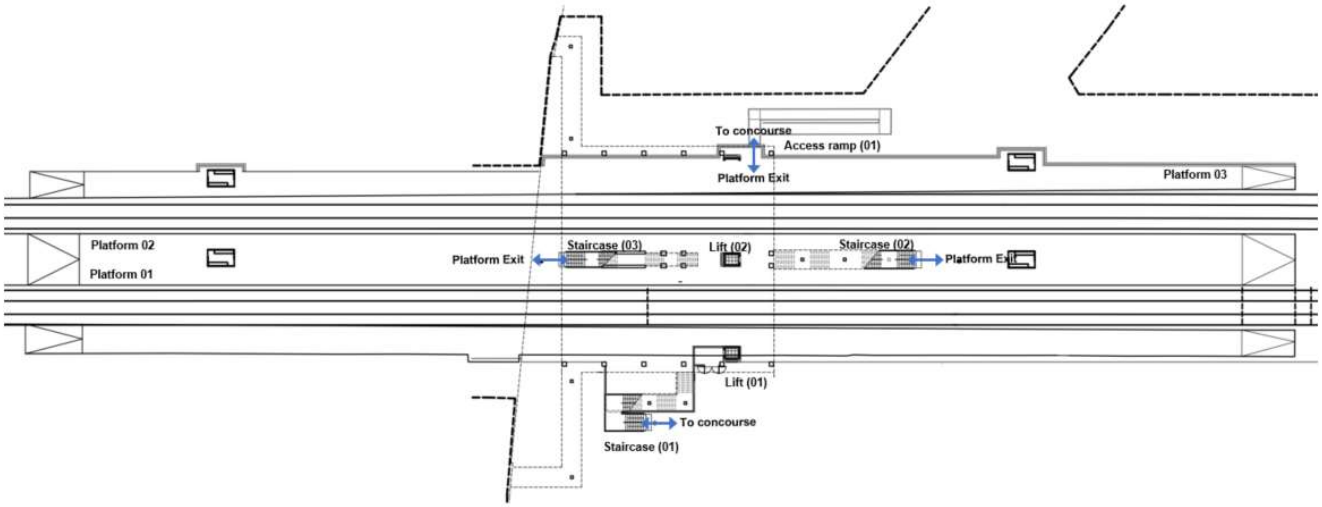


Figure 2-32 Kishoge station. Platform level plan.

2.5.4. Adamstown

Similar to Park West & Cherry Orchard Station, Adamstown Station is a bridge-type station located approximately 300m west of the Adamstown development area. Access is provided from the northern side of the railway where a local road runs parallel to the track. The platform layout includes a terminal / turn-back platform which is located on the eastern side of the station. The building design and layout is similar to that at Park West & Cherry Orchard Station.

Figure 2-33 Adamstown station. Turnback platform at the East

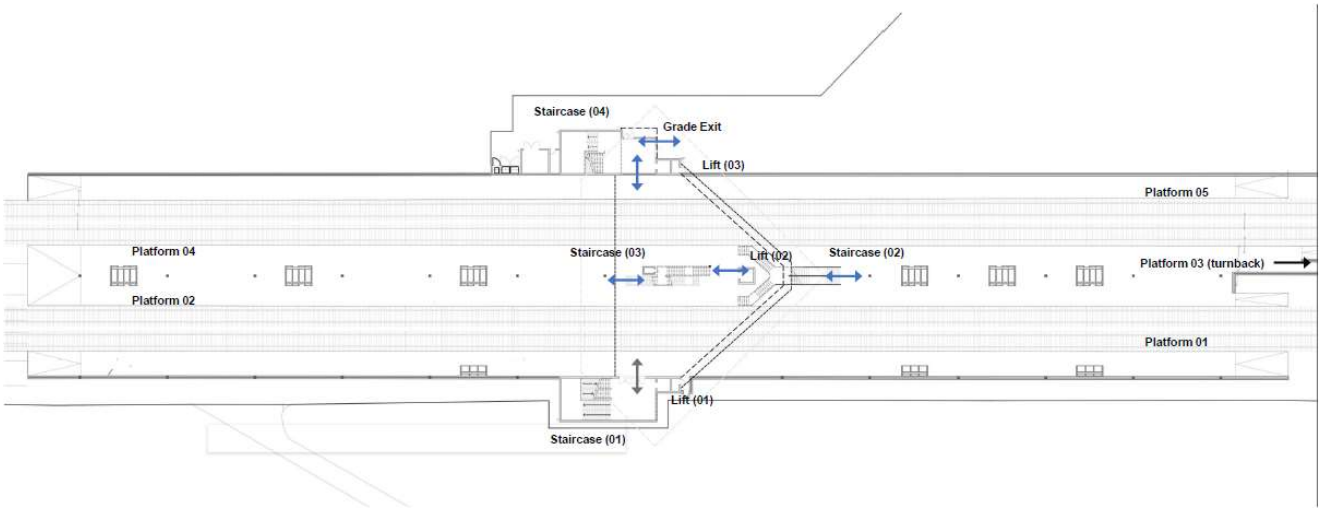


Figure 2-34 Adamstown station. Platform level plan

2.5.5. Hazelhatch & Celbridge

Hazelhatch & Celbridge Station is located approximately 2km south of Celbridge town on regional road R405. The station straddles the border between counties Kildare and Dublin.

The station layout consists of one central and two side platform areas with a turnback provided at the eastern end of the station, i.e. 5 platforms in total. The platforms are provided in an offset arrangement, with the central and southern platforms extending west below Hazelhatch R405 Road Bridge (OBC25). The station will operate as terminus station for proposed DART trains. Hence, the turnback service will be enhanced for Heuston and PPT / Dublin Connolly services.

The access building is on the platform level, to the north of the track area. A pedestrian footbridge provides access via stairs and lifts to the platforms.

The central platform area includes a number of historic buildings including the original station building and a pedestrian footbridge, both dating back to the 19th century.

Figure 2-35 Hazelhatch & Celbridge Station. Aerial view.

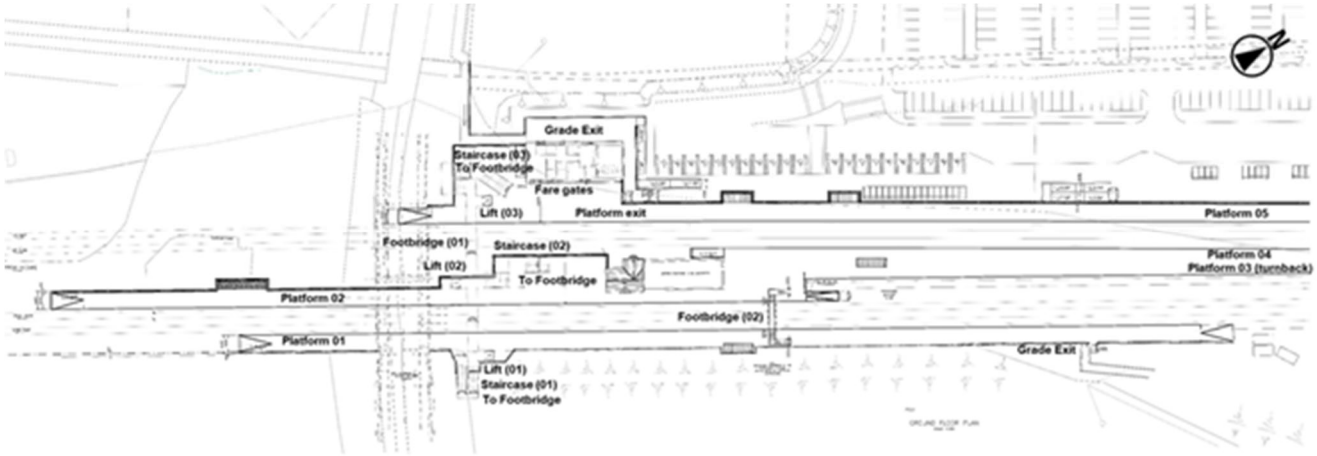


Figure 2-36 Hazelhatch & Celbridge Station. General plan.

2.5.6. Future Station Enhancement Works

Current Capacity Review studies have concluded that the existing stations sizing will be adequate to accommodate future passengers demand generally. However, specific local improvement measures necessary to meet current building regulations and / or other project-specific parameters have also been identified and will inform the requirement for future enhancement works.

In the case of the closed Clondalkin / Fonthill station, it is considered in principle the public will continue accessing only through the east building, since it is the one that provides access to all the platforms. The west building may provide further service in the future to additional requirements if needed.

2.6. Road Network

There are several roads crossing the railway within the subject area all of which all are via overbridges identified in section 2.3 above. In principle there are no interventions foreseen for these sections of road, however this section will be completed once the outcome of the GI investigations is available and a more detailed analysis on each bridge are completed.

2.7. Ground Conditions

The general topography of the subject area is flat and sloping gently towards the north. To the east of the existing Park West & Cherry Orchard Station the railway is in a cutting. To the west of Park West & Cherry Orchard Station, the height of the cutting gradually decreases and thereafter the railway is generally at grade or minor cutting throughout the study area.

The general superficial geology in the area is anticipated to comprise till overlying bedrock (limestone and shale). Isolated outcrops of limestone and shale at or near the ground surface is noted in places immediately to the east and west of the existing Adamstown Station between Stacummy and the R120 at Adamstown. A pocket of gravel overlying bedrock (limestone and shale) is shown underlying the track at Moorfield.

Existing historical ground investigation between Kylemore Road Bridge (OBC5A) and Hazelhatch & Celbridge Station show the ground conditions to comprise ballast overlying dark clay. Dense to medium dense gravel/sand and cobbles were occasionally recorded underlying both the clay and ballast strata. Bedrock was met in several exploratory holes underlying the superficial deposits at depths ranging between 0.50m bgl (58.34m AOD) and 4.40m bgl (53.15m AOD). Shallow bedrock encountered at less than 1.0m bgl was generally encountered between chainage 276+000 (Adamstown) and 277+200 (Adamstown Station).

Historical ground investigation was completed at three sites as part of the four tracking of the railway between Hazelhatch & Celbridge Station and Park West & Cherry Orchard Station in 2006. The ground investigation typically recorded a thin layer of topsoil underlain by a firm to very stiff silt/clay with locally soft silt/clay and occasional gravel and sand. Gravel was generally described as medium dense with limestone cobbles. Bedrock recorded as moderately strong limestone was encountered at depths ranging from 1.3m bgl (61.28m AOD to 9.2m bgl (51.30m AOD).

Peat was recorded between chainage 274+800m and 275+000m (East of Kishoge), however there were traces of organic material within a number of other exploratory holes throughout the area. Route-wide dynamic probes also identified potential soft deposits at several isolated locations within the rail corridor throughout the area but predominately encountered between chainage 274+600 (Kishoge) and 271+000 (Park West).

In the area west of Hazelhatch & Celbridge Station, historical ground investigation was completed to investigate an area of brownfield immediately west of the station. Anecdotal evidence indicated that there was previously a quarry that had been backfilled. Ground conditions typically encountered made ground between ground level and 9.20m bgl. Made ground generally comprised of firm to stiff clay, very loose gravel of ash, clinker, spent coal and boiler slag. Made ground was underlain by very soft silt, clay, sand and gravel. Bedrock consisting of a strong limestone was confirmed at depths ranging from 3.80m bgl (53.06m AOD) to 9.30m bgl (47.60m AOD).

2.8. Environment

This encompasses the area from west of Park West Avenue Road Bridge (OBC9B) to west of Hazelhatch R405 Road Bridge (OBC25). This area has been the subject of previous rail enhancements as part of the Kildare Route Project Phase 1.

Commencing at Park West & Cherry Orchard Station, the area west of the M50 toward Station Road is predominantly commercial and industrial premises north and south of the rail corridor, including an industrial estate and two EPA-licensed industrial emissions facilities. Between the Station Road, Clondalkin and the Lucan-Newlands Road there are residential properties north and south of the existing corridor and there is a community college located north of the existing line; Lynch's park is in proximity to the rail corridor and has traveller's accommodation. To the south of Clondalkin and around the canal, is Clonburris Strategic Development Zone (SDZ) which includes road proposals and new communities, residential development and businesses. There is also significant residential development at Adamstown, north of the existing line; Adamstown is also an SDZ. There are also several schools adjacent to the existing line on Station Road. The rail corridor then traverses more open greenfield/suburban landscape with a number of commercial properties found in the Stacumney area,

mainly on the north side. There is a Pitch'n'Putt course between the rail line and the Loughlinstown Road. At Hazelhatch, there is another grouping of mainly residential properties either side of the existing line and on the north-west side of Hazelhatch & Celbridge Station.

To the west of Clondalkin / Fonthill train station, there is an RMP enclosure site with an associated encircling SMR zone. There are several features listed on the National Inventory of Architectural Heritage (NIAH) in the area including the Station Road overbridge; the Railway Station House; and Lucan-Newlands Road overbridge. On the northern side of the existing line is Coolevin House (an NIAH and on the Record of Protected Structures (RPS)). Further north again are various NIAH, RPS, features on the Record of Monuments and Places (RMP) and Sites and Monuments Records (SMR). West of the Adamstown Road and south of the existing rail line and is an RMP (castle tower house) with an associated SMR Zone. There are two RMPs/SMR Zones – a church and a graveyard. Stacumney House is a historic house/demesne, and Stacumney Cottage is an RMP. Hazelhatch & Celbridge Station is both an NIAH and an RPS feature, as are the station gates/railings. The footbridge (near the Hazelhatch Road) crossing both the up and down train lines is an NIAH, while another footbridge crossing just the down line/ southern track is classed as an RPS.

Around the Adamstown area, the landscape character area (LCA) for South Dublin County Council indicates these green spaces are part of the Lucan LCA (Suburban South Dublin). The area north and south of Hazelhatch is part of the Kildare LCA (Northern Lowlands). On the southern side of the line the LCA is mainly covered by SDCC LCA (Newcastle Lowlands).

Just to the west of the M50 crossing there has been recent linear replanting along the rail line. There is green/ open space north of the existing line at Griffeen Valley and south at Waterstown Park. Artificial ponds (north side of the existing line) are located in Griffeen Valley Park. The Griffeen River is known to host salmonid species and currently has Good Water Framework Directive (WFD) ecological status. In Stacumney, on the northern side of the existing line is an old bungalow-type building noted for bat roost potential. On the southern side of the line, the old lime kiln was also noted for bat roost potential. On Balscott Lane, just on the border of KCC and SDCC administrative boundary, is a small stand of Japanese knotweed. During the 2011 EIS, invasive plant species were noted at Hazelhatch. There is also a record of otter potential for the Castletown River.

The groundwater vulnerability underlying the study area generally ranges from high and extreme/or rock near surface. Much of the subsoils are comprised of till derived from limestones, and some limestone gravels around Adamstown where there is also some bedrock at or near the surface along a section of the existing rail line. A faultline trends NE-SW traversing the rail line on approach to Stacumney.

Several overhead lines cross the existing rail line a number of times, as well as a number of underground lines. Many of the urban/residential areas are serviced by the low and medium pressure gas pipeline network, crossing the rail corridor mainly at road crossings, and there are two high pressure gas pipeline crossings.

The area west of the Hazelhatch & Celbridge Station is broadly rural in nature with large open field systems; this area is part of the Kildare Landscape Character Area (LCA) (Northern Lowlands) and South Dublin LCA (Newcastle Lowlands).

There are also small clusters of residential development, notably houses along Lord's Road to the northwest of Hazelhatch & Celbridge Station. The settlement of Celbridge town is located to the north and is an important regional town within Kildare, also functioning as a commuter town for Dublin and other significant employment centres in the region. Celbridge has experienced significant growth with more than a doubling of the population in the past 30 years. There are a collection of built heritage NIAH features in the vicinity of the train station, including Hazelhatch Bridge (which was replaced as part of the Kildare Route Project (KRP) Phase 1), the footbridge and the train station. To the south there are further NIAH listed features, and a further cluster south of the rail line around the Grand Canal and the R405 Road crossing. Lyons House and Estate is located to the south west of the train station and is an historic house and demesne as well as being on the Record of Protected Structures (RPS) under the Kildare County Development Plan (CDP). The estate includes a hotel and is also

associated with the UCD Lyons Farm. The Newcastle Estate, some 2.5km to the south of the rail line is an Architectural Conservation Area (ACA). Two RMP sites are located to the southwest of the station.

The Castletown Stream is located in the station area and flows north to the Liffey. It has Unassigned Water Framework Directive (WFD) ecological status. There is evidence of otter from NBDC records at the station car park and some evidence of invasive plant species in the vicinity of the station from previous ecological surveys. The Hazelhatch area has experienced multiple significant flood events in recent decades.

Refer to Section 4.1 (Environment) **Error! Reference source not found.** for further details.

2.9. Utilities

The roads network and rail corridor contains a significant number of utilities, albeit more sparsely spread than other areas along the Cork Mainline. Service providers with network assets in this area include the following:

- Aurora Telecom
- EIR
- ESB Networks
- Virgin Media
- Gas Networks Ireland
- ZAYO (T-50 Network Operators)
- South Dublin County Council Road Drainage (Storm Water Sewers)
- South Dublin County Council / Irish Water (Foul Water Sewers)
- South Dublin County Council / Irish Water (Water Supply)
- South Dublin County 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 roads/streets and rail line bridge crossings.

A number of services are also present at track level, crossing the railway corridor above or below the tracks. Consideration of the impacts on these services will also be necessary.

A number of key network infrastructure elements for particular utility providers are present and may 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 service conflcits cannot be avoided by design.

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:

- Signalling reconfiguration of the four-tracking between Hazelhatch and Park West (slow DART + lines to the north, fast Intercity lines to the south).
- Electrification of the two tracks to the north to accommodate DART+..
- Electrical clearance to structures.
- Keep current functionality of the existing network and public roads.
- Track alignment and drainage requirements (in accordance with their respective standards).

3.2. Systems Infrastructure and Integration

In addition to the track and civil infrastructure modifications relating to them DART+ South West Project, there is a requirement to provide Overhead Line Electrification Equipment (OHLE) signalling and telecoms infrastructure.

The electrification system will be similar in style to that currently used on the existing DART network and integrated and compatible across the DART+ Programme. 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 currently being developed. The Dart wide programme will adopt a 1500V Direct Current (DC) OHLE system to provide electrical power to the network's new electric train fleet.

It should be noted that all OHLE diagrams in this report are for visual information only. 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.

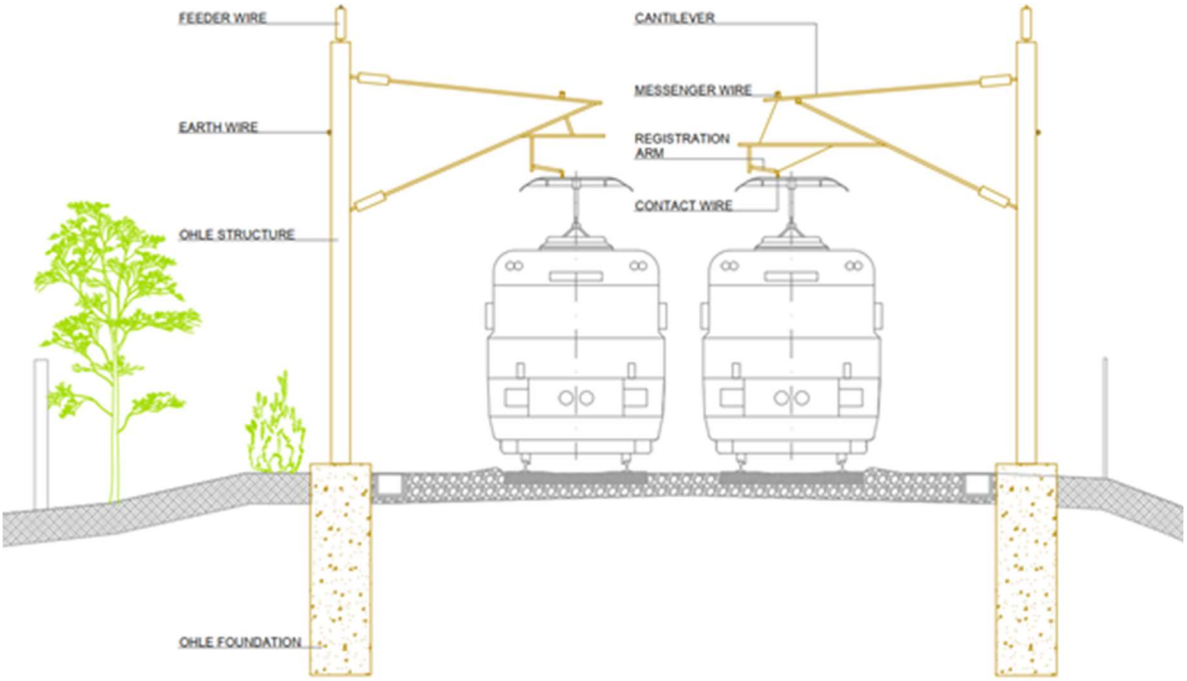


Figure 3-1 Typical OHLE arrangement in two track open route

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.

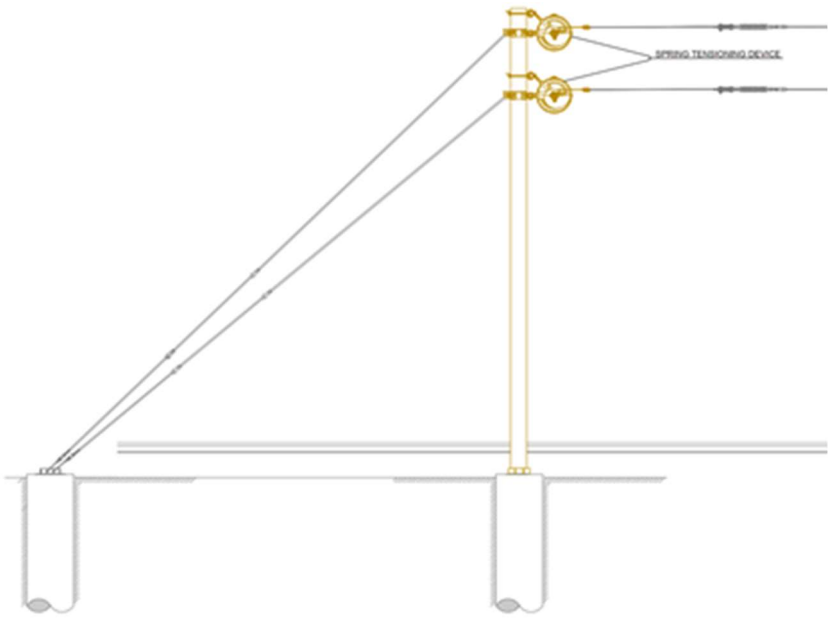


Figure 3-2 Typical anchor structure

The OHLE configuration through the overbridges for each track or civils option is currently being. This includes level and graded free running options, as well as level and graded options with elastic bridge arms fitted to the bridge.

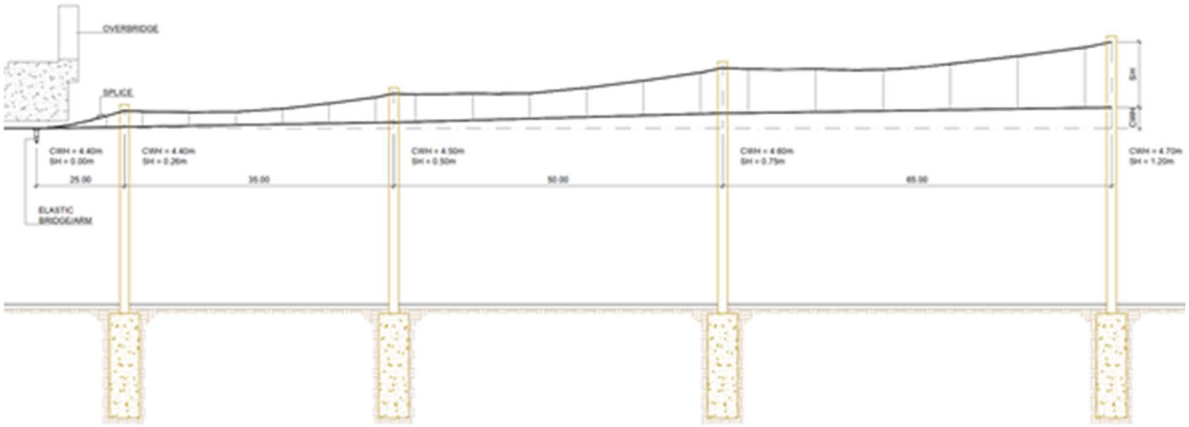


Figure 3-3 Typical arrangement on approach to a low bridge

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 encompasses the area from west of Park West Avenue Road Bridge (OBC9B) to west of Hazelhatch R405 Road Bridge (OBC25). This area has been the subject of previous rail enhancements as part of the Kildare Route Project Phase 1.

Commencing at Park West & Cherry Orchard Rail Station and heading west, the rail corridor passes under the M50 where, just to the west of this crossing there has been recent linear replanting along the rail line. West of the M50 toward Station Road is predominantly commercial and industrial premises both north and south of the rail corridor. The Clondalkin Industrial Estate is located to the south of the corridor. There are two EPA-licensed industrial emissions facilities: Greyhound Recycling & Recovery and Metal Processors Limited.

Between the Station Road and the Lucan-Newbridge Road there are residential properties both north and south of the existing corridor. Residential estates include Moorfields Estates to the north and John Connelly Estate to the south [within 200m of the existing rail line].

There are several features listed on the National Inventory of Architectural Heritage (NIAH) in the area including: the Station Road (L1006) Bridge, Clondalkin over the rail line; the Railway Station House; the bridge over Lucan-Newlands Road; and two houses just to the south of the existing rail line (within 50m). On the northern side of the existing line (within 50-100m) is Coolevin House which is also listed on the NIAH and furthermore is included on the list of Record of Protected Structures (RPS) for the county. Further north again, located between the Lucan-Newlands Road and the Neilstown Road, is Neilstown Lodge which is an NIAH and an RPS. There is also a castle and a 16th/17th century house, further to the north of the line both registered on the Record of Monuments and Places (RMP) and Sites and Monuments Records (SMR). Approximately 150m to the west of Clondalkin / Fonthill Station, there is an enclosure site (RMP) located within the 50-100m buffer band, however its associated encircling SMR zone designation covers a wider area and is in proximity to the existing rail line. To the south of Clondalkin and around the canal, is Clonburris Strategic Development Zone (SDZ) which includes road proposals and new communities, residential development and businesses.

Kishoge & Griffeen Community College is located north of the existing line (within 250-300m buffer band from the rail centreline). Lynch's park is in closer proximity to the rail corridor and has traveller's accommodation.

There is significant residential development at Adamstown, north of the existing line along Adamstown Avenue. There are several schools adjacent to the existing line on Station Road (L5787): Kishoge Community School; Adamstown Community College; Saint John the Evangelist National School; and Adamstown Castle Educate Together National School. Adamstown is also an SDZ.

There is green / open space north of the existing line at Griffeen Valley and south at Waterstown Park. Artificial ponds (north side of the existing line) were noted near Hayden's Lane in Griffeen Valley Park during previous ecology surveys. The Griffeen River itself is also known to host salmonid species.

Around the Adamstown area, the landscape character area (LCA) for South Dublin County Council indicates these green spaces are part of the Lucan LCA (Suburban South Dublin). Approximately 100m to the south side of the existing rail line and to the west of the Adamstown Road, there is an RMP (a castle tower house) with an associated encircling SMR Zone designation. Approximately 250m south of Adamstown Railway Station is an RMP (enclosure) with an associated SMR Zone designation. There is bedrock at or near the surface along a section of the existing rail line at Adamstown.

There are then a number of commercial properties in the Stacumney area, mainly on the north side of the existing line within 100m-200m of the rail line. Just on the northern side adjacent to the existing line is an old bungalow-type building which was noted for bat roost potential during ecology field surveys. On the southern side of the

line, the old lime kiln was also noted for bat roost potential during the 2011 EIS. There are two RMPs/SMR Zones – a church and a graveyard. Stacumney House, a historic house/demesne, is also located here. On the south side of the line Approximately100m is an RMP site (Stacumney Cottage, an enclosure). There is a Pitch n Putt course between the existing rail line and the Loughlinstown Road. A 110 kV overhead line also crosses the rail line in this area. This area is north and south is part of the Kildare LCA (Northern Lowlands). On the southern side of the line at Hazelhatch station, the LCA is mainly covered by SDCC LCA (Newcastle Lowlands). A faultline also trends NE-SW traversing the rail line on approach to Stacumney.

Then there is another grouping of mainly residential properties either side of the existing line and on the north-west side of Hazelhatch & Celbridge Station. On Balscott Lane (L6005) near the station, there are the gates/railings/walls of Hazelhatch & Celbridge Station, which is classed as both an NIAH and an RPS feature. The station building is also classed as an NIAH and RPS. The footbridge (OBC24A) (near the Hazelhatch Road) crossing both the up and down train lines is classed as an NIAH, while another footbridge (OBC24) crossing just the down line/ southern track is classed as an RPS. On Balscott Lane, just on the border of KCC and SDCC administrative boundary, there is a small stand of Japanese knotweed noted during the 2020 ecology survey, around the Iarnród Éireann junction box; it extends up-slope and into a private hedgeline. Of note is an NBDC record of otter potential for the Castletown River. During the 2011 EIS, invasive plant species were noted at Hazelhatch.

A 220 kV overhead line crosses the existing rail line a number of times: near the M50, three times at Adamstown, and at Loughlinstown near Hazelhatch. There are two 38 kV underground lines which also cross the corridor near Park West Avenue and at Grange Castle Road (R136). Many of the urban/residential areas are serviced by the low and medium pressure gas pipeline network, crossing the rail corridor mainly at road crossings. There are two high pressure pipeline crossings – at the Fonthill Road North (R113) and the Grange Castle Road.

Much of the groundwater vulnerability underlying this area is rated between high and extreme/rock near surface. Much of the subsoils traversing the area are comprised of till derived from limestones; limestone gravels are found around Adamstown.

It is noted that Ninth Lock Bridge (OCB13), Cloverhill Road Bridge (OBC11) and the Finnstown R120 Road Bridge (OBC19) were all replaced as part of the previous KRP Phase 1, although they remain listed as NIAH.

The area west of Hazelhatch & Celbridge Station is broadly rural in nature with large open field systems, however there are also small clusters of residential development, notably houses along Lord's Road to the northwest of the station. These houses are within the 200-300m buffer area of the rail centreline at this location. The settlement of Celbridge town is located approximately 2km to the north.

There are a collection of built heritage features in the vicinity of the train station including Hazelhatch R405 Road Bridge (OBC25), Hazelhatch Footbridge (OBC24) and the train station, all listed as NIAH (although the Hazelhatch Road Bridge (OBC25) was replaced as part of the Kildare Route Project (KRP) Phase 1). The Castletown Stream is located in the station area and flows north to the Liffey. It has Unassigned Water Framework Directive (WFD) ecological status. There is evidence of otter from National Biodiversity Data Centre (NBDC) records at the station car park and some evidence of invasive plant species in the vicinity of the station from previous ecological surveys. The Hazelhatch area has experienced multiple significant flood events in recent decades.

4.2. Permanent Way

The vertical and horizontal alignment is constrained by the elements summarised in the table below.

Table 4-1 Permanent Way Geometrical Constraints

ID	Name	Description
1	Track geometry: location of tie-in to existing alignment	There exists a length of plain line that is supported by piled formation, located on the proposed slow track west of Hazelhatch & Celbridge Station. It is a requirement to tie-in the proposed alignment to the existing track prior to this piled area. In order to do this it may be necessary to install a double junction (including a diamond crossing) which may be difficult to maintain.
2	Existing station and depot functionality	The location of the P&C on the east side of Hazelhatch & Celbridge Platform 2 means that the switch toe is only 5m from the end of the existing platform, so there may need to be a localised alteration to the platform to accommodate end throw of trains traversing the points.

The design speed through this section is a project objective:

- Fast lines 100mph (160km/h)
- Slow lines 70mph (110km/h) - DART services (to be electrified)

As an exception to the above, it is noted that where trains diverge across P&C's the local speed in the vicinity of the turnout may be limited to the operational speed capacity of the P&C - i.e. the track geometry emanating from a turnout is a limiting factor.

Track spacing will nominally be thus:

- Up Slow to Down Slow – standard sixfoot (2.0m between tracks)
- Down Slow to Up Fast - standard tenfoot (3.6m between tracks)
- Up Fast to Down Fast – standard sixfoot (2.0m between tracks)

Points and Crossings (P&C's) will, wherever possible, be located on straight parallel track that is separated by standard sixfoot intervals (as a minimum) to enable the use of standard P&C units. This will be the approach for all connections in this section.

In this area there are requirements for:

- Provision of bi-directional running to facilitate access to the turnback platforms at Hazelhatch & Celbridge and Adamstown Stations and a new turnback platform at Park West & Cherry Orchard Station for the DART services.

The required electrification of the northern two tracks in the four-tracking area means that space is required between the track and the railway boundary for OHLE masts and foundations. This is a key constraint on the options available.

In addition to the constraints that will have an effect on the track alignment, there is no track drainage system installed in this area. Although there are no known drainage issues in the area, the proposed track formation and vertical design may require the installation of a new and positive drainage system.

This section already accommodates a four-track railway, so it is envisaged that the reconfiguration of the tracks from Up Fast, Up Slow, Down Slow, Down Fast to Up Slow, Down Slow, Up Fast, Down Fast with provision for the electrification of the two tracks on the north side (Slow tracks) for the DART services will fit within the existing boundary. Therefore it is expected that no additional land will be required.

4.3. Existing Structures

This area already accommodates a four-track railway, therefore the structures are not expected to significantly constrain reconfiguration of the horizontal track alignment. With regards to electrification of the two northern tracks, vertical clearance beneath the existing structures were provided by IE and are included in **Table 4-2** The vertical clearances provided are based upon "Bridge Impacts – extract from Electrification Study 2011", except

by those values marked with an asterisk (*), which were measured by IE. A topographical survey is currently underway, and the vertical clearance under each structure will be verified once the results are available. However, the existing information suggests it is likely that an OHLE solution can be achieved at all structures without structural intervention. It is also noted that Hazelhatch Footbridge (OBC24) will not pose a constraint to the electrification works since the two tracks under it are to serve intercity services only (non-electrified tracks)

Table 4-2 Vertical Clearance Beneath Structures

Name	ID	Function	Overline Vertical Clearance (m)
Park West Avenue Road Bridge	OBC9B	Public Road	5.126
Park West Station Concourse Bridge	OBC9C	Station	5.182*
Park West Station Building Bridge	OBC9D	Station	6.413*
M50 Motorway Bridge	OBC10A	Public Road	5.646*
Cloverhill Road Bridge	OBC11	Public Road	5.046
Ninth Lock Bridge	OBC13	Public Road	4.897
Clondalkin / Fonthill Station Building East	OBC13C	Station	5.147
Nangor Road Bridge	OBC13A	Public Road	4.895*
Clondalkin / Fonthill Station Building West	OBC13D	Station	5.147
Kishoge Station Bridge	OBC14D	Station	Unknown
Kishoge Road Bridge	OBC14C	Public Road	5.115
Adamstown Footbridge	OBC16A	Pedestrian	5.299
Finnstown R120 Road Bridge	OBC19	Public Road	4.885
Adamstown Station Building	OBC20D	Station	4.954
Crowley's Bridge	OBC20E	3rd Party Road	4.883*
Stacumny Bridge	OBC21	Public Road	4.862
Straleek Footbridge	OBC23B	Pedestrian	5.115
Hazelhatch Footbridge	OBC24	Pedestrian	4.886 (not impacted as only spans across the fast tracks)
Hazelhatch Footbridge	OBC24A	Pedestrian	5.474
Hazelhatch R405 Road Bridge	OBC25	Public Road	5.014

This area already accommodates a four-track railway, so it is envisaged that the reconfiguration of the tracks will fit within the existing railway corridor and no interventions will be required for existing retaining walls.

4.4. Geotechnical

No onerous ground or groundwater conditions are anticipated in the majority of the study area based on the existing information. Shallow bedrock at or near the ground surface is likely to be present immediately to the east and west of the existing Adamstown Station.

Isolated locations of soft compressible cohesive material has been noted in existing historical ground investigation locations between Ch 274+600m (Kishoge) and 271+000m (Park West). The exact frequency and extents will be further analysed upon receipt of further ground investigation.

Elsewhere, anecdotal evidence suggests that a backfilled quarry is present on the northern side of the railway to the west and south west of Hazelhatch & Celbridge Station and the existing 100m section track is piled at this location. Due to the significant thickness, variable composition of made ground and variable depth of bedrock, new sections of piled tracks may be required.

4.5. Existing Utilities

The various utilities in this area will be constraints during both the design and construction phases. As such, their treatment in the temporary and permanent situations has been carefully considered during the development of options.

The majority of utilities that cross the rail corridor are concentrated in several road bridges and train stations throughout the area as shown in Section 2.3 Structures. There are several crossings that occur underneath the tracks, such as Irish Water pipes and ESB ducts. There are also several crossings above the tracks, in which all are ESB overhead cables. The services that are located in existing structures spanning the rail corridor are unlikely to be affected by any option as these structures will not be modified. The main constraints regarding utilities in the area are as follows:

- Utilities crossing under the tracks may affect the placement of foundations for rail electrification infrastructure. These are minor constraints as in most cases the foundations can be placed either side of the service, avoiding any disruption. Consultations are ongoing with service providers to find the exact location of these pipes / ducts by GPR and / or slit trenches.
- Various ESB cables cross over the tracks in this area. The main issue with overhead cables is the required clearance for rail electrification and any electrical interference that may occur. The height of OH cables is indicative of the voltage, the higher the voltage the higher the cables. Please see below in Table 4-3 a list of existing OH cables and voltages and whether they are identified as constraints.

Table 4-3 ESB OH Cables Constraints

ESB Cables	Location	Constraint
220 kV OH	Various crossings between Cherry Orchard Footbridge (OBC8B) and Hazelhatch.	Diversion not required. These cables have sufficient vertical clearance.
110 kV OH	Crosses over tracks 350m and 500m west of Cloverhill Road Bridge (OBC11).	Diversion unlikely. These cables most likely have sufficient vertical clearance, however, this is to be confirmed with ESBN
38 kV OH	Crosses over tracks at Park West & Cherry Orchard Station.	Diversion required. The vertical clearance is insufficient. Talks are ongoing with ESBN

MV OH	Crosses over tracks; west of Kishoge Station, 200m west of Finnstown R120 Road Bridge (OBC19), Celbridge Golf Club	Diversion required. The vertical clearance is insufficient. Talks are ongoing with ESBN
LV OH	Crosses over tracks; west of Cloverhill Road Bridge (OBC11), south of Straleek Footbridge (OBC23B).	Diversion required. The vertical clearance is insufficient. Talks are ongoing with ESBN

5. Options

5.1. Options Summary

Based on the information presently to hand it is thought that electrification and track reconfiguration could be achieved without the need for bridge intervention throughout this area.

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

A total of 2 no. 'Main Options' have been developed - a 'Do-Nothing' Option and a 'Do-Minimum' Option.

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

A summary of the Main Options is presented in the table below. A detailed description of each Main Option is included Section 5.2 below.

Table 5-1 Options Summary

Option	Description
Park West to Hazelhatch Option 0: Do Nothing	Leave as is.
Park West to Hazelhatch Option 1: Do Minimum	Addition of P&Cs to provide the functionality to reconfigure the existing 4-track to S-S-F-F for the DART services.

5.2. Options Description

This section describes the Main Options that have been considered for this area. Option Variations are elaborated within the Main Option text. With the exception of Option 0 (Do-Nothing) and Option 1 (Do-Minimum), there are some design disciplines that have technical features that are common to all Options (e.g. OHLE and Cable & Containment). Similarly, there are technical aspects that have been considered but are determined to have no (or insignificant) bearing on the development or selection of Options in this area (e.g. ground conditions). To remove repetition among the Option descriptions, these issues are addressed at the end of the Option description section.

5.2.1. Park West to Hazelhatch Option 0: Do Nothing

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

5.2.2. Park West to Hazelhatch Option 1: Do Minimum

This Do minimum option examines the addition of P&Cs to provide the required functionality to reconfigure the tracks with the Slow lines for the DART services to the north side of the railway corridor, whilst the Fast services are situated on the south. Passive provision for a future DART Underground has been made.

The constraints in the area that must be taken into account for design purposes include:

- Hazelhatch Station: ideally, the proposed design shall tie-in with the existing track outside the platform extents to avoid creating any effects or additional work on the existing platforms.
- Hazelhatch Footbridge (OBC24A) and R405 Hazelhatch R405 Road Bridge (OBC25): these two structures are located at the western end of Hazelhatch Station and care must be taken regarding lateral and vertical clearances.

- Existing piled track: at the West side of Hazelhatch Station, there is an area where the two upper tracks are running on piled track foundations (due to poor ground conditions in the area). Alignment alteration around this area is not recommended in order to avoid complications in relation to track foundations.
- Two existing crossovers with assumed P13-13 turnouts located between the main lines to the immediate west of Hazelhatch & Celbridge Station: ideally to be kept unaltered, comprising 1 facing and 1 trailing crossover providing operational flexibility in case of degraded conditions.
- Further P&C interventions to existing 4 tracking: crossovers are required between the Up Slow and Down Slow lines at Hazelhatch & Celbridge, Adamstown and Park West & Cherry Orchard Stations to permit access to their respective turnback platforms.

Currently the design team has developed two design options: one with a double junction and other with single turnouts (no diamond crossing) that provide the same functionality, of connecting the Slow lines to the Fast lines, to the west of Hazelhatch & Celbridge Station. The drawback of the diamond crossing is that it is a maintenance liability, whereas the single turnout solution is a lower maintenance option but occupies a greater track length with its footprint.

In summary, the following outlines the advantages and disadvantages on the inclusion of a diamond crossing:

- Advantages:
  - There is an optimization of space in a very constrained area.
  - The two existing crossovers at the western end are not affected.
  - The eastern tie-ins in the Slow Lines (upper lines) are located before reaching the existing piled track, so no alterations to it at this area.
- Disadvantages:
  - The Double Junction layout is not a preferred layout, introducing a diamond that is not a good design feature and one which is difficult to maintain while in service.

A common constraint on both options is to tie-in with the existing tracks before the piled track (proposed Slow lines west of Hazelhatch & Celbridge Station). No intervention on this piled track area is desirable, due to the risk of differential formation stiffness.

There is a proposed scissors crossing on the eastern side of Hazelhatch & Celbridge Station. The toes of the proposed scissors will be close to the end of the Platform 2 of Hazelhatch & Celbridge Station, set 5m away from the end of the platform. It may be difficult to increase this distance, so some local alteration of the end of the platform may be required (probably 10m). The platform is longer than 174m, at 220m, so it should not be an issue.

5.3. OHLE Arrangements

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

Option 1 for the Park West to Hazelhatch area has been developed to be capable of supporting electrification. Key to this is the retention of a continuous space between the track and the railway boundary for locating OHLE masts. The electrification through this area will comprise STC structures in two track areas and TTC structures in four tracking area, as detailed in section 3.2.1. The area through the stations at Hazelhatch & Celbridge, Adamstown, Kishoge, Clondalkin / Fonthill and Park West & Cherry Orchard and will be provided with TTCs on the platform. This is the subject of further design development.

The following passage refers to multiple bridge structures, numerous times. For conciseness only the bridge numbers have been used; please refer to 2.3 Existing Structures for full names.

Overbridge OBC24 is located on the non-electrified tracks, so an OHLE assessment is not required for this bridge.

For footbridges OBC16A and OBC24A, the bridges are sufficiently high in their existing configuration for the OHLE to pass through the bridge without connection to them. They will be wired using a free-running arrangement with a contact wire height of 4.7m. OHLE masts are expected to be positioned around 20m from each outer edge of the bridge for OBC16A. OBC24A is adjacent to OBC25. The mast positioning here will be designed based on OBC25. Routing of parallel feeders will be dependent on the development of the system design but could either be an aerial insulated conductor or a ground-level insulated cable in trough route.

For overbridges OBC10A, the bridges are sufficiently high in their existing configuration, but the OHLE will need to be connected to the bridges as it passes through due to the length of the bridge. These connections will not be visible from road level. They will be wired using a fitted arrangement using cantilevers with small system height, with a contact wire height of 4.7m. Normal dynamic clearance of 100mm could be achieved.

For overbridges OBC11, OBC13, OBC19, OBC20E, OBC21 and OBC25, the bridges are sufficiently low in their existing configuration that the OHLE will need to be connected to the bridges as it passes through.

These connections will not be visible from road level. They will be wired using a fitted arrangement using elastic bridge arms, with a contact wire height of 4.4m. For OBC11 and OBC25, a normal dynamic clearance could be achieved. For OBC13, OBC19, OBO 20E and OBC21 , a special reduced clearance could be achieved.

For OBC23B footbridge, the bridge is sufficiently low in its existing configuration that the OHLE will need to be fitted as it passes through, but the bridge itself cannot accommodate fitment. It will be wired using a fitted arrangement with elastic bridge arms and a contact wire height of 4.4m, with an OHLE mast placed directly next to the bridge to support the OHLE. Normal dynamic clearance could be achieved.

For OBC9B, OBC13A and OBC14C, the overbridges are adjacent to station buildings and the bridges are sited directly above station platforms. The bridges are sufficiently low, and sufficiently long, in their existing configurations that the OHLE will need to be connected to the bridges as it passes through. These connections will not be visible from road level but will be visible from platform level. The OHLE configuration will be graded contact wire, with either small system height or twin contact equipment (zero system height), and a contact wire height of 4.4m through the bridges under all conditions. OHLE through the bridge will be fitted, either using small system height cantilevers supported from the bridge, or elastic bridge arms supported from the bridge. For either option these connections will be at multiple locations due to the bridge length. Minimum electrical clearances will be 100mm static, and 80mm dynamic. Allowance has been made for 25mm of upward track movement. The opportunity exists to begin grading the contact wire up from 4.4m towards nominal wire heights, and this will assist with achieving minimum separation distances at the station platform. The opportunity will also be taken to open up a system height under the bridge, removing the need for further elastic bridge arms.

OHLE masts are expected to be positioned around 20m, 55m and 105m from the outer edges of the bridge before reverting to normal spacings. Routing of parallel feeders will be dependent on the development of the system design but could either be an aerial insulated conductor or a ground-level insulated cable in trough route.

5.4. Permanent Way

See Appendix C for the full list of Track drawings.

A total of 2 no. Permanent Way possible configurations have been developed for this area. They follow the existing rail corridor footprint as much as possible.

Table 5-2 Permanent Way Options

ID	Drawing No	Description
Per Way Option 1	DP-04-23-DWG-PW-TTA-65745 DP-04-23-DWG-PW-TTA-65746 DP-04-23-DWG-PW-TTA-65747	Park West Track Plan Layout Adamstown Track Plan Layout Hazelhatch - Park West Track Plan Layout Option 1
Per Way Option 2	DP-04-23-DWG-PW-TTA-65745 DP-04-23-DWG-PW-TTA-65746 DP-04-23-DWG-PW-TTA-65748	Park West Track Plan Layout Adamstown Track Plan Layout Hazelhatch - Park West Track Plan Layout Option 2

5.5. Geotechnical

All options propose electrification and new track alignments/layouts and will require detailed geotechnical design for the following elements:

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

5.6. Roads

There is no road intervention foreseen for this area.

5.7. Cable and Containments

Existing containment routes consist of buried duct, surface troughing and ladder rack/tray. Option 1 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. 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

5.9. Structures

At this stage a “Do-Nothing” option is considered appropriate for all the structures described in section 2.3. This is based on the clearance analysis presented in section 5.3 and Appendix D of this report. The currently ongoing survey campaigns should confirm or otherwise the feasibility of this “Do-Nothing” option.

5.10. Drainage

The performance of the existing drainage in this area is not fully known, though no relevant changes are expected at this stage.

A more detailed assessment is needed to assess whether upgrades to the drainage system are required at specific locations.

6. Options Selection Process

6.1. Option 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, based on 'Guidelines on a Common Appraisal Framework for Transport Projects and Programmes' (CAF) published by the Department of Transport, Tourism, and Sport (DTTAS), March 2016 (updated 2020) and informed by TII's Project Management Guidelines (TII PMG 2019). The Option Selection Process involves a three stage approach as summarised below:

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

The starting principle of the optioneering process and a focus of the Project Team has been to reduce the potential impacts on the surrounding environs by accommodating necessary works and interventions within the existing rail corridor, where practicable. However, it is acknowledged that as the Cork Mainline is an existing operational rail line operating in a pre-defined corridor, the options to accommodate the necessary works at some locations along the route are limited due to spatial constraints

6.2. Stage 1 Preliminary Assessment 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.

6.3. Preliminary Assessment (Sifting)

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

Table 6-1 Sifting Process

Option	Requirements		Description
Option 0	Engineering	Constructability	Not applicable. No intervention proposed.
		Geometrical fitness for intervention	Not applicable. No intervention proposed.
		Safety	Not applicable. No intervention proposed.
		New track configuration SSFF, with two Slow Tracks on the North	FAIL. No intervention proposed. 4-tracking configuration is not achieved.
		Electrification of DART+ tracks	FAIL. No intervention proposed. Electrification of the DART+ tracks not achieved.
		Provide access to DART platforms from Slow lines	FAIL. No intervention proposed. No connection to new DART+ platforms.
		Track alignment and drainage (standards)	FAIL. No intervention proposed. Track alignment and drainage not achieved.
	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 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.
		New track configuration SSFF, with two Slow Tracks on the North	PASS. Minor interventions may achieve 4-tracking configuration. Addition of P&Cs to provide the functionality.
		Electrification of DART+ tracks	PASS. Minor interventions may achieve electrification of the DART+ tracks.
		Provide access to DART platforms from Slow lines	PASS. Minor interventions may provide connection to new DART+ platforms.
		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

Of the 2 no. Main Options identified, the Do-Minimum option passes the sift process and is therefore considered feasible. The Preliminary Assessment Process results are summarised in the table below:

Table 6-2 Summary of Sift Process Results

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

The starting principle of the optioneering process has been to accommodate necessary works and interventions within the existing horizontal and vertical rail corridor, where practicable, to reduce the potential for new or additional impacts on the receiving environment, i.e. the 'Do-Minimum' option. In this case the 'Do-Minimum' option is feasible and therefore is the preferred option or solution for the subject area.

6.4. Stage 2 Detailed Assessment Process (MCA)

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.

6.5. Emerging Preferred Option

At the moment, the Emerging Preferred Option is Option 1 "Do-Minimum".

This aligns with all do-nothing or do-minimum options to develop the electrification works under the existing bridges, which in all cases imply no intervention in the bridges with impact in the existing roads (some interventions could be needed for earthing and bonding) and minimal track lowering in some of them where the electrical clearance is sub nominal.

The currently ongoing survey campaigns and geotechnical investigations to be started in Q2 2021, should confirm the feasibility of the above options, currently deemed likely, or determine the need for more intervention in the bridges where such option remains open.

Given the preference for a minimal impact, the MCA is not necessary, as all do-nothing or do-minimum options are to be adopted unless further analysis proves any of them non-feasible.

Appendix A – Sifting Process Backup

Appendix B – Drawings

The following drawings accompany this Technical Report:

Permanent Way Drawings

DP-04-23-DWG-PW-TTA-65745

DP-04-23-DWG-PW-TTA-65746

DP-04-23-DWG-PW-TTA-65747

DP-04-23-DWG-PW-TTA-65748

Appendix C – Assessment of Bridges with Limited Clearance