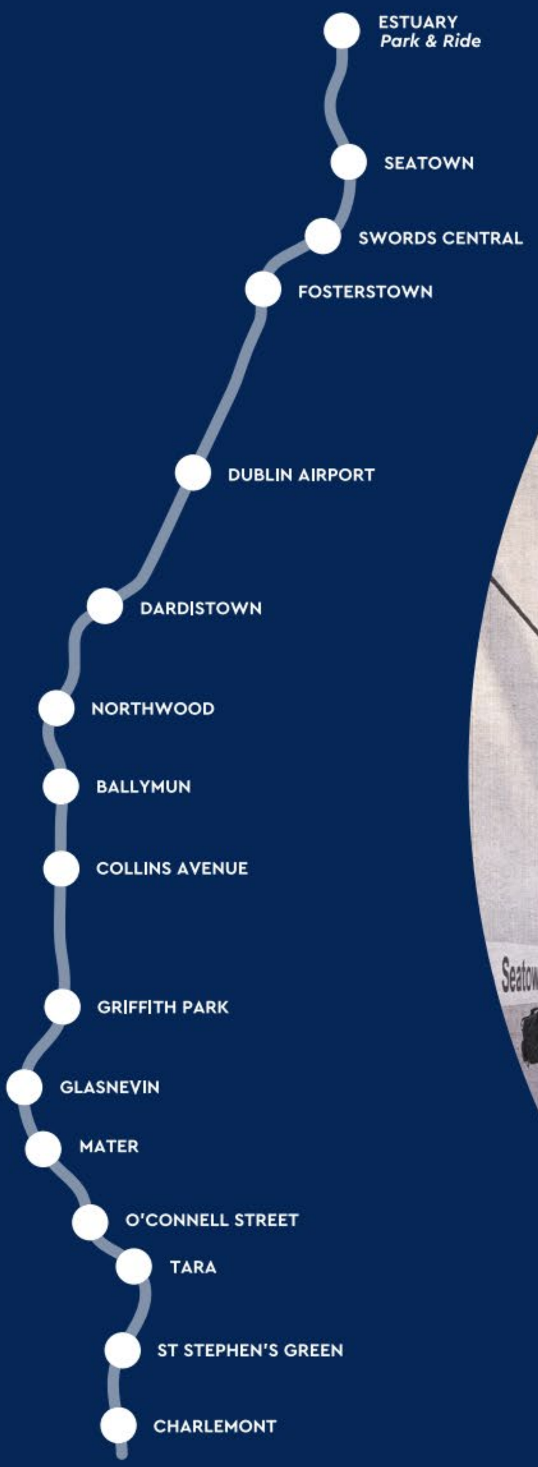


4 Description of the MetroLink Project

Contents

List of Abbreviations

Initials	Meaning
AC	Alternating Current
ACA	Architectural Conservation Area
ACID	Access Control and Intrusion Detection
AEP	Annual Exceedance Probability
ATC	Automatic Train Control
ATS	Automatic Train Supervision
ATO	Automatic Train Operation
ATP	Automatic Train Protection
AZ	Assessment Zone
BOH	Back of House
CBTC	Communications Based Train Control
CCTV	Closed Circuit Television
DAA	Dublin Airport Authority
DANP	Dublin Airport North Portal
DART	Dublin Area Rapid Transit
DASP	Dublin Airport South Portal
DC	Direct Current
DCC	Dublin City Council
DCHG	Department of Culture, Heritage and the Gaeltacht
DFB	Dublin Fire Brigade
DOP	Drop Off Point
DTO	Driverless Train Operation
EHP	Emergency Help Point
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ESBN	Electricity Supply Board Networks Ltd
EV	Electrical Vehicle
FCC	Fingal County Council
FOH	Front of House
GAA	Gaelic Athletic Association
GDSDS	Greater Dublin Strategic Drainage Strategy
GIS	Gas Insulated Switchgear
GoA4	Grade of Automation 4
GSWR	Great Southern & Western Railway (also known as the South-Western Commuter or Kildare line)
ha	Hectare
HGV	Heavy Goods Vehicle
HV	High Voltage
IFI	Inland Fisheries Ireland
kV	Kilovolt
LAP	Local Area Plan

Initials	Meaning
LV	Lower Voltage
m	Metre
MEP	Mechanical, Electrical and Plumbing
MGWR	Midland Great Western Railway (also known as the Western Commuter or Maynooth Line)
mm	Millimetre
MUA	Make-up Air System
MV	Medium Voltage
MVA	Megavolt Amperes
MW	Megawatt
MWh	Megawatt Hour
NTA	National Transport Authority
OCC	Operational Control Centre
OCR	Overhead Conductor Rail
OCS	Overhead Contact System
OH	Overhead
OPW	Office of Public Works
OTE	Over Track Exhaust
PHP	Passenger Help Point
PSD	Platform Screen Doors
pphpd	Passengers Per Hour Per Direction
RO	Railway Order
SCADA	Supervisory Control and Data Acquisition system
SE	Smoke Exhaust
SIR	Station Incident Room
STMP	Scheme Traffic Management Plan
STO	Semi-automatic Train Operation
SWDR	Swords Western Distributor Road
SuDS	Sustainable Drainage Systems
TBM	Tunnel Boring Machine
TII	Transport Infrastructure Ireland
TOR	Top of Rail
TVM	Ticket Vending Machine
TVS	Tunnel Ventilation System
UG	Underground
UPS	Uninterrupted Power Source
UTO	Unattended Train Operation
V	Volt
VE	Ventilation

4. Description of the MetroLink Project

4.1 Introduction

This Chapter provides a detailed description of the MetroLink Project, and all of the infrastructure and systems required to deliver the MetroLink Project (hereafter referred to as the proposed Project).

The proposed Project will comprise a high-capacity, high-frequency, modern and efficient metro railway between Estuary Station and the Park and Ride (P&R) facility, north of Swords via Dublin Airport to Charlemont Station which lies south of Dublin City Centre. The alignment is 18.8km long from end to end, while the alignment between the two end stations (Estuary to Charlemont) is 18.1km long. The northern section of the proposed Project, between Estuary and Northwood, will be largely on the surface, in retained cut, cut and cover, or on embankment, with a short section of tunnel under Dublin Airport. The southern section from Northwood to Charlemont will be underground in tunnel. There will be 16 new stations along the alignment with Estuary Station at surface level, four stations at Seatown, Swords Central, Fosterstown and Dardistown in retained cut, and Dublin Airport Station along with the remaining ten stations will be underground. Other principal project elements include a P&R facility at Estuary, two viaducts one over the Broadmeadow and Ward Rivers and one over the M50 Motorway, an Operational Control Centre and Maintenance Depot at Dardistown, and intervention tunnels and shafts associated with Dublin Airport South Portal (DASP), located on the City Tunnel at Albert College Park, and south of Charlemont station. The proposed Project has been designed to interchange with existing and future elements of the transport network. The key interchanges are as follows:

- Dublin Airport;
- The Western Commuter Line also known as the Maynooth Line (formerly the Midland Great Western Railway) and the South-Western Commuter Line also known as the Kildare Line (formerly Great Southern and Western Railway) at Glasnevin Station;
- The DART at Tara Station;
- Luas Lines (at O'Connell Street, St Stephen's Green and Charlemont Stations); and
- The Dublin Bus network and the future BusConnects network.

This Chapter should be read in conjunction with the following EIAR Chapters, which expand upon aspects of the proposed Project:

- Chapter 5 (MetroLink Construction Phase) which provides a detailed description of the construction required to deliver the proposed Project; and
- Chapter 6 (MetroLink Operations & Maintenance) which provides a detailed description of the operation of the proposed Project.

Information that has informed the development of this Chapter includes collaborative discussions, assessment and workshops with the project design team, TII and Environmental Impact Assessment Report (EIAR) specialists.

In addition, substantial consultation has taken place with key stakeholders to understand their concerns and consider them in the development of the proposed Project. These include Dublin City Council (DCC), Fingal County Council (FCC), Office of Public Works (OPW), Inland Fisheries Ireland (IFI), Waterways Ireland, relevant Government Departments such as the Department of Tourism, Culture, Arts, Gaeltacht Sport and Media, utility providers and sensitive receptors (such as hospitals and schools), private developers, and various other stakeholders that have been listed in Chapter 8 (Consultation) of this EIAR. Input from EIAR specialists during design progression has been key in identifying design solutions that will minimise the environmental impacts of the proposed Project.

This Chapter is structured as follows to present a comprehensive project description for the proposed Project:

- **Section 4.2:** This section describes the proposed Project objective.
- **Section 4.3**: This section identifies the main components of the proposed Project and introduces the four assessment zones (AZ1-4) which are used to subdivide the description of the proposed Project and the reporting of the environmental impact assessment in later chapters.
- **Section 4.4**: This section describes the geographical location of the proposed Project.
- **Sections 4.5 to 4.8**: These sections set out the overarching design principles adopted for the proposed Project, covering the Project approach to sustainability, the urban realm and landscaping design principles, and drainage design.
- **Sections 4.9 to 4.11:** These sections describe in more detail the common characteristics of the stations, the bored tunnels, and the cut and cover sections.
- **Section 4.12:** This section describes the route-wide systems that will facilitate the operation of the proposed Project, covering the track, the rolling stock, the power / signalling / communications / catenary systems, lighting, fencing and boundary treatments.
- **Section 4.13**: This section describes the provisions for highway modifications, footpaths and cycling.
- **Sections 4.14 to 4.17**: These sections describe in some detail, including maps and illustrations, the stations and other features of the proposed Project in the four assessment zones (AZ),

- AZ1 Northern Section: Estuary Station to Dublin Airport North Portal,
- AZ2 Airport Section: Dublin Airport North Portal to Dublin Airport South Portal,
- AZ3 Dardistown to Northwood: Dublin Airport South Portal to Northwood, and
- AZ4 Northwood to Charlemont: City Section.

- **Sections 4.18 and 4.19**: These sections provide a Glossary and References.

In addition to the diagrams presented in this Chapter, figures illustrating aspects of the proposed Project are available and are referenced where appropriate within this Chapter. Detailed drawings are also provided in the Railway Order (RO) Drawing Pack.

4.2 Project Objective

The overall project objective for the proposed Project, as established by the National Transport Authority (NTA) and Transport Infrastructure Ireland (TII) and as informed by planning policy context, MetroLink, is to:

'provide a sustainable, safe, efficient, integrated and accessible public transport service between Swords, Dublin Airport and Dublin City Centre'. (National Development Plan 2021-2030, Box 9.1).

4.3 Project Overview

Diagram 4.1 presents a schematic layout of the main features of MetroLink while Table 4.1: Description of the Principal Elements along the Proposed Project provides further details of the principal infrastructural elements of MetroLink and their geographical extent and location.

MetroLink will differ from DART and InterCity services operated by Iarnród Éireann and Luas services due to the following:

- MetroLink offers a higher service frequency;
- MetroLink is designed to carry more people along shorter distances;
- MetroLink is fully segregated from the surrounding road network, with sections at the ground surface, elevated on embankments or crossings, in cut, or in tunnel thereby not interfering with road traffic and pedestrians, unlike DART which has several road crossings; and
- MetroLink uses automated trains controlled from the proposed Operational Control Centre (OCC) at Dardistown Depot.

Diagram 4.1: Infographic Overview of Principal Locations along the Alignment

Table 4.1: Description of the Principal Elements along the Proposed Project

<table>
<tr><th>Project Elements</th><th>Outline Description</th></tr>
<tr><td colspan="2">Permanent Project Elements</td></tr>
<tr><td>Tunnels</td><td>It is proposed to construct two geographically separate, single-bore tunnels, using a Tunnel Boring Machine (TBM). Each section of tunnel will have an 8.5m inside diameter and will contain both northbound and southbound railways within the same tunnel. These tunnels will be located as follows:
▪ The Airport Tunnel: running south from Dublin Airport North Portal (DANP) under Dublin Airport and surfacing south of the airport at Dublin Airport South Portal (DASP) and will be approximately 2.3km in length; and
▪ The City Tunnel: running for 9.4 km from Northwood Portal and terminating underground south of Charlemont Station.</td></tr>
<tr><td>Cut Sections</td><td>The northern section of the alignment is characterised by a shallow excavated alignment whereby the alignment runs below the existing ground level. Part of the cut sections are open at the top, with fences along the alignment for safety and security. While other sections are "cut and cover", whereby the alignment is covered.</td></tr>
<tr><td>Tunnel Portals</td><td>The openings at the end of the tunnel are referred to as portals. They are concrete and steel structures designed to provide the commencement or termination of a tunneled section of route and provide a transition to adjacent lengths of the route which may be in retained structures or at the surface.
There are three proposed portals, which are:
▪ DANP;
▪ DASP; and
▪ Northwood Portal.
There will be no portal at the southern end of the proposed Project, as the southern termination and turnback would be underground.</td></tr>
<tr><td>Stations</td><td>There are three types of stations: surface station, retained cut stations and underground stations:
▪ Estuary Station will be built at surface level, known as a 'surface station';
▪ Seatown, Swords Central, Fosterstown Stations and the proposed Dardistown Station will be in retained cutting, known as 'retained cut stations'; and
▪ Dublin Airport Station and all 10 stations along the City Tunnel will be 'underground stations'.</td></tr>
<tr><td>Intervention Shaft</td><td>An intervention shaft will be required at Albert College Park to provide adequate emergency egress from the City Tunnel and to support tunnel ventilation. Following the European Standard for safety in railway tunnels TSI 1303/2014: Technical Specification for Interoperability relating to 'safety in railway tunnels' of the rail system of the European Union, it has been recommended that the maximum spacing between emergency exits is 1,000m.
As the distance between Collins Avenue and Griffith Park is 1,494m, this intervention shaft is proposed to safely support evacuation/emergency service access in the event of an incident. This shaft will also function to provide ventilation to the tunnel. The shaft will require two 23m long connection tunnels extending from the shaft, connecting to the main tunnel.
At other locations, emergency access will be incorporated into the stations and portals, or intervention tunnels will be utilised at locations where there is no available space for a shaft to be constructed and located where required.</td></tr>
<tr><td>Intervention Tunnels</td><td>In addition to the two main 'running' tunnels, there are three shorter, smaller diameter tunnels. These are the evacuation and ventilation tunnels (known as Intervention Tunnels):
▪ Airport Intervention Tunnels: parallel to the Airport Tunnel, there will also be two smaller diameter tunnels; on the west side, an evacuation tunnel running northwards from DASP for about 315m, and on the east side, a ventilation tunnel connected to the main tunnel and extending about 600m from DASP underneath Dublin Airport Lands. In the event of an incident in the main tunnel, the evacuation tunnel will enable passengers to walk out to a safe location outside the Dublin Airport Lands.</td></tr>
</table>

Project Elements	Outline Description
	▪ Charlemont Intervention Tunnel: The City Tunnel will extend 360m south of Charlemont Station. A parallel 300m evacuation and ventilation tunnel is required from the end of the City Tunnel back to Charlemont Station to support emergency evacuation of maintenance staff and ventilation for this section of tunnel.
Park and Ride Facility	The proposed Park and Ride Facility next to Estuary Station will include provision for up to 3,000 parking spaces.
Broadmeadow and Ward River Viaduct	A 260m long viaduct is proposed between Estuary and Seatown Stations to cross the Broadmeadow and Ward Rivers and their floodplains.
Proposed Grid Connections	Grid connections will be provided via cable routes with the addition of new 110kV substations at DANP and Dardistown. (Approval for the proposed grid connections to be applied for separately but are assessed in the EIAR).
Dardistown Depot	A maintenance depot will be located at Dardistown. It will include: ▪ Vehicle stabling; ▪ Maintenance workshops and pits; ▪ Automatic vehicle wash facilities; ▪ A test track; ▪ Sanding system for rolling stock; ▪ The OCC for the proposed Project; ▪ A substation; ▪ A radio mast; and ▪ Other staff facilities and a carpark.
Operations Control Centre	The main OCC will be located at Dardistown Depot and a back-up OCC will be provided at Estuary.
M50 Crossing	A 100m long viaduct to carry the proposed Project across the M50 between the Dardistown Depot and Northwood Station.
Temporary Project Elements	
Construction Compounds	There will be 34 Construction Compounds including 20 main Construction Compounds, 14 Satellite Construction Compounds required during the Construction Phase of the proposed Project. The main Construction Compounds will be located at each of the proposed station locations, the portal locations and the Dardistown Depot Location (also covering the Dardistown Station) with satellite compounds located at other locations along the alignment. Outside of the Construction Compounds there will be works areas and sites associated with the construction of all elements of the proposed Project including an easement strip along the surface sections.
Logistics Sites	The main logistics sites will be located at Estuary, near Pinnock Hill east of the R132 Swords Bypass and north of Saint Margaret's Road at the Northwood Compound. (These areas are included within the 14 Satellite Construction Compounds).
Tunnel Boring Machine Launch Site	There will be two main tunnel boring machine (TBM) launch sites. One will be located at DASP which will serve the TBM boring the Airport Tunnel and the second will be located at the Northwood Construction Compound which will serve the TBM boring the City Tunnel.

During construction, it will be necessary to have main construction compounds, satellite construction compounds, an easement strip along the alignment and logistics sites. Further details of these are provided in Chapter 5 (MetroLink Construction Phase) Section 5.3. The locations of temporary construction compounds and logistics sites are illustrated on Figure 5.1 in Chapter 5 of the EIAR.

The proposed Project is presented and assessed in the EIAR based on four distinct geographical areas as outlined in Table 4.2.

Table 4.2: Geographical Areas

Ref.	Geographical Section	Description of Extent of Geographical Section
AZ1	Northern Section	Estuary Station to DANP. It includes the railway crossing on a viaduct over the Broadmeadow and Ward Rivers and associated flood plains. This section will include open, retained cut, and cut and cover sections. Section AZ1 includes the Park and Ride facility at Estuary Station as well as stations at Seatown, Swords Central and Fosterstown.
AZ2	Airport Section	Section AZ2 of the proposed Project includes the ESBN connection and new substations, the DANP, the tunnel underneath Dublin Airport, Dublin Airport Station and DASP and associated intervention and ventilation tunnels.
AZ3	Dardistown to Northwood	Section AZ3 of the proposed Project covers from south of DASP to the Northwood Portal. Section AZ3 includes Dardistown station, the Dardistown Depot, ESBN connection and substations, the M50 Crossing, Northwood station and the TBM launch site at Northwood. This section will include open, retained cut, and cut and cover sections of the alignment.
AZ4	Northwood to Charlemont	Section AZ4 extends from a location south of the Northwood Portal to the tunnel termination located south of Charlemont Station, ten underground stations, and the Albert College Park Intervention shaft.

4.4 Project Location

The proposed Project will be located fully within County Dublin, passing through the administrative areas of FCC and DCC. The geographical extent of the proposed Project is shown on Figure 4.1 located at the end of this Chapter. The station locations are listed in Table 4.3.

Table 4.3: Summary of Stations

AZ No.	Station Name	Level	Location
AZ1	Estuary	At surface	In farmland off the R132 adjacent to M1 Junction 4, north of the Broadmeadow River.
	Seatown	Retained cut	On the eastern side of the R132 Swords Bypass, south of Seatown Road Roundabout.
	Swords Central	Retained cut	On the eastern side of the R132 Swords Bypass, south-east of the Malahide Road Roundabout.
	Fosterstown	Retained cut	At Airside Retail Park, adjacent to the R132 Swords Bypass.
AZ2	Dublin Airport	Underground	Under the existing Terminal 2 surface carpark
AZ3	Dardistown	Retained cut	Located on an undeveloped site between Dublin Airport and M50 Motorway adjacent to the Dardistown Depot.
	Northwood	Underground	Under the R108 Ballymun Road near Northwood Avenue junction with access from both sides of the road.
AZ4	Ballymun	Underground	On the west side of the R108 Ballymun Road, by the old Ballymun Shopping Centre (now demolished).
	Collins Avenue	Underground	To the east of the R108 Ballymun Road, south of the junction with Collins Avenue and in front of Our Lady of Victories Church.
	Griffith Park	Underground	Under the playing pitch used by Home Farm FC, adjacent to the R108 St Mobhi Road at the entrance to Whitehall College of Education.

AZ No.	Station Name	Level	Location
	Glasnevin	Underground	Just north of the Royal Canal along the R135 at Cross Guns Bridge. An Iarnród Éireann railway station will also be constructed here on the existing railway to provide for interchange between the Iarnród Éireann mainline and commuter services on the MGWR (Western Commuter Line/Maynooth line) and the GSWR (South-Western Commuter/Kildare line).
	Mater	Underground	Under the Four Masters Park to the south-west of the Mater Hospital.
	O'Connell Street	Underground	Under a development area between O'Connell Street, Moore Lane and Henry Place and south of Parnell Street. Directly west of the O'Connell Street Luas Stop.
	Tara	Underground	Adjacent to the existing Tara Street Station to provide for interchange to DART and mainline train services.
	St Stephen's Green	Underground	Under St Stephen's Green East roadway and park.
	Charlemont	Underground	Under an area of land linked to the Carroll's Building on Grand Parade, in close proximity to the Charlemont Luas Stop.

4.5 MetroLink Design Principles

The design principles for the proposed Project were developed to set out the core of the design development for the proposed Project which were established as key to delivering a successful metro project. This design vision is based around the following principles:

- To develop an efficient station design that creates a station layout that minimises travel distance and time between transport connections, the stations and train;
- Universal design to provide an inclusive and accessible environment for all that creates an uplifting experience for both passengers and staff;
- A design that provides spaces that can be easily monitored and are safe;
- A simple and easy to navigate design, with legible spaces that provide intuitive routes to and from the trains, supported by clear sightlines and wayfinding;
- Create generic stations that can be adapted to context to reflect the place where they are located with commonality in design that reflects the identity of the local area;
- A flexible design that can be easily maintained, modified and changed in time without disrupting the station's normal operation and a future-proofed building that can adapt to changing needs;
- A project that considers the environment and actively seeks to reduce the impacts caused by its construction and operation;
- Application of an economy of scale, where standardisation and modular design processes will capture a positive cost-benefit while maintaining quality and commonality across all MetroLink stations; and
- An attractive modern architectural style for the new stations set within a landscaped urban realm that complements and integrates with the surrounding area.

4.6 Sustainable Design

4.6.1 Policy Framework for Sustainability

As outlined in Chapter 3 (Need for the Proposed Project) there is a significant focus on achieving the UN Sustainable Development Goals in national policy and this is central to the National Planning Framework to ensure that Ireland has a more sustainable future.

The Environmental Protection Agency (EPA) Sustainable Transport Performance Measures (EPA 2011) - highlights that sustainable transport is central to efforts to control greenhouse gas emissions, air pollution and environmental damage. The benefits of sustainable transport extend beyond environmental considerations, delivering improvements in congestion, productivity, health and quality of life.

4.6.2 Sustainability Objectives for Future Delivery Stages

TII's Environmental Strategy (TII 2019, Section 2.1) 'commits to incorporate sustainability principles into the development and operation of the national road, light rail and metro networks; therefore, contributing to social wellbeing, supporting economic efficiency, and protecting, restoring and enhancing environmental systems for future generations.'

TII's Statement of Strategy 2021-2025 (TII 2020) sets out TII's sustainability goals. These goals include:

- "New Infrastructure - Deliver national road, light railway, metro and Active Travel infrastructure, contributing to compact growth, sustainable mobility, enhanced regional accessibility and the transition to a low-carbon future".

The strategic objectives to deliver the New Infrastructure goal includes the following:

- "Deliver infrastructure that supports low-carbon transport systems and emission reductions".

TII's goals and strategic objectives are aligned with those of the Department of Transport.

In 2018, TII developed its Corporate Sustainability Statement. This document presented policy drivers for sustainability within the organisation and its operations. Following on from the development of this statement, TII has also produced a Sustainability Implementation Plan (SIP), which articulates how the sustainability strategy and vision will be carried out through all TII Projects, investments and operations.

TII's Sustainability Implementation Plan – Our Future (TII 2021) sets out the vision to lead in the delivery and operation of sustainable transport, enabling their networks to drive inclusive growth, create job opportunities and enhance the well-being of all persons, including vulnerable groups, strengthen resilience to climate change, maintain commitment to the environment and continuing to prioritise safety. The Plan recognises the need to rethink, reimagine and redesign approaches to ensure sustainability is at the heart of everything that TII does, requiring it to be the leading provider of sustainable infrastructure. The plan is based on the following six key principles:

- *To provide effective efficient and equitable mobility* – Enable compact growth and regional accessibility through networks and services that support more efficient journeys, more effective connectivity and increased accessibility.
- *To enable safe and resilient networks and services* – Enable safe secure, accessible and inclusive travel though the provision of transport networks, systems and services that are resilient to future change.
- *To collaborate for a holistic approach* – To develop smart and sustainable assets and services through innovating and improving the planning, design, construction, operation and maintenance of the transport network, increasing collaboration and systems-thinking to seek mutual gains and mitigate negative externalities.
- *To deliver end to end Improvements* – Deliver enhanced whole life-cycle value through impact and influence on stakeholders, partners and suppliers.
- *To transition to net zero* – Reduce the carbon impact of construction, operation and use of the transport network through responsible use of resources, reuse and repurposing, as well as driving the net-zero transition and enabling customers to make more sustainable choices.
- *To create total value for society* – Maintain and enhance the balanced delivery of economic, environmental and social value through robust planning, rigorous appraisal and decisions that prioritise sustainability.

The proposed Project has been developed to ensure compliance with the TII Sustainability Implementation Plan principles discussed above.

4.6.3 Implementation of Sustainability Policy Areas in MetroLink Project Design

Sustainability for the proposed Project means delivering and operating an efficient, low carbon and climate-resilient metro system, which better connects passengers as part of an integrated transport system, unlocks regeneration opportunities, drives international connectivity and enables compact growth for present and future generations, while also being designed to be responsive to future demand requirements. The Project design includes the following sustainability initiatives in order to meet the project sustainability aims outlined in TII's Sustainability Implementation Plan.

4.6.3.1 EN1: Climate Change Mitigation and Adaptation

The Project design has been developed to ensure that the proposed Project can be constructed and operated to reduce climate change effects and to be resilient to climate change.

The proposed Project design has been developed for a 1 in a 1000-year flood event (incorporating a 20% allowance for climate change) and that to ensure that it will not cause flooding further upstream within catchments based on the Flood Risk Assessment (FRA). The specific design developments in this regard are as follows:

- The design of a viaduct crossing the Broadmeadow and Ward rivers;
- The design of culverts crossing the Sluice River and Turnapin Stream to accommodate 1 in 100-year flood event (1% AEP); and
- The design of the diverted Turnapin stream (at Dardistown) with a 15m riparian zone maintained either side of the new channel.

The proposed Project design has also been developed to ensure that material and energy usage during the construction and operational phases is minimised. The following are the main sustainable design elements provided for in the Project design:

- The design of the underground stations includes for a natural light glass roof box where possible, which maximises light ingress into the station below, thereby reducing energy requirements during the operational phase;
- A number of design solutions have been developed to enhance the efficiency of the railway systems infrastructure of the proposed Project and these include:

- A system of regenerative breaking which returns energy generated during breaking to the traction power system with reverse substations and energy storage batteries has been identified as being feasible for the proposed Project;
- Lighting systems have been designed to maximise efficiency by utilising LED lighting in stations and by utilising sensors to turn on lighting in Back of House (BOH) areas of stations only when someone is in the area;
- The proposed Project will be a fully automated, with a Grade of Automation 4 (GOA4) system. Vehicle starting and stopping, and operation of doors will be fully automated. Automated systems will consume less energy as a result of optimised acceleration, traction and braking system;
- Heat Recovery systems will be included in the BOH rooms at the stations;
- At the proposed Estuary P&R approximately 23% of the car parking spaces (694 spaces) will have EV charging points installed and the design will allow this provision to increase in line with demand; and
- Solar panels will be used in the Main Dardistown Depot Building Roof at Dardistown (subject to agreement with Dublin Airport Authority, DAA).

The further development of the project during the construction and operational phases will ensure that the sustainability gains are further enhanced through the implementation of a whole-life Carbon Management Plan, aligned to PAS 2080 to inform the design, build and operation of the proposed Project. As part of the design process, a carbon baseline for the construction and operational phases of the project has been established against which further progress will be measured through these phases of the project, to drive delivery of a reduction in capital and embodied carbon against a baseline.

4.6.3.2 EN2: Materials and Resources

The volumes and types of materials that will be needed to construct and operate the proposed Project have been estimated, establishing a baseline for the EIAR. As a significant portion of the alignment is underground, construction of the proposed Project will generate a large surplus of excavated material. The proposed Project design has been based on the principle of ensuring a low environmental footprint and the following strategies have been adopted in this regard:

- Materials management is a key element of this project, having particular regard to the 3.1M m^3 of spoil material. In the development of this EIAR, a number of mitigation measures have been identified to manage the materials generated by the project. Refer to the EIAR Chapter 24 (Materials & Waste Management) for further details;
- The principal design feature of the tunnel section of the proposed Project is that it is a single bore tunnel as outlined in Section 4.10 of this Chapter. This option reduced the quantity of spoil material to be generated when compared to a twin bore solution;
- The Waste Management Plan will be further developed by the contractor(s) to manage the construction and demolition waste;
- Demolition waste will be generated by the project as described in the EIAR Chapter 5 (MetroLink Construction Phase) and Chapter 24 (Materials & Waste Management). A notification under Article 27 of the European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011), as amended (Waste Directive Regulations (2011)) (referred to as Article 27) has been made to the Environmental Protection Agency on behalf of TII to classify much of the inert material to be generated by the proposed Project as a by-product and not a waste. This will allow the material to be re-used. Article 27 is discussed further in Chapter 24 (Materials & Waste Management). It is predicted that an overall recovery rate of 95% can be achieved for construction and demolition (C&D) wastes (excluding soils and stones);
- Lifecycle assessment for major asset components will be undertaken to influence procurement of low carbon and sustainable materials and equipment;
- Reduction of mains water use during construction and operation will be achieved through the design of efficient water systems and devices at stations and buildings;
- As outlined in Section 4.8 of this Chapter, sustainable drainage systems (SuDS) have been incorporated into the design to reduce mains water usage, to reuse water and to management potential pollution of waterbodies. SuDS measures include the implementation of rainwater harvesting, green roofs, swales and retention basins; and
- The Dardistown Depot will include an automatic train washing plant which will recycle water for continuous re-use.

The further development of the proposed Project during the Construction and Operational Phases will ensure that the sustainability gains are further enhanced through consideration of the following:

- Low Environmental Impact Materials: Locally produced and manufactured materials, where possible as well as materials with high recycled content (when possible);
- Durability will be taken account of in different stages of the project. Robust and durable construction systems and materials will be used. The end of the life cycle of many elements is scheduled and they will need to be replaced at a certain point.

The proposed Project will embed sustainable procurement principles for all contracts that procure goods or goods within a service. The sustainable procurement strategy will be aligned with TII procurement policies.

4.6.3.3 EN3: Biodiversity

The Project design has been developed to minimise the potential impacts on biodiversity along the alignment. This includes protecting areas of valuable and threatened species and habitats designated within the Natura 2000 protected areas network and other areas of wildlife reserves, protected habitats, trees, and species of flora and fauna, by avoiding these sites, implementing biodiverse and sensitive landscape designs, incorporating pollution control on new outfalls to water bodies, and through the management of construction impacts such as dust, noise and general disturbance.

The design of Estuary Station and P&R was modified to remove structural elements from the area designated in the Fingal Development Plan 2017 - 2023 (FCC, 2017) as "Open Space". This resulted in reduced permanent impacts on riparian habitat areas.

The provision of a viaduct over both the Broadmeadow and Ward rivers has reduced the potential impacts on the riparian habitats associated with both of these waterbodies.

Extensive landscaping is being provided as part of the proposed Project along the alignment parallel to the R132. The area will be dominated by species-rich planting with native species included in the planting lists. The provision of this area will offset the loss of trees along the R132 required due to the construction of the proposed Project. Further mitigation measures are proposed to reduce potential impacts on biodiversity arising during both the construction and operational phases of the project. These can be viewed in Chapter 15 (Biodiversity).

The further development of the proposed Project during the construction and operational phases will ensure that the sustainability gains are further enhanced through consideration of the following:

- Further design development to reduce impacts on existing habitats and develop native planting mixes for the landscape design;
- Pre-construction biodiversity surveys will be undertaken to confirm the habitats identified in Chapter 15 (Biodiversity) and on the basis of these surveys, enabling works will be undertaken to fence off and protect valuable habitat areas;
- An Outline Invasive Species Management Plan (Appendix A15.8) will be enacted prior to the construction works to treat and manage identified invasive species and ensure that these will not be spread during the construction of the proposed Project; and
- All mitigation measures identified in Chapter 15 (Biodiversity) and in the outline Construction Environmental Management Plan (CEMP) (Appendix A5.1) will be implemented.

4.6.3.4 EN4: Heritage

The proposed Project has the potential to affect areas of heritage as a result of extensive excavation works, demolition of buildings, and the construction of stations. Heritage conservation has been a key consideration throughout the design of the proposed Project to date to minimise potential impacts on archaeology and architectural heritage. Where possible measures have been taken to retain historic settings of heritage features and mitigate visual impacts on heritage features through detailed landscape design and the operational management plan. Design changes that were introduced to reduce impacts on heritage include the following:

- The realignment of MetroLink away from Lissenhall Bridge (National monument, RMP, reference DU011-081), to minimise risk of potential impacts;
- The urban realm and landscape design of Collins Avenue Station in front of the Church of Our Lady of Victories (NIAH, Reference 50130121) to enhance the setting of the church;
- The urban realm and landscape design for Griffith Park Station at Whitehall College (RPS, Reference 7746 & NIAH, Reference 50130149) to enhance the setting of the area including the reinstatement of the gates to the college further up the avenue closer to the college buildings;
- The railings and gates at Dalcassian Downs (RPS, Reference 8698 & NIAH Reference 50130021) adjacent to the proposed station at Glasnevin will be removed prior to the commencement of the construction phase, carefully stored and reinstated following construction;
- Prior to the construction phase the railings, gates, plinth walls, Healing hands sculpture and Celtic cross at Four Masters Park (RPS, Reference 737) will be removed, stored carefully and reinstated following the completion of construction of the proposed Mater Station;
- Re-design of the proposed station at O'Connell Street Upper to avoid the requirement to demolish 42 O'Connell Street Upper (RPS Reference 6021 and NIAH, Reference 500 10558), 59 O'Connell Street Upper (NIAH, Reference 500 60601), and 60 O'Connell Street Upper (RPS Reference 6028 and NIAH, Reference 500 10534);
- At St Stephen's Green (National Monument DU018-020334), the railings, plinth walls and gates around the perimeter of the park and the bollards and traditional lamp posts will be removed, carefully stored and then reinstated following the construction phase. Monuments including the

Wolfe Tone monument, granite columns and Famine Memorial will be removed prior to construction, stored safely and reinstated in the park after construction is completed. Furthermore, replacement tree planting for trees felled during the construction phase will be undertaken to reduce the impact of the setting on the National monument; and
- The proposed station design at Charlemont was amended to ensure that there was no direct impact on properties on Dartmouth Square West which are all on the DCC RPS.

A monitoring strategy has been developed and will be implemented to track the potential impacts of the proposed Project on heritage assets.

For a list of the proposed mitigation and monitoring measures associated with minimising the impacts on archaeology, please refer to Chapter 25 (Archaeology & Cultural Heritage) and for proposed mitigation and monitoring measures to mitigate and potential impacts on architectural heritage please refer to (Chapter 26: Architectural Heritage).

Overall, the proposed Project will deliver a metro system that has been designed to be sympathetic to the local heritage settings, leaving archaeological effects *in situ* and reinstating architectural heritage features wherever possible.

4.6.3.5 CC1: Skills and Learning

The proposed Project is seeking to develop a skill and learning programme that reflects the industry skills requirements, local demographics and the need for a gender-balanced workforce across all fields. The programme will also reflect the regulatory drivers and wider government priorities around skills, employment, diversity and business growth in the construction and transportation sector. The proposed Project will provide skills and learning to the construction workforce and the supply chain by:

- Mitigating skills shortages and gaps through training and upskilling; and
- Supporting a diverse, gender equal and inclusive workforce.

4.6.3.6 CC2: Community and Engagement

The Project design has been informed by ongoing public consultation with engagement of a wide range of stakeholders. A stakeholder and community engagement plan has been developed which has guided the frequency and means of communication to date. Extensive public consultation has taken place on the Emerging Preferred Route, the Preferred Route and on other significant project changes as described in Chapter 8 (Consultation).

The proposed Project will continue to progress community engagement by:

- Regularly reviewing and updating stakeholder and community engagement plans, including centralised complaint reporting lines and minimum standards for resolution for construction and programme for virtual and face-to-face events during design and operation;
- Develop and implement a programme of community engagement to raise awareness of sustainability topics linked to the design, construction and operation of MetroLink;
- Provide a dedicated and responsive helpline and social media channels for the community before construction starts;
- Actively maintaining partnerships and design focus groups established with the community;
- Ongoing engagement and contingency planning with other transport agencies to maintain the level of service during disruptive events, such as mass power outage and flooding; and
- Communicating in a timely and open manner.

4.6.3.7 CC3: Safety

The proposed Project involves complex engineering and construction techniques which will build on the TII experience of delivering safe construction on major infrastructure projects. This will be achieved during the construction phase by considering safety through the procurement of the proposed Project's contractors.

Personal safety is of concern for many people, particularly for women, many of whom prefer to travel by car which is considered to be safer than public transport (TII, 2020).

Safety has been central to the design development of stations, the P&R and surrounding areas to ensure that they are safe for all users to use. This has been achieved by ensuring that the design is based on the following relevant principles:

- The inclusion of targets for the safe construction of MetroLink and establish a culture of everyone home safe at the end of their shift;
- Full incorporation of universal design principles to provide accessibility for all including passengers with impaired mobility, hearing and sight, the elderly and young children;
- Provision of easy wayfinding throughout the stations and Estuary P&R;
- Provision of an open, safe and well-lit environment;
- Provision of CCTV systems and panic/alarms to monitor all stations for anti-social behaviour and direct MetroLink staff to manage incidents, and
- Implementation of and maintenance of an inclusive operational emergency response action plan.

4.6.3.8 CC4: Health and Wellbeing

The proposed Project will deliver health and wellbeing benefits by providing active travel options for a wide range of people in the areas served. Using public transport will enable users to include walking and cycling in their commute and reduce commuting times and associated stress associated with vehicle travel. Modal shift from road transport to MetroLink has the potential to reduce air pollution health risks in the city centre. Extensive assessments have been undertaken as part of the EIAR process to understand the potential impacts of noise, air quality and traffic on the communities and mitigation measures have been developed to manage identified impacts. These will include:

- The implementation of mitigation measures to mitigate potential noise and vibration impacts and monitoring to ensure limits are adhered to during the construction and operational phases;
- The establishment of an air quality baseline and implementation of measures in collaboration with other key stakeholders as required to ensure limits are adhered to;
- Delivery of a construction logistics plans that mitigates the impacts of construction traffic on nearby communities; and
- Include clauses around worker and community health and wellbeing in MetroLink's construction contracts.

Refer to the EIAR Chapter 10 (Human Health) for further details on the potential health impacts and benefits of the proposed Project.

4.6.3.9 SE1: Connectivity

The design for the proposed project has been developed to maximise connectivity and interchange opportunity between MetroLink and other sustainable transport modes. Specific design measures that have achieved this are as follows:

- High quality, safe and attractive access to all facilities, stations, trains and public spaces has been designed to promote independent mobility;
- High quality and safe access to all stations for cyclists has been designed with cycle parking being provided at every station open to the public (with the exception of O'Connell Street);
- Bus interchange being developed for many stations which are integrated with existing bus services as well as future proposed BusConnects;
- Interchange with existing heavy rail, DART and Luas light rail services at Glasnevin, O'Connell Street, Tara Street, St Stephen's Green and Charlemont;
- The provision of a minimum of 23% EV charging points at the Estuary P&R facility; and
- Implementation and maintenance of electronic connectivity services on all trains and at stations.

4.6.3.10 SE2: Productivity

The proposed Project will provide a substantial increase in capacity of Dublin's public transport network. Users will experience reduced journey times and improved reliability. The proposed Project has been designed to differ from the DART and Luas services by providing for a much higher level of service frequency. The automation of the rolling stock which is a first for Ireland facilitates increased frequency whilst also improving reliability.

4.6.3.11 SE3: Facilitating Shared Growth and Planning for the Future

Co-operation with local planning authorities through the design process has ensured that the design of the proposed Project complements local development plan requirements, facilitating local growth. Future changes to Dublin's demographics have been incorporated into the design through passenger growth and traffic modelling. To support this, Fingal County Council has re-zoned 390 hectares of land as the "Metro Economic Corridor" in close proximity to the proposed alignment.

4.6.3.12 SE4: SME and Local Spend

Increased employment during the construction of the proposed Project will have a direct positive impact on the local and regional economy. The proposed Project will create opportunities for local and SME businesses during construction and operation. The proposed Project will deliver economic benefits to SMEs and local businesses, which will in turn benefit residents and the Irish economy as a whole. The proposed Project will facilitate these benefits by:

- Developing a sustainable procurement strategy to include local and SME businesses in the procurement of services and materials where possible;
- Encouraging contractors to source staff locally and consider and include under-represented groups; and
- Investing in local business and innovation where appropriate.

4.7 Architectural, Urban Realm and Landscaping Design Principles

This section describes the over-arching architectural, urban realm and landscaping design principles, building upon the general design principles described in Section 4.5 and the sustainability principles described in Section 4.6. It also summarises the general principles for universal design.

4.7.1 General Design Principles

MetroLink offers the unique opportunity to contribute to the vitality of Dublin. It looks to the city's sustainable future and seeks to meet the urgent need for increased public transport infrastructure.

The project will deliver a robust and authentic design with a strong metropolitan identity, unique and sympathetic to Dublin. Concepts such as singular station volumes, use of natural light, intuitive wayfinding, robust and long-lasting materials, and contextual placemaking will be followed through all stages of development and construction, combining the very best in architectural vision.

The process of developing and defining the architectural vision was undertaken through a collaborative engagement with the design team and comprised:

- Setting aspirations and core values for MetroLink;
- Undertaking benchmarking workshops and case study evaluations;
- Developing principles for the MetroLink design identity – as part of a wider transport network, across the alignment and throughout the stations;
- Developing a strategic vision and key principles for station architecture and public realm;
- Establishing high level strategies for space, volume, natural light, and wayfinding; and
- Identifying opportunities to unlock value and catalyse growth and development, particularly along the R132 MetroLink corridor.

Diagram 4.2: Tara Station at Dusk

Following the definition of the Architectural Vision, the Concept Architecture Design was developed, implementing Metrolink's key design principles within the linewide identity, station typologies, common components and supporting infrastructure across the alignment. Diagram 4.2 shows an example of the concept design at Tara Station.

The concept design also sets out the visual and material design intent for primary front-of-house station environments and the careful integration of the stations into their respective contexts through the development of public realm design intent for each station location.

Developed through collaborative dialogue with TII and their design team, the design intent was also informed by engagement and consultation with stakeholders and local authorities.

4.7.2 Linewide Identity

MetroLink will have a strong and consistent identity throughout the entirety of the alignment, giving users a recognisable familiarity along the route with an effortless travel environment that is intuitive, safe, accessible, and enjoyable.

Through adopting a kit of parts approach, use of common components, and a considered and coherent material palette, the line identity will become inherent in each station creating a consistent journey from surface to underground stations.

The commonality encompasses the surface and underground station architecture and environments, including entrances, concourses, platforms, vertical circulation, material palettes for example, and will extend to details such as signage, station furniture, fittings and technology at the next design stages.

Additional benefits of common design to the MetroLink project include:

- Economy of scale - programme and cost benefits;
- Reduction in number of elements to be designed overall through standardisation – allowing more time to refine and improve functionality of key items/elements;

- Key elements can be detailed and developed with input from industry to increase efficiency of manufacture, installation, and future maintenance;
- Simplified development, testing and assurance through mock-ups and prototypes, with opportunity for stakeholder input;
- Improved safety, quality, and consistency in workmanship through repetition in construction methodology; and
- Simplified maintenance regimes and increased durability through repeated detailing.

4.7.3 Generic Surface Station Environment

The consistent architectural arrangement for all open cut stations ties in with the architectural language of the underground station typology, whilst also reflecting the locality of the FCC area.

The highly efficient arrangement of the surface stations tapers in response to passenger flows, reducing its impact at street level through an optimized footprint (Diagram 4.3). The primary above ground architectural expression comprises an expressive low-lying roof canopy. Supported by a regular rhythm of V-columns, the canopy inclines to indicate the station entrance intuitively at its high point, its mass broken down with the use of a central glazing strip, also adding to the passenger experience along with the warmth of the timber soffit. The canopy serves as a unifying language across the typical (Seatown, Swords and Fosterstown) and a-typical (Estuary and Dardistown) surface stations.

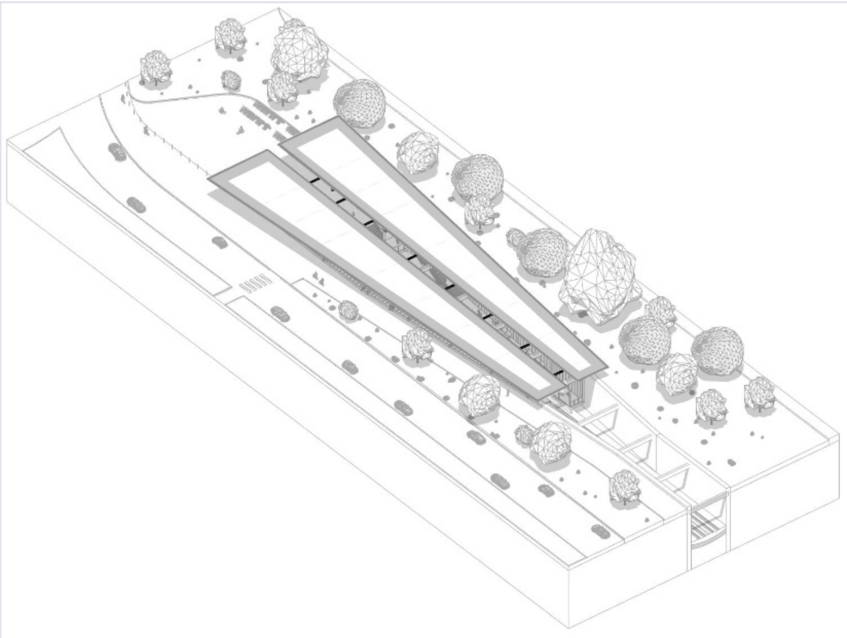


Diagram 4.3: Typical Footprint of a Station in Retained Cut

The surface stations use glazed perimeter screens to allow views across, into and out of the stations to support intuitive wayfinding and natural surveillance, also maximising natural light received at platform level. Echoing the architecture of the underground stations and making reference to the use of heritage stonework in the local context, the station side walls take a common approach to materiality using panellised natural stone or GRC cladding to create a monolithic surface, its textural quality catching the light and providing visual stimulation.

The design intent for both generic underground and surface station typologies also outlines high level principles for the following servicing strategies to inform the next design stages:

- Lighting
- Service zoning
- Ventilation
- Acoustics
- Signage and wayfinding

4.7.4 Generic Underground Station Environment

The volumetric arrangement for the underground stations delivers a generous, well-considered primary front of house volume for passengers with clear wayfinding (Diagram 4.4). By inclining the station side walls the station can house more service rooms at the upper levels, this approach reduces the overall size of the station structure below ground and minimises the impact of the station on the city.

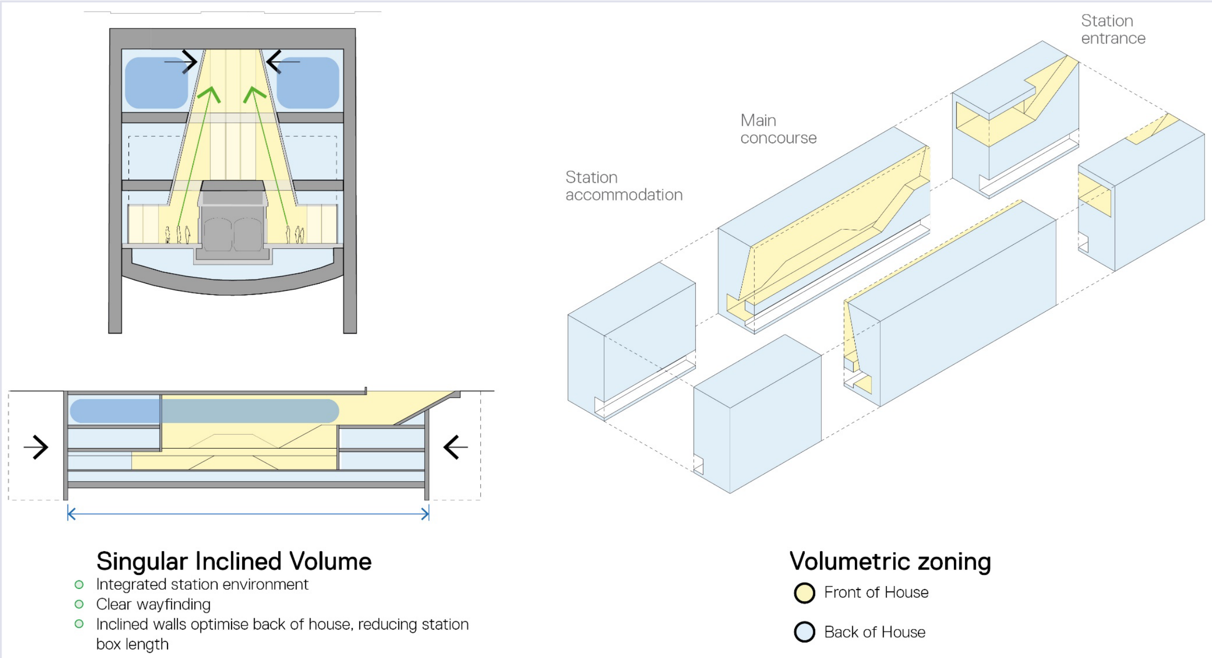


Diagram 4.4: Generic Volumetric Arrangement for the Underground Stations

Creating a fluid, intuitive and uplifting environment for passengers was a key criterion for the station design. The station arrangement and procession of spaces from entrance to platform share the same principles of design across all underground stations in order to create familiarity, enhancing passenger experience and intuitive wayfinding. When possible, skylights maximise the use of natural light, giving hierarchy to the primary station volume and providing a connection to the outside. The textured surface of the inclined walls catch the light to provide visual stimulation, supporting the play of light and shadow in the primary volumes of the underground stations, creating a high-quality station environment unique to MetroLink (Diagram 4.5).

The internal front of house environments at each station will provide a consistent, high quality passenger experience, and contributes to the common design language of MetroLink. The passenger journey through each station, and across the MetroLink line, is supported by a consistent identity to aid wayfinding, legibility, and inclusivity.

Diagram 4.5: Longitudinal View of the Interior of an Underground Station

A shared, well-defined palette of high-quality, robust materials is applied across all underground stations to create a strong sense of identity across the MetroLink line, whilst bringing an efficiency in testing and prototyping within the material selection assurance process. This consistency also extends across the surface stations and common components as a unifying identity across the line.

4.7.5 Common Components

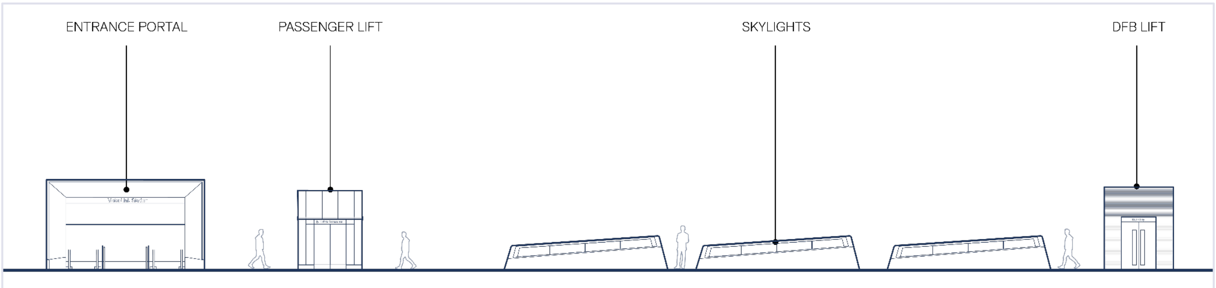


Diagram 4.6: Sketches of Common Components at Ground Level

The common components at each station will provide a consistent, high quality passenger experience. The entrance portals, skylights, public facing lifts, and service lifts ("station popups") will form a coherent linewide MetroLink brand identity as part of the Dublin streetscape, aiding wayfinding and placemaking (Diagram 4.6). The concise and recognisable material palette across the common components takes inspiration from both historical and contemporary elements of the city's built environment.

The station popups share a set of principles that ensure a high-quality passenger experience is achieved across the Metrolink network:

- Durability, security, functionality;
- Commonality across contexts;
- Branding and identity;
- Universal access;
- Weather protection and safety; and
- Environment.

The entrance portals provide secure shelter over the escalators to the underground station, with glazed elevations to maximise natural light and aid wayfinding.

The passenger lifts also use glazing, helping users quickly orientate themselves and enable good visual permeability across the public realm. Dublin Fire Brigade (DFB) lifts are clearly differentiated in their approach to materiality.

The skylights draw natural light into the underground station environment with forms that maintain visual permeability in the local area and ensure durability. A shared approach to materiality and detailing creates a coherent and highly identifiable set of station elements within the above ground public realm.

Diagram 4.7: View of Skylights at Tara Station

High quality, self-finished materials, robust forms and careful detailing provide highly functional, secure, and durable station elements that contribute to the common MetroLink language and identity.

4.7.6 Urban Realm and Landscaping

Extensive landscaping is proposed around Estuary Station and the P&R, to incorporate a sculptured landscape, with biodiverse planting integrated with wetlands and drainage attenuation ponds (see Section 4.14.3). The stations at Estuary, Seatown, Swords Central and Fosterstown will be connected by landscaping proposals provided as part of the proposed Project along the R132 whereby it will be possible to walk or cycle along its approximate 5km route. The public realm areas around these stations are defined by the station architecture and the necessity for a plaza arrival area to the front of each station. The public realm around the stations, in conjunction with the amendments to the R132 layout as part of the R132 Connectivity Scheme, interfaces with the surrounding urban framework. The public realm design for these stations has been developed around access points and desire lines for both cyclists and pedestrians to access the stations. Through the explorations of these access movements, the landscape design elements were created, and these form the main elements of the landscape design.

As part of the proposed Project, the Dardistown Depot will be developed at a green field site in the Dardistown area. The development of this site will involve the diversion of an existing stream, while retaining and enhancing its riparian corridor. The landscape design of the Dardistown Depot has been developed to ensure the integration of the proposed Project into the surrounding landscape. Landscape treatments here include woodland planting, mature planting, wildflower meadow, tree planting, screen planting and riparian planting to stream edges. Surface interfaces of track are treated with embankment planting and woodland mixes to integrate the development within its landscape character area. These areas include the DANP and DASP, Fosterstown Lane area, and the M50 interface.

Key aspects of the proposed Project are as follows:

- The individual identity of each station is enhanced and defined by a feature tree or a feature group of trees and the nature of the associated planting.
- The planting palette is inspired by its setting in the landscape for example by the nearby estuary and coastal planting.
- The planting beds define the spaces and are functional in their creation of space and their use within the proposed Project. Some of these planting beds are incorporated into the SuDS design as detention basins taking the run-off from the adjacent pavement and feeding that water into the wider drainage scheme in a sustainable manner.
- Other landscape elements direct and orientate the users within the proposed Project, with elements such as benches and textured tactile paving being used to orientate pedestrians through the proposed Project.
- The retained cut stations are adjacent to a cut and cover section of track, there is provision for the integration of landscape elements on top of the railway infrastructure beneath. Soil depths and the associated technical requirements are provided for within the design so that the planting can be integrated and established as main elements with the public realm on top of the proposed Project's infrastructure.
- The proposed Project interfaces with adjacent existing developments and the landscape design seeks to form appropriate relationships and linkages through the use of retaining walls and blocks of planting which define the spaces and integrate the proposed Project within its existing context. At the interface between the proposed Project and the R132, the vertical alignment of the path network is split between the road alignment and the station alignment with planted slopes addressing the change in level.
- Cycle parking is provided in one of two options, (1) a specifically designed cycle park building and (2) surface parking, both covered and uncovered, which is integrated within the landscape design at each particular station. Routes between the cycle parking and the R132 and its integrated cycle network (provided under that project) are shared between cyclists and pedestrians and of appropriate width to accommodate both safely.

The 11 underground stations will be constructed using top-down excavation. These stations will involve an isolated footprint of excavation for each development. This excavation will have an impact on the existing urban realm and landscape due to works required during construction. The design of the stations allows for soil and growth substrate above the infrastructure so that planting can be considered and implemented as part of the proposed Project. This planting ranges from large mature trees to blocks of shrub planting and SuDS elements as part of the design. Further descriptions of the urban realm and landscaping proposals for station typologies is described in Section 4.9 and each station is described in Sections 4.14 to 4.17.

4.7.7 Universal Design Principles

The overarching principle of universal design aims to make the proposed Project accessible for everyone to use, regardless of their age, gender, physical capabilities or cultural background. Design measures considered the following seven principles:

- Equitable Use – The proposed Project has been designed for use by people with diverse abilities, by providing the same means of use for all passengers without segregating or stigmatising any users.
- Flexibility in Use – The design accommodates a wide range of individual preferences and abilities, providing choice in the methods of use and adaptability to the passenger's pace of travel.
- Simple and Intuitive Use – The layout of the facilities is easy to understand, regardless of the passenger's experience, knowledge, language skills, or current concentration level.

- Perceptible Information – Information is communicated effectively to the passenger, regardless of ambient conditions or the passenger's sensory abilities. Information will be provided in different modes (pictorial, verbal, and tactile).
- Tolerance for Error – The design minimises hazards and the adverse consequences of accidental or unintended actions by providing warnings of hazards.
- Low Physical Effort – The design can be used efficiently and comfortably and with minimal fatigue.
- Size and Space for Approach and Use – Appropriate size and space is provided for approach, reach, manipulation and use regardless of the passenger's body size, posture, or mobility. The design provides a clear line of sight to important elements for any seated or standing passenger.

4.8 Drainage Design

4.8.1 General Principles

The drainage design has been developed for the proposed Project in order to convey and manage surface water from the system where required. The system has been designed to allow for gravity flow to discharge points with pumping systems in place only where gravity flow is not possible. The system has been designed based on the following principles:

- To ensure the treatment, management and attenuation of all surface water received and generated by the proposed Project prior to discharge;
- To ensure that clean surface water runoff is managed separately from potentially contaminated flows such as firewater; and
- To ensure the effective management and mitigation of surface, fluvial, coastal and groundwater sources of flooding.

Uncontaminated surface runoff collected within the drainage system will be discharged to surface water bodies (preferably) or the storm sewer network after the following treatment:

- Attenuation in appropriately sized attenuation ponds or other SuDS features (1% AEP (Annual Exceedance Probability) or 1 in 100-year storm with allowance for climate change and freeboard);
- Discharge limit controls on the outflows to greenfield runoff rates (1% AEP with climate change correction);
- Treatment SuDS features; and
- Treatment via Petrol/Oil Interceptors.

An automated valve control system will also be in place which will automatically close in the event of a fire or accident in order to ensure that any contaminated water is contained within the system. Contaminated water will then either be discharged to sewer or pumped to tanker for appropriate disposal.

The following subsections describe the track drainage system and the types of SuDS available. Further details on the drainage design considered in the EIA are provided in Chapter 18 (Hydrology), while Figures 18.9 - 18.14 show the locations of attenuation ponds and discharge locations for each of the catchment areas. The discharge points to receiving waters are also shown on Figure 4.1. The drainage design has followed the principles of SuDS having regard to the Greater Dublin Strategic Drainage Strategy (GDSDS). These SuDS principles are discussed earlier in Section 4.6 and are illustrated below (Diagram 4.8-4.12).

4.8.2 Track Drainage System

The drainage design for the proposed Project is based on the following.

- All track drainage is directed to the centre of the track, where a main central drainage channel (1m wide) is located to convey the flow to the assigned discharge point. In most cases the slope of the channel will follow the gradient of the track. When the track grade is flat, for example at stations, the channel will have a built-in minimum slope to achieve a minimum velocity of 0.5m/s.

- The central drainage channel is used to maximise potential online storage and reduce the required size of the attenuation tanks or ponds that are required prior to discharge. In tunnel sections, the channel width is set at 1m, with a depth of up to 1m. For all sections, the central channel will be formed in situ.
- When the track is curved, lateral pipes will transfer flows to the main central drainage channel through connections at 4.0m to 6.5m spacing.
- The maximum design flow of all elements is 80% of capacity. The 'spare' 20% is to allow for uncertainty in the surface water run-off estimation and to mitigate the impact of over-design on the track drainage.
- At stations and pumped discharge points, the central channels are joined in a main collector pipe or channel, which directs the water towards the pumping well. A group of three pumps will be installed inside the well, two in duty and one in standby, to pump the water up a rising main to a reception manhole and then on to the approved outfall point.
- Drainage collected in the surface sections will be discharged at the green field rate controlled via attenuation storage to a watercourse. Drainage collected in sumps in the tunnel sections will be discharged to a watercourse, or where a suitable site is not available, to public sewer subject to an agreement with Irish Water.

4.8.3 SuDS

A number of SuDS elements have been included in the proposed Project design which will contribute to meeting sustainable initiatives detailed in section 4.6.

- *Rainwater Harvesting:* Rainwater harvesting is the collection of rainwater runoff from roofs and other impermeable surfaces, storage, and subsequent reuse as a non-potable water resource. A rainwater harvesting tank is proposed at Dardistown Depot for irrigation of plantings, allowing a sustainable water recycling solution.
- *Green Roofs:* Green roofs are areas of living vegetation that are placed on top of buildings, as shown in Diagram 4.8. They may be used for several reasons such as their ecological value, aesthetics and for reducing the volume of surface water run-off.

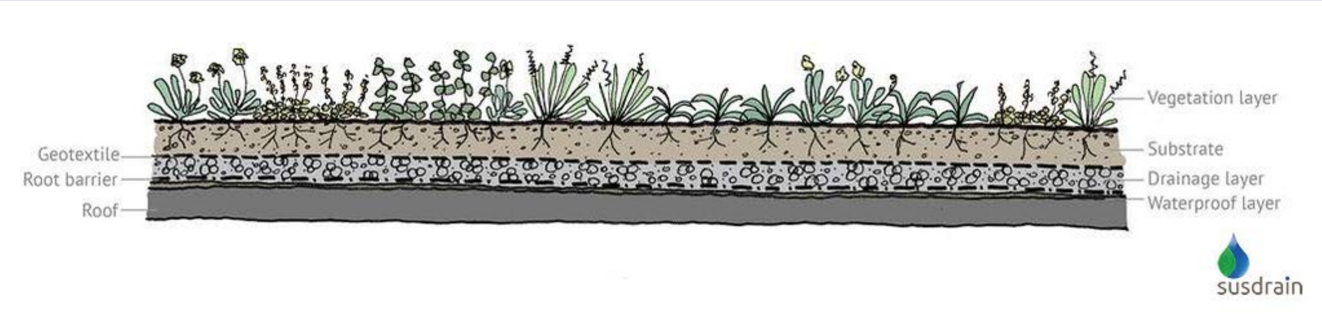


Diagram 4.8: Typical Green Roofs (Taken from Susdrain)

- *Rain Gardens:* Rain gardens are typically small systems that receive rainfall and runoff from a very limited paved area, as shown in Diagram 4.9. They comprise a 200mm to 500mm layer of compost and sand amended native soils or specified engineered soil mixes, and have a simple inflow where rainwater enters the garden, and they have a maximum ponding depth of 150mm. It is proposed to have rain gardens around Estuary Station and P&R where rainwater runoff will be collected and drain to six attenuation ponds (see Section 4.14.3). Rain gardens provide a sustainable solution by reducing the discharge of surface water to the drainage network, as well as benefiting the local biodiversity.

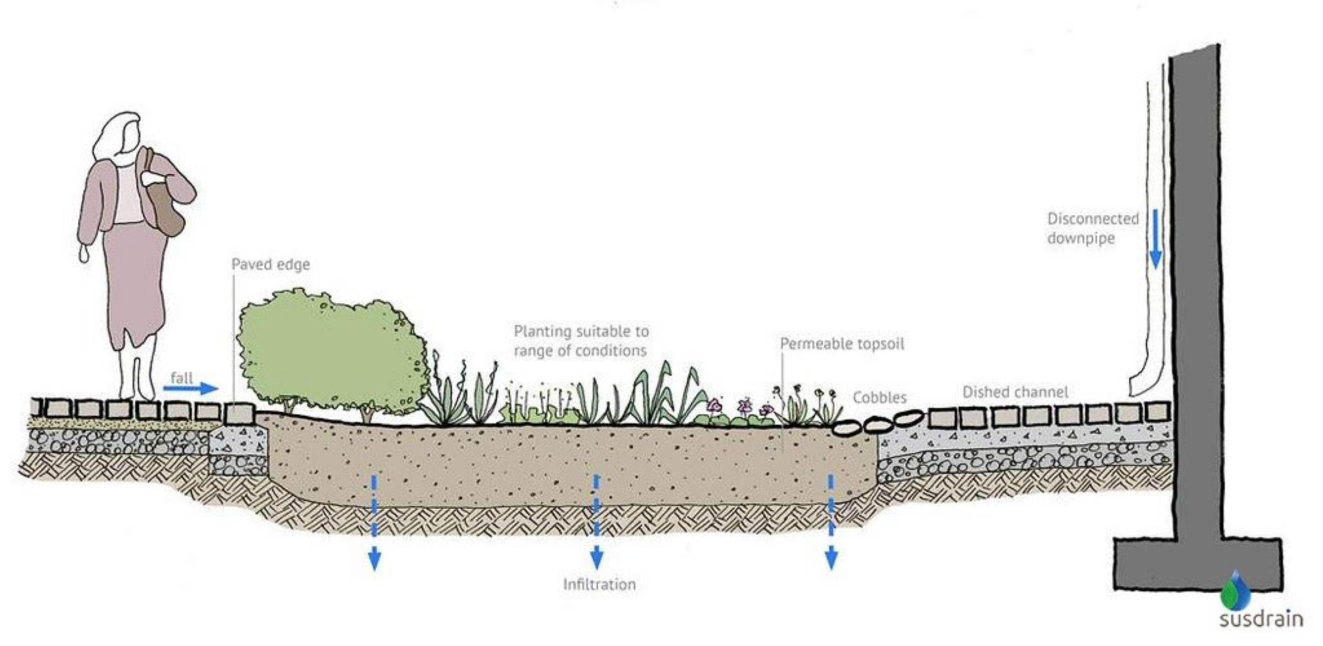


Diagram 4.9: Typical Rain Garden (Taken from Susdrain)

- *Filter Drains:* Filter drains are trenches along the roadside that are filled with a permeable material or media that is designed to filter, temporarily detain, and then convey runoff. They are commonly used when limited space is available.
- *Filter Strips:* Filter strips are ribbons of grass or other dense vegetation with shallow, even gradients, situated adjacent to impermeable surfaces. Runoff from impermeable areas is designed to flow at low velocities over the filter strips enabling pollutant removal via sedimentation, filtration and infiltration.
- *Swales:* Swales are shallow, flat bottomed, vegetated open channels that convey and attenuate surface water runoff and provide a measure of treatment of pollutants. They are incorporated at Estuary, along the landscaping adjoining the R132, and the landscape planting associated with Seatown, Swords Central, Northwood, Ballymun and Collins Avenue Stations. They collect drainage from impervious areas such as roads and car parking, and are used, wherever possible, in lieu of pipework.
- *Infiltration Basins:* Infiltration basins are flat bottomed, shallow landscape depressions that store runoff, allowing pollutants to settle and filter out before infiltration to the subsurface soils, as shown in Diagram 4.10. Due to the poor infiltration property of soil in the Dublin area, infiltration basins are not proposed at this stage.

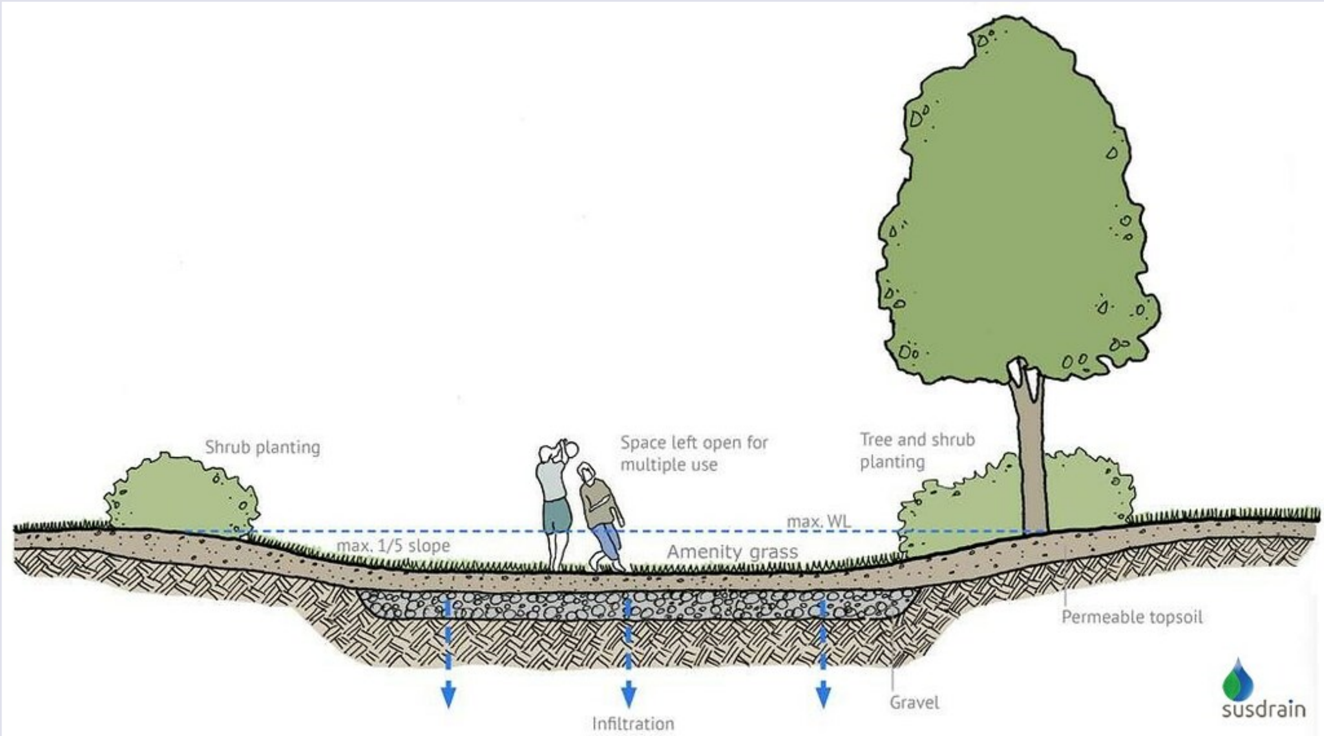


Diagram 4.10: Typical Infiltration Basin (Taken from Susdrain)

- *Pervious/Permeable Pavements:* Pervious pavements allow rainwater to infiltrate through the surface to the underlying structural layers where the water is temporarily stored before use, infiltration to the subsoil underneath, or released through a downstream discharge as shown in Diagram 4.11.

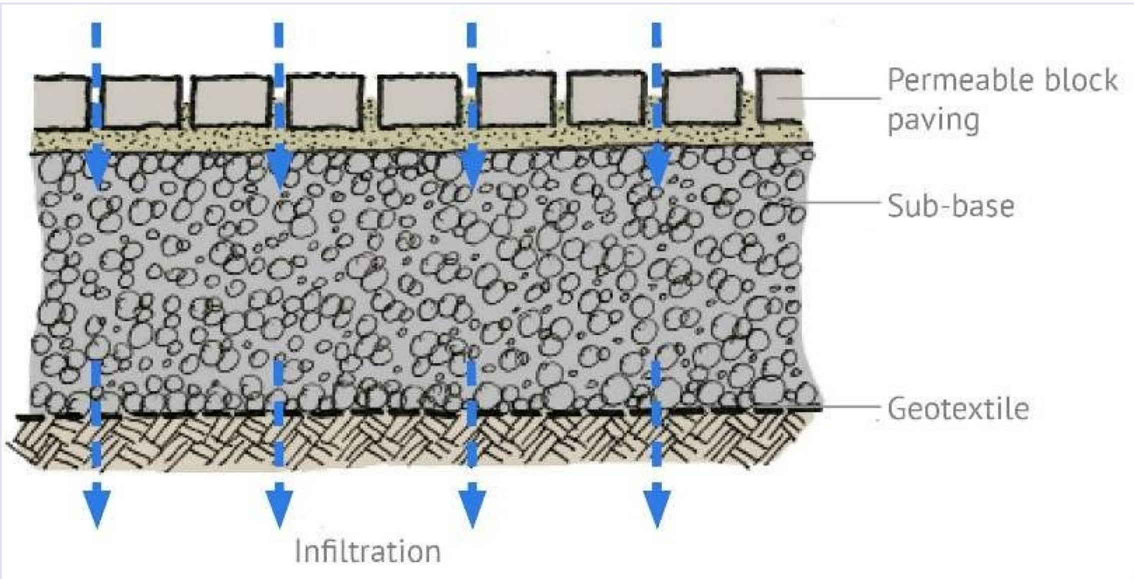


Diagram 4.11: Typical Pervious/Permeable Pavement (Taken from Susdrain)

- *Geocellular Drainage:* Geocellular drainage is useful where site constraints preclude the use of other methods and is considered for attenuating the runoff and for the removal of sediments and floatables in underground cells. These are used for example at Seatown and in the urban realm at underground stations.
- *Retention Ponds and Wetlands:* Retention ponds and wetlands are depressions that include a permanent volume of water (normally a maximum of 1.2m deep (CIRIA, 2015)) and are designed to temporarily detain and treat runoff. The term "wetland" is used to describe bodies of water with

larger proportions of the surface area covered by aquatic planting. This type of SuDS has not been proposed at this stage and will be considered at later design. Diagram 4.12 shows a typical schematic of a retention pond.

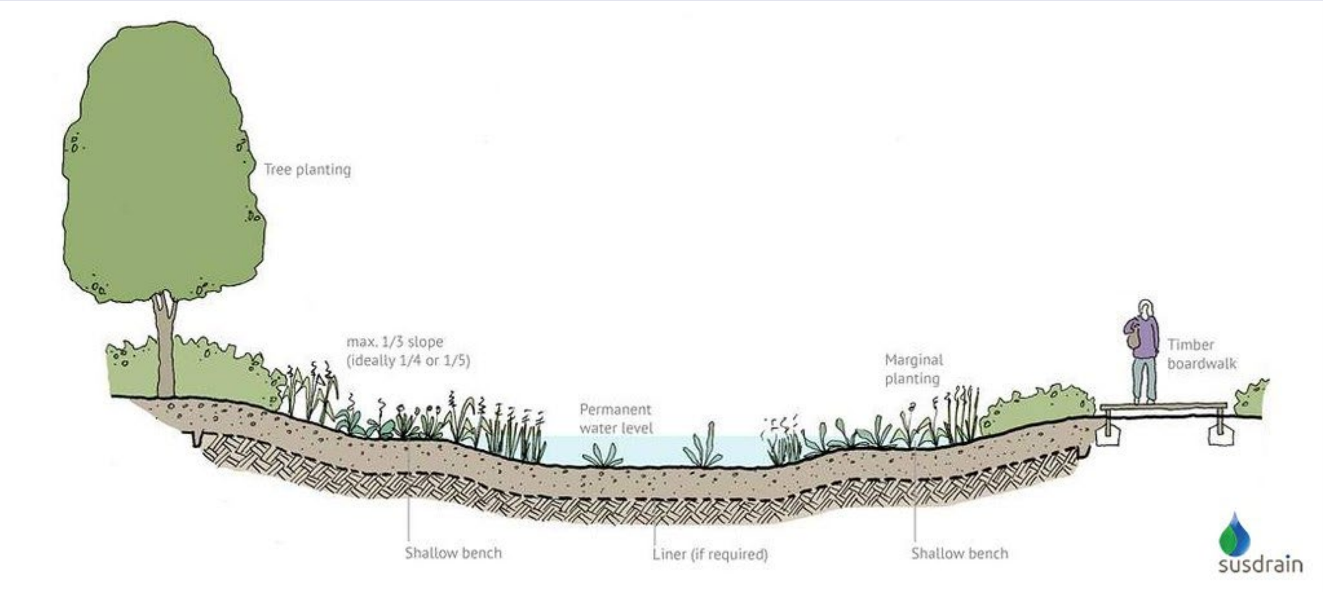


Diagram 4.12: Typical Retention Pond/Wetlands (Taken from Susdrain)

4.9 Stations

4.9.1 Design Concept

As discussed above in Section 4.7, stations have been designed in line with the architectural, urban realm and landscape principles developed for the proposed Project. However the station concept design has also been developed to ensure that stations operate to maximum efficiency having regard to the following principles:

- Easy wayfinding throughout the station;
- Clear indication of changes between concourse at ground level and lower-level platforms for stations in retained cut and between the ground level, concourse, an intermediary mezzanine and lower-level platform for underground stations, accessed by stairs, escalators, and lifts;
- Where possible maximize the use of natural daylight (for underground stations);
- A safe and open environment;
- Make a clear distinction between public and restricted areas;
- Provide efficient use of space for Front of House (FOH) and Back of House (BOH) on all levels;
- Have no gate lines; and
- To provide cycle parking at each station, except at O'Connell Street Station.

Most of the stations are placed close to existing and planned bus stops, and some of the stations have provisions for vehicle drop off points. Access to each station will be by either lift, escalator or stairs, which have been designed to meet the anticipated patronage, universal design principles, and to allow for safe evacuation in case of an emergency.

Signage will be provided throughout the stations to ensure that passengers can easily follow directions for entry or exit to the station or their preferred destination.

Passenger information displays will be provided to show a summary of arrivals and departures. In addition, on each of the platforms, next train displays will be provided, positioned to provide easy passenger viewing along the length of the platform.

A Public Address System with Voice Alarm (PAVA) interfaced with the Fire Alarms System will be provided at all levels throughout the stations.

Passenger Help Points (PHPs) will be located throughout the station to provide two-way communication with the OCC for passenger information or assistance.

Emergency Help Points (EHPs) will be provided at all stations and at all levels to provide passengers with immediate two-way communication with the OCC. The Closed-Circuit Television (CCTV) system is interfaced with these EHPs so that the operator at the OCC can also monitor the specific EHP in use similar to the existing Luas network. CCTV cameras are provided that are linked back to the OCC and backup OCC.

All station platforms will be 65m in length (slightly longer than the trains of 64m) and at least 3m wide. The design for the width of the platforms is based on the predicted number of passengers, assumptions about the distribution of passengers along the platform, and the position of other features such as the stairs and escalators. This approach follows Station Planning Standards and Guidelines, Transport for London, 2012 and Station Capacity Planning, Transport for London S1371.

Full height Platform Screen Doors (PSD) will be provided along the complete length of the platforms to screen off the platform from the tracks. The location of the doors along the platform will be aligned with the doors of the rolling stock.

All stations will have BOH rooms to accommodate the various technical systems required for the operation of the proposed Project as well as welfare facilities for staff. Passenger welfare facilities will be provided at the main interchange stations of Glasnevin, O'Connell Street, Tara and Charlemont.

At each station there will be a Station Incident Room (SIR), which will be unstaffed during normal operations and will be located on the concourse level. The SIR is available for staff to operate and control station systems locally during any incidents and emergencies.

Estuary Station is a surface station, and the platforms are open along both sides so emergency stairs are not required. In the remaining stations, emergency stairs are provided in addition to the normal accesses via stairs, lifts and escalators, which will also serve as an evacuation route from the platforms to street level in the event of an incident.

The following section describes the general features of the three types of stations and further descriptions of each station are provided in Sections 4.14 to 4.17 of this Chapter. Chapter 6 (MetroLink Operations & Maintenance) provides a description of the passenger experience using the stations and details on emergency procedures.

4.9.2 Station Typology

There are three different station typologies for the proposed Project, and these have been designed to interpret the architectural and urban realm vision, given the location of the stations along the alignment and the spatial constraints at street level for each station.

The station types (see Table 4.4) developed in response to these conditions are:

- Surface Station: This station typology is at ground level;
- Retained Cut Station: This station type features a station constructed primarily below ground level and is supported by retaining walls either side of the alignment but is not fully enclosed underground; and
- Underground Station: This station type is fully underground with a roof slab over the station to enclose the station fully underground.

Table 4.4: Station Types

Surface Station	Retained Cut Stations	Underground Stations
Estuary	Seatown Swords Central Fosterstown Dardistown (future)	Dublin Airport Northwood Ballymun Collins Avenue Griffith Park Glasnevin Mater O'Connell Street Tara St Stephen's Green Charlemont

4.9.2.1 Surface Stations

There is one surface station, Estuary Station, which is also the only station linked with a P&R facility. A detailed description of this station and the P&R is provided in Section 4.14.3. This section summarises the key design principles for this station which are:

- Multi-modal design to connect with passengers arriving and leaving by bus, car, taxi, cycle and on foot;
- Design integrated with existing footpaths and road network and with the planned future development of the surrounding area;
- Provision for car and cycle parking, including EV charging;
- Architectural concept of the station building (the canopy, platforms, and finishes) and passenger circulation between the platforms and connections with the P&R and arrivals from the west and east side of the station;
- Accessibility for all through signposting, step free access and visual and auditory aids; and
- BOH services, including a Backup OCC, for the smooth running of the railway.

The basic form for Estuary Station is illustrated in Diagram 4.13.

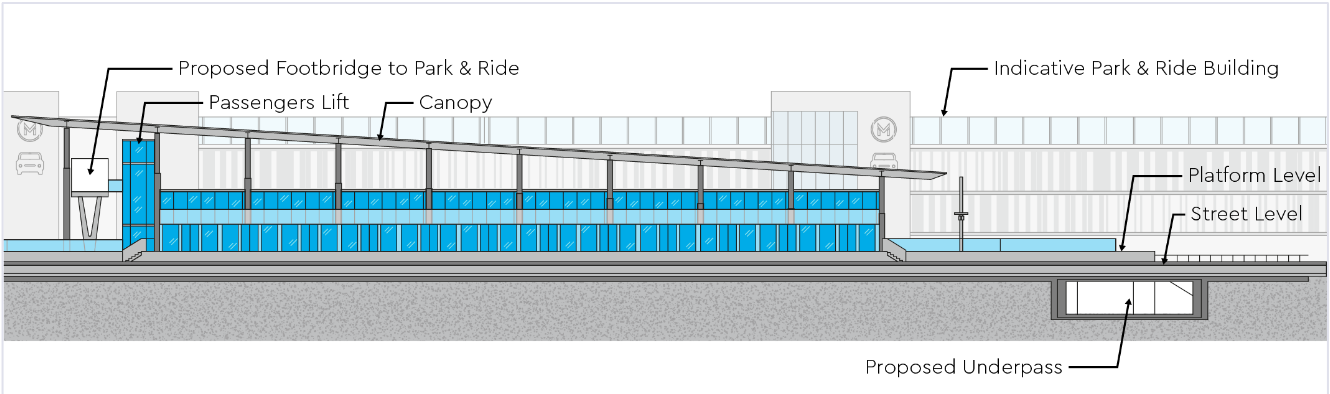


Diagram 4.13: General Long Section Arrangement of Estuary Station

The station, with the forecourt, platforms, the BOH, backup OCC, and traction sub-station, will all be built at ground level. The station platform will link with the Estuary P&R second floor via a pedestrian bridge, which will also cross over the pedestrian, cycle and road accesses to the station beneath.

The platforms will be 65m long and 8m wide, except by the stairs to the pedestrian bridge where the platform will be approximately 5m wide.

4.9.2.2 Retained Cut Stations

Four stations are included in the proposed Project along the retained cut section of the alignment running adjacent to the R132:

- Seatown Station;
- Swords Central Station;
- Fosterstown Station; and
- Dardistown.

In the opening year, Dardistown will operate only for staff travelling to and from the maintenance depot and OCC. TII will apply for consent for future use as a passenger station at a future date having regard to forecast demand.

The design for the retained cut stations is defined by the architectural and urban realm vision, the simplicity and functionality of the station and the surrounding topography and land use. The key design features are listed below:

- The station entrances will be covered;
- Canopies provide visual identification from surrounding areas, shelter over the platforms, and will also provide the environment to create meeting points for passengers;
- Provision of cycle parking;
- The design will preserve the integration of neighbourhoods that might be separated by the stations and track alignment and urban design solutions have been provided in order to enhance such integration;
- Environmental aspects have been considered to reduce the potential impacts of the open cuts; and
- BOH services will be provided to maintain operations, the required of maintenance of the stations and welfare facilities for staff.

The stations will be protected by a green canopy. Each of these stations will typically consist of two levels, connected by stairs, except Fosterstown where escalators will be provided due to the predicted higher passenger demand. Two lifts between the street and platform levels complete the operational layout of these types of stations. There will be a sheltered concourse at ground level, where the entrance/exit will be located. Platforms will be located on the lower level and will be 65m long with variable widths from north to south, widening at the busiest areas closest to stairways and lifts. The required platform widths for each station are based on predicted passenger demand, and more details are provided under the relevant station headings later in this Chapter. A typical arrangement for a retained cut station is outlined in Diagram 4.14 and Diagram 4.15

BOH services, technical rooms and staff facilities will be located at platform level under the concourse slab. These will be areas with an operational function for employees, as described further in Chapter 6 (Operations & Maintenance), which are not accessible to the travelling public. The platforms will be fitted with full height PSDs.

Dardistown Station will vary from the standard retained cut station design due to its operational requirements to provide rail access into Dardistown Depot. The configuration is altered by having two additional tracks that run in parallel with the public platforms. This has required a wider cutting but retains the main design principles as applied to the other retained cut stations.

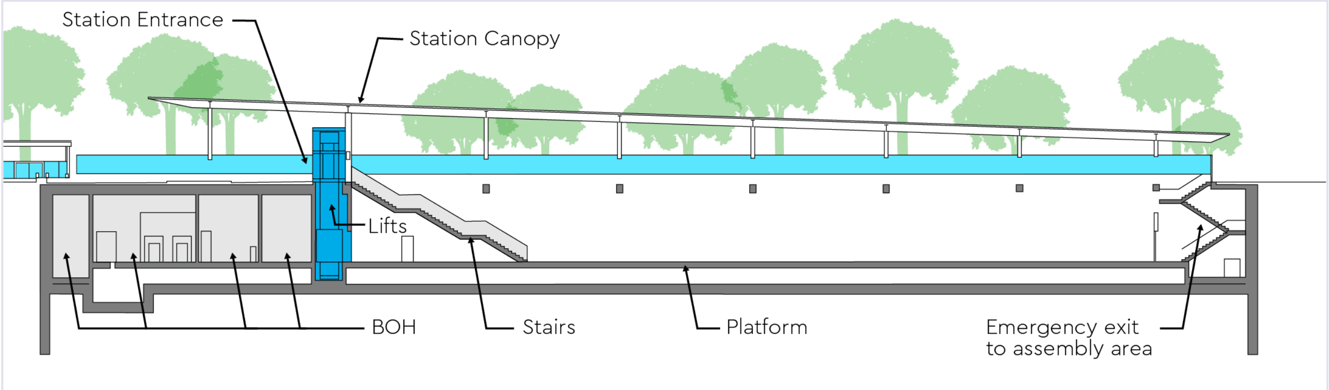


Diagram 4.14: General Long Section Arrangement of a Retained Cut Station

Diagram 4.15: Typical Retained Cut Station Concourse

4.9.2.3 Underground Stations

There will be 11 underground stations at Dublin Airport, Northwood, Ballymun, Collins Avenue, Griffith Park, Glasnevin, Mater, O'Connell, Tara, St Stephen's Green and Charlemont.

The design for the underground stations is based on the following key design features:

- A single public open volume with inclined walls between the skylights and ceiling and the mezzanine;
- Linear circulation from the entrance to the platforms;
- Separate upper concourse level;
- Platform open to the mezzanine level;
- Front of house and back of house on all levels;
- Natural light over the platforms where possible; and
- Common elements of design.

Underground stations will have the following principal elements as illustrated in Diagram 4.16

- The street level access with a canopied entrance leading to the concourse level, the mezzanine level, and the platforms;

- Escalators, stairs and lifts between the various levels;
- Under-Platform and Under-Track levels are reserved for utility and communications services only;
- Operational systems; and
- Skylights to allow natural light over the mezzanine level where feasible.

The station design assumes diaphragm walls will form a concrete box (referred to as the 'station box') propped by intermediate floor slabs and topped out with concrete roof slab. The platform level of these stations will be located approximately 23m to 25m below ground level, although Northwood station will be shallower at about 17m depth due to its transitional position between retained cut and tunnel. Descriptions of the construction methods for the underground stations are provided in Chapter 5 (MetroLink Construction Phase).

The constraints at some locations means that variations on the generic design are necessary. These constraints arise either because the station is associated with a new commercial development or because it is linked with another transport mode. This is the case for Northwood Station, O'Connell Street Station, Glasnevin Station, and Tara Station.

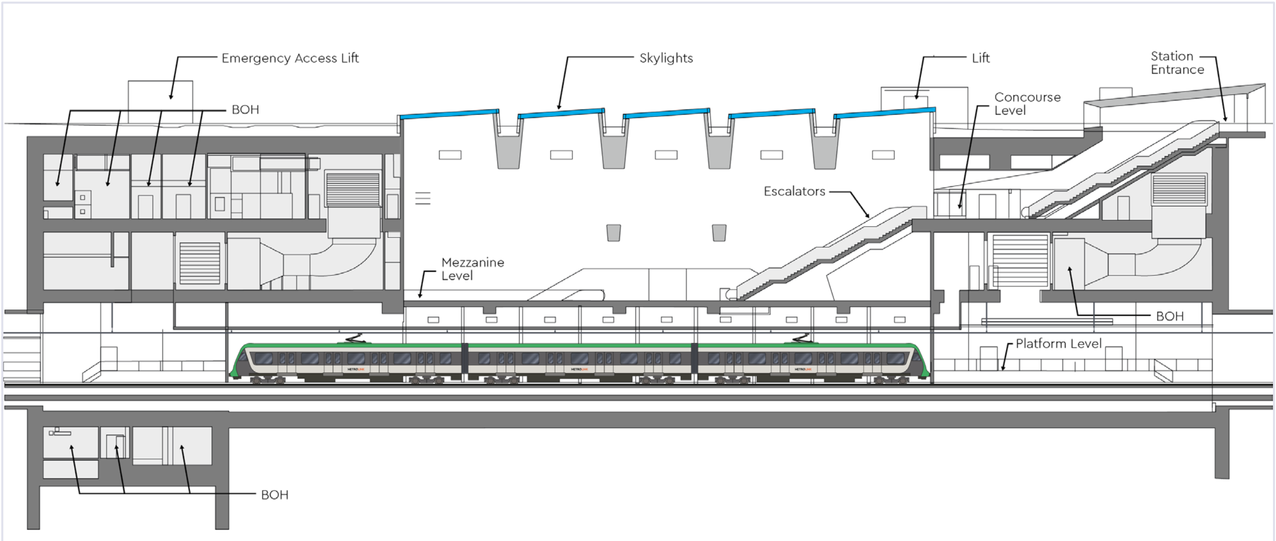


Diagram 4.16: General Long Section of an Underground Station

One entrance is proposed to each underground station along the long axis of the station box, with the exceptions of the stations at Northwood, O'Connell Street, Tara and Charlemont which will each have two entrances. Canopies will provide placemaking and protection to passengers in the immediate entrance area and at the top of the stairs and escalators. More substantial entrances will be provided at Dublin Airport and Glasnevin, while a smaller canopy structure will be provided over the entrance for Griffith Park Station.

As illustrated in Diagram 4.16, on entering the station, passengers will descend from street level via the escalators in a straight line from the concourse to the mezzanine level along the central axis of the station. Passengers then have the choice of two pairs of escalators placed to the side of the central axis, but clearly visible, to descend to the platforms. At stations with two entrances, escalators descend from each entrance to the concourse and mezzanine levels along the central axis and facing each other. Passengers then turn to the side to take one of four escalators to the platform. At Dublin Airport, a bank of six escalators will be provided street-concourse-mezzanine, and four escalators mezzanine-platform. At O'Connell Street the two entrances will be located at the northern part of the station, so the geometry of the escalators from the entrance to the concourse level is different. A bank of escalators extends between the concourse and mezzanine levels, with escalators to the platform level located to the side. The arrangements are slightly different for Northwood station, which is not as deep as the remaining underground stations and has two rather than three public levels. The escalators from the street level to the intermediate level are angled relative to the main axis along the station and a second pair of escalators descend from the intermediate level to the mezzanine along the main axis of the station. Passengers then turn to the side to take one of four escalators to the platform.

The street and concourse levels are typically connected by one set of stairs, with a flight of stairs to each platform. There are variations on these arrangements for those stations with two entrances. At Northwood, there are two sets of stairs between the street and platform levels. No stairs are proposed at Dublin Airport and O'Connell Street (except for the emergency stairs). At Tara, there is one flight of stairs from street level to the concourse, and then two flights of stairs to the mezzanine and platform levels. At Charlemont, there are no stairs from the street to the concourse level. At the northern end of the station there is one flight of stairs to the mezzanine and two to each platform, while at the southern end there are two flights of stairs to the mezzanine and platform levels reflecting the higher predicted footfall.

The underground stations are also served by public lifts, generally with one lift street to concourse level and two lifts concourse to platform level. More lifts are proposed at stations forecast to experience a higher footfall or to serve two entrances. Six lifts are proposed between the street and platforms and the concourse and platforms at Dublin Airport. At Northwood, two lifts will be provided between the street and mezzanine level and four between the mezzanine and platform levels. At Tara, two lifts are proposed between the street and concourse level and four between the concourse and platform levels.

PSDs in the underground stations will extend from the floor level on the platform to the station ceiling for the length of platform as illustrated in Diagram 4.17.

Diagram 4.17: Indicative Illustration of PSDs at Proposed Underground Stations

Emergency stairs will be included at each underground station connecting platforms and concourse to street level via two street level emergency exits. The stairways also provide emergency access from the adjacent tunnel sections. Two DFB/emergency services intervention lift shafts will be provided from street level providing access to platform level.

The following station surface features will be located at ground level at each underground station:

- Main station entrance with canopy, escalators and stairs (Diagram 4.18);
- Ventilation and air intake grills;
- Firefighting lifts (Intervention Shaft) one at each end of the station;
- Passenger lifts; and
- Emergency exits, one at each end of the station end with a 'pop up' opening at ground level.

The station facilities at ground level will be integrated with the existing urban environment. The following principles have been adopted to ensure that the design maximises the quality of urban integration:

- Green areas and existing trees will be protected where practicable. Where this is not practicable the future conditions will promote the normal growth of new or replacement trees;
- In urban areas, the underground station roof slabs will be located approximately 1.5m below ground level to avoid future constraints in the installation of urban services; and
- Design of elements that emerge in the urban space are implemented following the general design principles outlined in Section 4.5 and the urban realm and landscaping design principles described in Section 4.7.

Diagram 4.18: Typical Station Entrance

4.10 Tunnels

4.10.1 The Main Tunnels and Ancillary Tunnels

The tunnel sections are provided to ensure that there is maximum operational efficiency of the proposed Project while also reducing potential impacts on the developed urban areas above the alignment. In total there will be approximately 11.7km of bored tunnel along the alignment of the proposed Project. The two main sections of tunnel along the alignment are:

- **Dublin Airport Tunnel:** The Airport Tunnel in AZ2 passes beneath Dublin Airport and is approximately 2.3km long running between the DANP and the DASP in the AZ2 Airport Section (see Diagram 4.1 and Figure 4.1). Parallel to the Airport Tunnel, there will also be two smaller diameter evacuation tunnels on the west side running northwards from DASP for about 315m and on the east side two ventilation tunnels connected to the main tunnel and extending approximately 600m from DASP underneath Dublin Airport Lands. In the event of an incident in the main tunnel, the evacuation tunnel will enable passengers to walk to a safe location outside the Dublin Airport Lands. The construction of these tunnels is by TMB, as described in Chapter 5 (MetroLink Construction Phase) (Section 5.5.3).
- **City Tunnel:** This tunnel will run southwards from a portal at Northwood through to Dublin City Centre in AZ4 and is just under 9.4km long (see Diagram 4.1 and Figure 4.1). The tunnel passes through nine underground stations before terminating 360m south of Charlemont. At the southern end of the City Tunnel, a parallel evacuation and ventilation tunnel (Charlemont Intervention Tunnel) will be provided that extends for approximately 300m from near the end of the City Tunnel back to Charlemont Station. This parallel tunnel is incorporated to support emergency evacuation of maintenance staff and ventilation for the tunnel section south of Charlemont.

Both tunnels will comprise a single bore, twin track tunnel with an external diameter of 9.2m and an internal diameter of 8.5m. The internal diameter is determined by the requirements for rolling stock clearance, space to locate utilities and other railway services, and emergency evacuation. The minimum curvature radius considered for the main tunnel is 350m and the bored tunnel has been designed accordingly.

The tunnel wall will consist of concrete segment rings, sealed together. The tracks will be canted (one rail higher than the other) where the tunnel curves, to allow trains to corner safely. A cross section of a typical bored tunnel configuration is shown in Diagram 4.19.

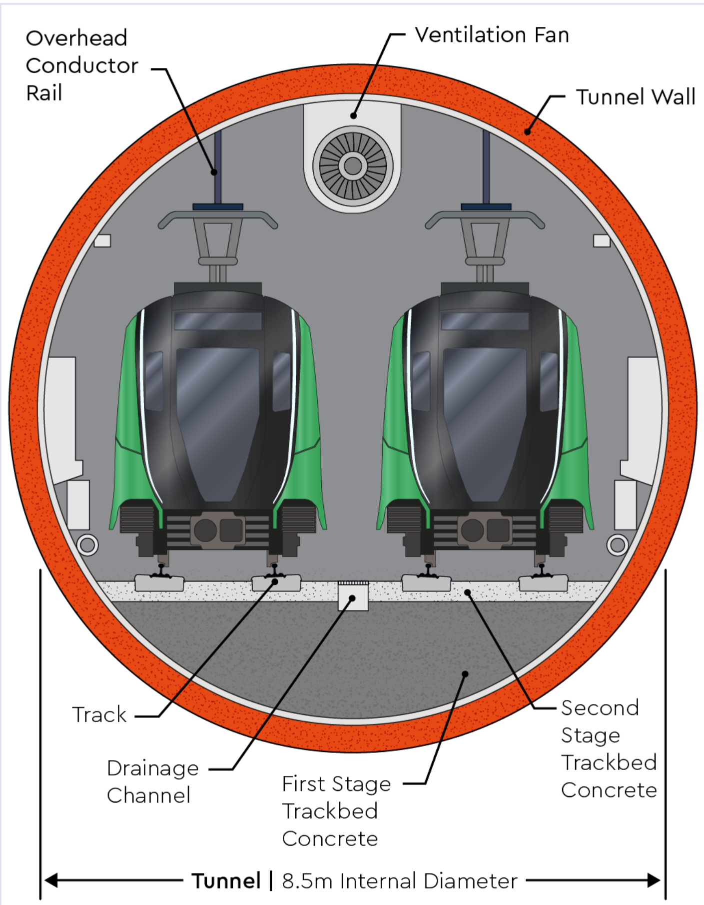


Diagram 4.19: Indicative Bored Tunnel Configuration

The ventilation tunnels would typically have an internal diameter of about 6m and the pedestrian tunnels would be provided with an inner clearance about 2.3m wide and 2.4m high.

4.10.2 Albert College Park Intervention Shaft

The European Standard for safety in railway tunnels TSI 1303/2014: Technical Specification for Interoperability relating to 'safety in railway tunnels' of the rail system of the European Union, recommends that the maximum spacing between emergency exits is 1000m. In general, the underground stations are sufficiently close together to allow safe evacuation from the tunnel through the station to their emergency exits. However, at Albert College Park, where the distance between Collins Avenue and Griffith Park Stations exceeds 1km, a stand-alone intervention shaft will be built between the main tunnel and Albert College Park where there is a suitable area of undeveloped land for the exit point. The Albert College Park intervention shaft is described further in Section 4.17.5.

4.10.3 Tunnel Fit Out

The main tunnels will be fitted out to include:

- Tunnel drainage comprising a central drain covered by a grill;
- Overhead Conductor Rail (OCR) system to power the trains;
- Telecommunications equipment;
- Ventilation including jet fans for smoke exhaust;
- CCTV;
- Lighting;
- Wi-Fi;
- Medium Voltage (MV) and Low Voltage (LV) power; and
- A back up signalling system.

The fire-fighting system within the bored tunnel sections will include the following elements:

- A wet standpipe system (ring configuration) with fire hose connection to be located at each entrance to the tunnel i.e., portals, emergency exits, and both ends of the station and fitted to the side wall of the tunnel every 60m;
- Water tanks and pumps located at stations;
- Tunnel lighting which will be activated in the event of a fire;
- Photo luminescent signs to direct evacuees in the case of emergency;
- CCTV Cameras along both sides of the tunnel; and
- Emergency Telephone.

4.11 Surface Sections of MetroLink

4.11.1 Surface Sections

The alignment will be at ground level at several locations, which are identified in Table 4.5 and shown on Figure 4.1 together with the chainages along the alignment. There are three surface sections in AZ1 Northern Section, the first c500m from Estuary Station south towards the northern end of Broadmeadow and Ward River Viaduct, a shorter section about 153m long south of the Viaduct and along the west side of the R132, and a third section in the Fosterstown South area crossing Sluice Culvert and Forrest Little Stream. There are two short surface sections of the alignment in AZ3 Dardistown Section on either side of the M50 Viaduct.

Table 4.5: Summary of chainages and lengths of sections of rail at the ground surface

Alignment Element	Chainage Start	Chainage End	Length (m)
Surface	1+000	1+499	499
Surface	1+761	1+913	153
Surface	5+589	5+994	406

Alignment Element	Chainage Start	Chainage End	Length (m)
Surface	9+567	9+656	89
Surface	9+755	9+992	237

Diagram 4.20 shows that the surface sections will lie on shallow earthworks to form a platform including a 0.5m sub-base blanket overlain with two layers of concrete soil, and the slab tracks for the rail.

4.11.2 Elevated Sections on Embankment and Viaduct

The alignment will be elevated for about 260m over the Broadmeadow and Ward River Viaduct between Ch. 1+499 and Ch 1+761 and approximately 100m over the M50 Viaduct between Ch. 9+656 and 9+755. Descriptions of these structures are provided later in this Chapter in Sections 4.14.4 and 4.16.4. The approaches will be on embankment.

4.11.3 Cut and Cut and Cover Sections

For these shallow excavated locations, the use of retained-cut, cut and cover, and U-section structures are proposed.

Table 4.6 summarises the sections of alignment in the different types of shallow excavations and their locations are also illustrated on Figure 4.1.

The majority of the proposed Project through Section AZ1 Northern Section (see Diagram 4.1) progresses in a cut section with a section of cut also in the Dardistown area. This section of the alignment is characterised by a shallow excavated alignment whereby the alignment runs below the existing ground level. For the lengths of the alignment in cut, the design incorporates sections of retained-cut, cut and cover, and U-section structures as appropriate to the depth of the rail below ground level and available construction space.

The use of retained-cut and the cut and cover structures are more appropriate for the majority of the cut section of this project, considering the urban environment of the project, as they can be constructed in more restricted spaces when compared with U-section cut. For shallower cuttings, where direct excavation is feasible, U-section structures are proposed. Diagram 4.20 illustrates the different cut sections to be used along the alignment.

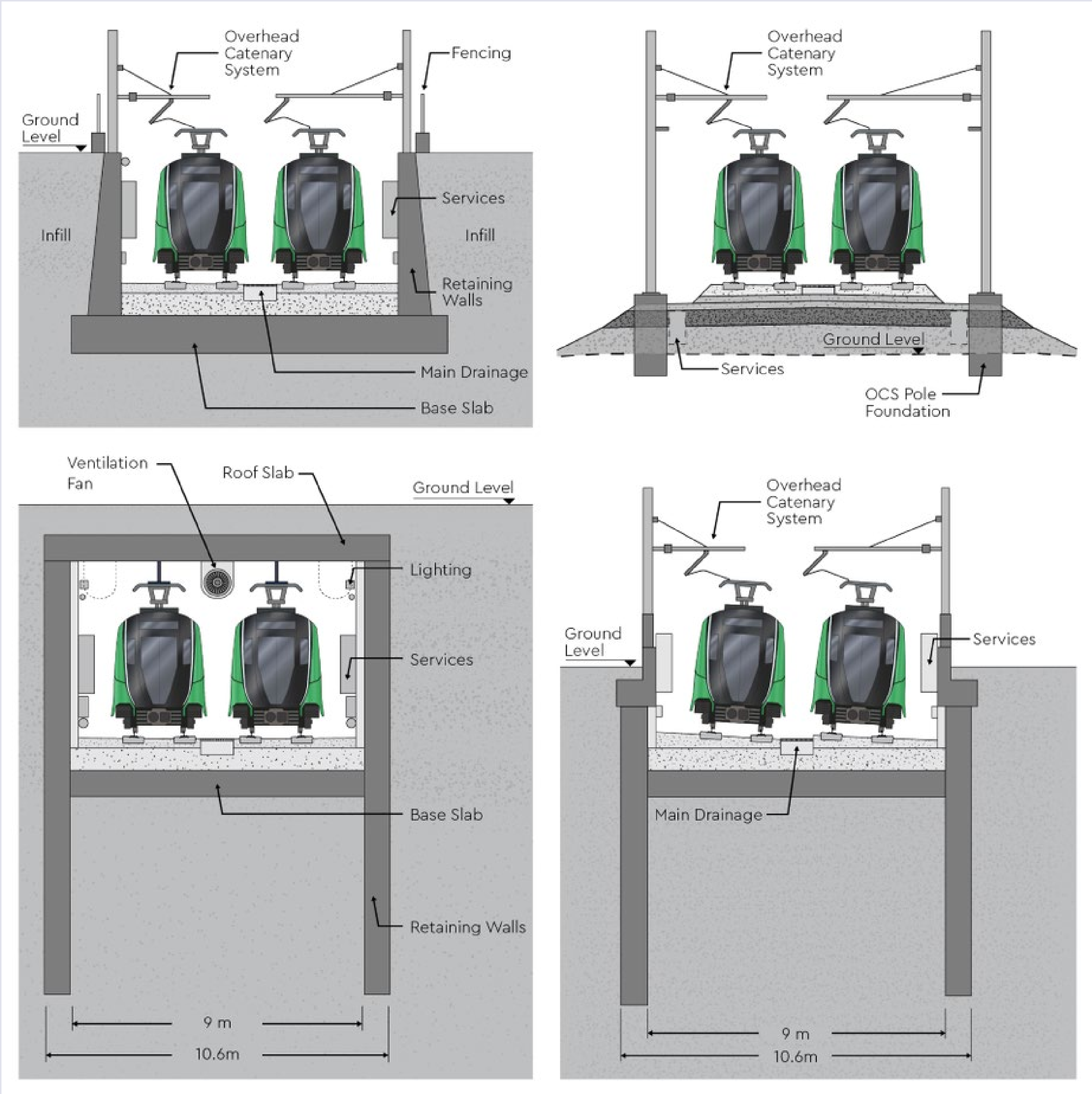


Diagram 4.20: Surface and Cut Sections to be used along the Alignment (Clockwise from Top Right, Surface, Retained Cut, Cut and Cover, and U-cut)

Table 4.6: Summary of Chainages and Lengths of Section in Retained Cut, U-section, and Cut and Cover

Alignment Element	Chainage Start	Chainage End	Length (m)
Retained cut	1+913	1+973	60
U-Section	1+973	2+157	184
Retained cut	2+157	2+184	27
Cut and Cover	2+184	2+274	90
Retained cut	2+274	2+373	99
Cut and Cover	2+373	2+799	426
Cut and Cover	2+899	2+940	41
Retained Cut	2+940	2+998	58
Cut and Cover	2+998	3+068	70
Retained cut	3+068	3+181	113
Cut and Cover	3+181	3+189	8
Retained cut	3+189	3+245	56
Cut and Cover	3+245	3+612	367
Retained cut	3+612	3+668	56
Cut and Cover	3+668	3+767	99
Cut and Cover	3+865	3+901	36
Retained Cut	3+901	3+980	79
Cut and Cover	3+980	4+028	48
Retained Cut	4+028	4+118	90
Cut and Cover	4+118	4+138	20
Retained cut	4+138	4+277	139
Cut and Cover	4+277	4+443	166
Retained cut	4+443	4+491	48
Cut and Cover	4+491	4+518	27
Retained cut	4+518	4+666	148
Cut and Cover	4+666	4+736	70
Cut and Cover	4+832	4+892	60
Retained cut	4+892	4+993	101
Cut and Cover	4+993	5+030	37
Retained Cut	5+030	5+101	71
Cut and Cover	5+101	5+184	83
Retained Cut	5+184	5+362	178
U-Section	5+362	5+589	227
Retained cut	5+994	6+022	28
Cut and Cover	6+022	6+065	43
Cut and Cover	8+476	8+648	172
U-Section	8+648	9+021	373
Cut and Cover	9+021	9+375	354
U-Section	9+375	9+567	192
Retained Cut	9+992	10+083	91
Cut and Cover	10+083	10+251	168

4.12 MetroLink Route-wide Systems

This section of the chapter describes a number of systems that are key elements of the proposed Project and that operate along the full extent of the alignment. These systems are as follows:

- Track;
- Rolling Stock;
- Power System;
- Catenary System;
- Computer Based Train Control (CBTC) System;
- Command and Control Systems;
- Heating, Ventilation, and Air Conditioning (HVAC)
- Lighting; and
- Fencing and Boundary Treatment.

Further details on how these systems will operate are provided in Chapter 6 (Operations & Maintenance).

4.12.1 Track, Crossovers and Turnbacks

Twin tracks comprising one set of tracks running in each direction will be provided along the length of the proposed Project alignment. The track along the entire alignment will consist of slab track, comprising concrete slabs or sleepers as a base to which the railway is attached (refer to Diagram 4.21). This design is widely used on the Luas system in Dublin.

Diagram 4.21: Example of Slab Track

The concrete slab will be configured to collect stray current, which is described further in Chapter 12 (Electromagnetic Compatibility & Stray Current).

Protection against derailment will be provided through guard rails, plinth upstands, curbing or recessed channels depending on location. On elevated structures, containment will be provided by the use of a guard rail, which would be offset to the inside of one or both of the running rails by a distance sufficient to contain the train wheels, and either fixed to the sleepers or bolted to the rail. In event of evacuation, the track slab will be suitable to use as a walkway.

Turnback's are located at the end of the line and allow trains to return in the opposite direction. Crossovers are locations where trains will be able to swap between northbound and southbound railways and vice versa. Crossovers allow trains to change direction quickly to ensure continuance of service during degraded service patterns due to an incident. Turnback's and crossovers may be used in combination, while crossovers are also provided at additional locations along the alignment.

Turnback's will be provided at Estuary and at a location between Fosterstown and north of Dublin Airport Station (immediately north of the DANP) between Ch. 5+670 and the DANP at Ch. 6+085.

Double crossovers will be provided at Estuary, Swords Central, Dardistown, Ballymun, Glasnevin, O'Connell Street and St Stephen's Green. In addition, two double crossovers at Charlemont will facilitate the turnback requirements at the southern end of the alignment.

Diagram 4.22 illustrates the turnback and crossover at Estuary Station and Diagram 4.23 illustrates the configuration of crossovers at Charlemont. Further illustrations of crossovers are provided in the RO Drawing Pack.

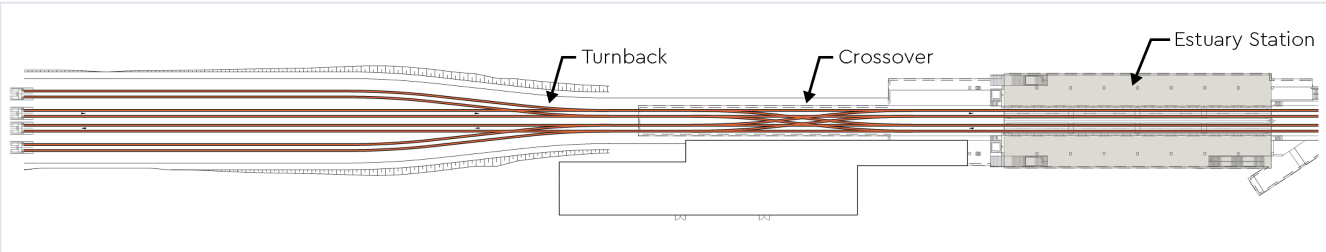


Diagram 4.22: Illustration of the Turnback and Crossover at Estuary Station

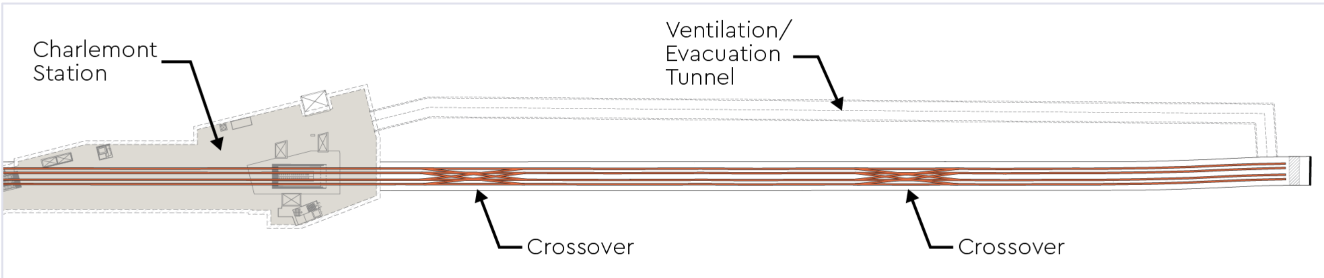


Diagram 4.23: Illustration of the City Tunnel and Charlemont Intervention Tunnel south of Charlemont Station

4.12.2 Rolling Stock

4.12.2.1 Grade of Automation

There are five grades of automation (GOA) as defined in EN 62290-1 (2014) [IEC 62290] implemented on different railway systems, as outlined in Table 4.7.

Table 4.7: Grade of Automation and Operation

Type	Description
GOA 0	On-Sight train operation by driver without any restriction.
GOA 1	Fully manual train operation where a train driver controls the starting stopping of a train, operation of train doors, and handling of emergencies or sudden train diversions.
GOA 2	Semi-automatic train operation (STO). The starting and stopping of a train is automated but a standby train driver remains in the driver´s cab to prompt the train to start, control the operation of train doors, manually operate the train if needed, and handle emergencies. Example: London Underground Victoria Line.
GOA 3	Driverless train operation (DTO). The train can start and stop automatically but a train attendant may be present to operate the train doors and to drive the train manually in case of emergencies. Example: London Docklands Light Rail.
GOA 4	Unattended train operation (UTO). Fully automated starting stopping of trains, operation of train doors and handling of emergencies. No regulatory requirement of staff to be present on the train. Example: Copenhagen Metro.

The proposed Project will be a fully automated GOA4 system. Starting and stopping, operation of doors and handling of emergencies will be fully automated without any on-train staff. The advantages of this level of automation are summarised below:

- This provides the opportunity for shorter platforms lengths and thus smaller station sizes;
- Trains can travel at shorter intervals (headways) one after another;
- If passenger volume is high, additional trains can be deployed independently of the regular timetable, they can be automatically sent into operation direct from the depot;
- Automatically controlled trains consume less energy, as a result of optimised acceleration, traction and braking processes and there are maintenance benefits for example through reduced wear and tear; and
- Train punctuality is improved as the automated system calculates exactly by how much and at which point a train has to accelerate and brake for it to arrive punctually at the next station.

4.12.2.2 Rolling Stock

The trains for the proposed Project will comprise bi-directional, high floor trains capable of providing the required demand of up to 20,000 passengers per hour per direction (pphpd). Doors on either side of the train will be used according to the direction of travel. The 20,000 pphpd is achieved by providing 40 trains per hour, each with a capacity for 500 passengers. This is equivalent to 100 seconds operational headway. The service pattern developed around this headway is explained further in the Section 6.5.4 of Chapter 6 (Operations & Maintenance).

The width of the trains will be to a maximum of 2.65m. The design allows for 20% of passengers to be seated plus four standing passengers per square metre of floor space. The length of the train will be approximately 64m. Diagram 4.24 illustrates a typical train of the specified dimensions. High floor trains have a larger passenger capacity when compared to low floor trains of the same length, such as those used on the Luas network, because the train floor surface sits entirely above the wheels of the train which will otherwise need to intrude into the interior.

Diagram 4.24: Indicative Train Length

The exact train door configuration will be determined at the next design stage and will ensure that passenger boarding, and alighting will fit the dwell times at the stations. For the purposes of the environmental assessment, the door configuration will comprise twelve double doors on each side of a three-carriage train with each double door being between 1.4m to 1.7m wide. The synchronisation of the opening and closing of train doors with the platform screen doors, the width of the double doors and the even levels between the floor of the carriages and the platforms will facilitate access for all passengers.

The trains will be equipped with three main on-board systems:

- Signalling for the Communications-Based Train Control (CBTC);
- Automatic control of the train movements; and
- Fire and safety measures, including CCTV monitoring from the OCC.

These systems are described in detail in Chapter 6 (Operations & Maintenance).

4.12.2.3 Train Speeds

The design speed and normal operating speed for the proposed Project is 80km/hr.

4.12.3 Proposed MetroLink Grid Connections and Power Systems

4.12.3.1 High Voltage Substations

Electrical power will be provided from the national grid (Electricity Supply Board Networks Ltd - ESBN) at 110kV (kilovolt) alternating current (AC), which will feed two high voltage (HV) bulk connection (multi-purpose connection) substations, which will be Gas Insulation Switchgear (GIS) transmission power substations. The new electrical substations will be constructed at the DANP and at the Dardistown Depot. These connections will be sought through a separate planning application by ESBN, but the environmental effects are assessed as part of the proposed Project in this EIAR. Other works required include the installation of a number of new transmission cables and minor works at two existing utility transmission substations at Newbury and Belcamp.

The HV Substations will have the facility to connect two 110kV power supplies. Two step-down transformers 110kV/20kV will be required at each site, for increased redundancy in the event of a failure. The HV Substations will be rated at minimum of 50.852 Megavolt amperes (MVA). Each substation will be capable of supporting the whole MetroLink system in the case the other substation fails.

The two step-down transformers 110kV/20kV will be required at each substation to reduce power supply to MV and the MV supply will be distributed by way of "a ring system" consisting of cables which will run in buried ducting or on tunnel wall mounted cable trays along both sides of the track. The traction power refers to electrical power delivered to MetroLink to power to the trains. Auxiliary power refers to electrical power delivered to MetroLink to provide power for heating, ventilation, control and communication systems, station equipment and so on. Diagram 4.25 provides a schematic of the power supply configuration.

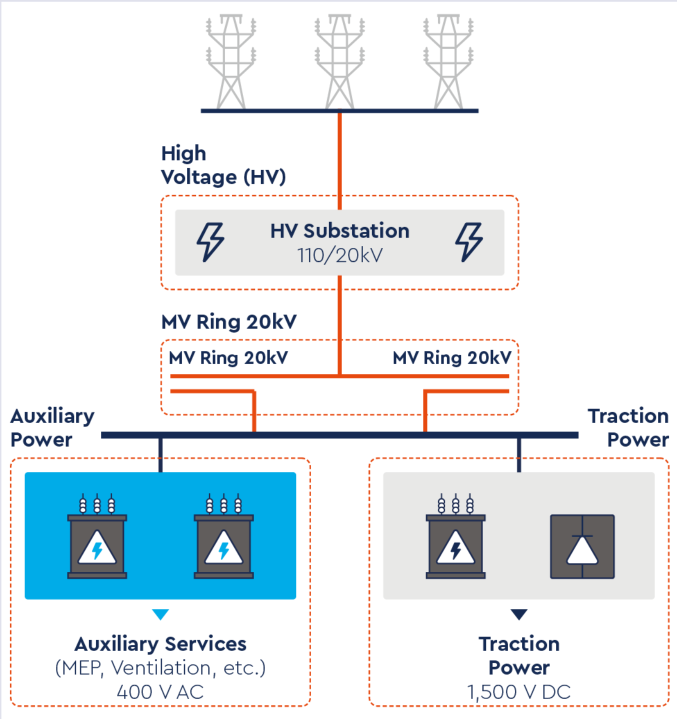


Diagram 4.25: Schematic of MetroLink's Operational Power Supply

Options for the ESBN routes for new cables to connect into MetroLink electricity sub-stations are illustrated on Figure 22.5 and on Figure 4.1 where they lie close to the proposed Project. The routes are mostly located along existing highways to reduce the potential environmental impact of installation.

There will be two physical interfaces between MetroLink and ESBN. The first will define the boundary between the respective areas of responsibility of MetroLink and ESBN on the HV power circuits. The second will define the boundary of responsibilities on the control and auxiliary circuits, which are used for protection, control, monitoring and signalling purposes.

The site required for the ESBN side of the substation will be approximately 85m x 35m with a two-storey building 48m x 15m which will be approximately 15m in height.

The site required for MetroLink side will be approximately 48m x 70m which will be divided in two areas, the first area with a footprint of 48m x 45m for the implementation of HV 110kV supply installations (110kV busbar Disconnect, Circuit breakers, Earth isolators disconnect, 110/20kV transformers), and the second one with a building of approximately 35m x 15m for MV supply installations.

These substations use a dielectric gas, sulphur hexafluoride (SF6) which is a highly potent greenhouse gas requiring the implementation of strict protocols in construction and maintenance, including leak detection measures, to avoid fugitive emissions.

The building will house the plant and contain auxiliary services equipment such as controls and telecommunications, an emergency diesel generator, batteries and welfare facilities. The building will be connected to the mains water supply and sewerage networks. The building would typically be industrial in form with a structural steel frame with profiled metallic sheet wall and roof cladding. Internal masonry walling will be adopted, except where specific load carrying requirements necessitate the use of reinforced concrete walls. The buildings will have internal access gantries and walkways for access to equipment.

The building will be constructed and certified in accordance with the requirements of the Building Regulations. External doors and escape doors will generally comprise metal flush doors and mild steel frames. Fire doors will comply with BS 476-22: 1987 - Fire tests on building materials and structures.

Fencing around the building, with the exceptions of site entrances/gates, will typically comprise an internal 2.6m high galvanised steel palisade fencing.

4.12.3.2 Traction Substations

Traction simulation of the electrical load requirements and the optimum spacing between traction substations to avoid voltage drops and electrical losses has been undertaken to determine the number and location of traction substations. The proposed Project requires eight new traction substations to provide power to the trains, which will be located at Dardistown Depot and the following seven stations (see also Diagram 4.26):

- Estuary;
- Fosterstown;
- Dardistown Station;
- Collins Avenue;
- Glasnevin;
- Tara; and
- Charlemont.

At Estuary, the traction substation will be incorporated into the same building housing the backup OCC and the room housing the utility connections to the north of the station and west of the track. At Fosterstown and Dardistown Station the traction substations would be at platform level in the BOH and not visible to the travelling public. Two traction substations will be provided at Dardistown Depot within Building E (see Section 4.16.2.3) one for the main line traction and one for depot traction and would not be visible to the general public. For the underground stations the traction substations will be incorporated into the BOH within the station box and again not visible to the travelling public.

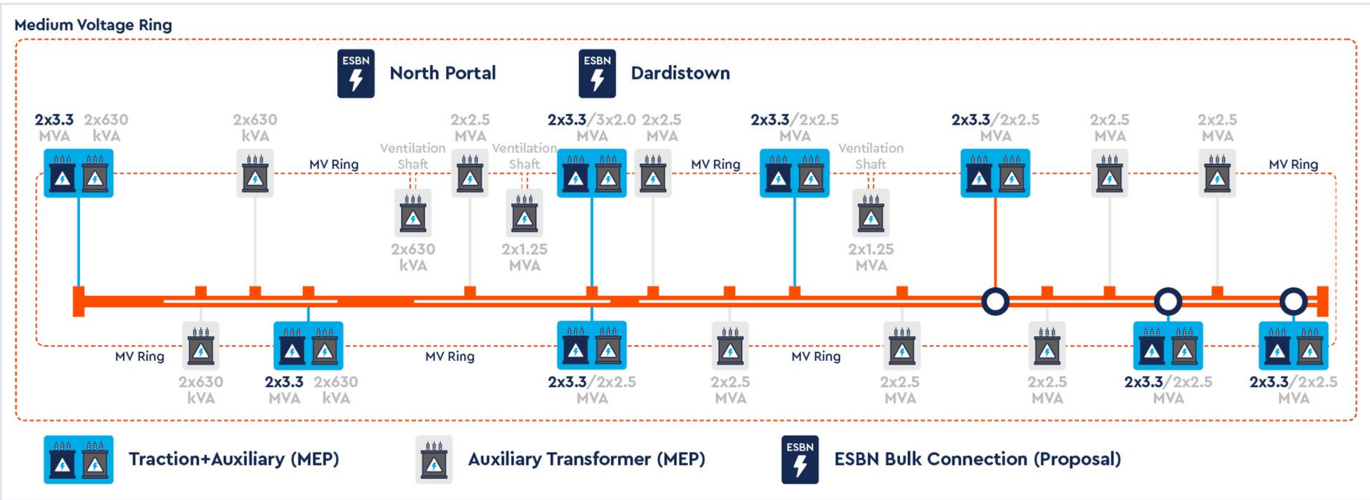


Diagram 4.26: Locations for Substations

The substations will be supplied from the MV ring (20kV AC) and will include traction power transformers and rectifier units which provide the DC voltage and current to distribute to the traction power system. Each traction substation will have two 20kV / 2x1.25kV 3.3MVA transformers and two 1500V DC 3MW rectifiers units.

All traction supply substations at the stations will have the same type of equipment. Some equipment will be at ground level and others underground depending on the type of station (surface, retained cut, and underground).

4.12.3.3 Traction Power System

The traction power system is DC, which is converted from an AC power supply, which enables trains to move on the network through a catenary system which is rated at 500VDC.

The traction power supply will be fed to the trains through the Overhead Contact System (OCS) and collected by the train pantographs as indicated in Diagram 4.27. The running rails will be used to enable the traction current to return to the traction substations. A collection system will be incorporated to return stray current to the substation supply.

Diagram 4.27: Example of a Pantograph above a Train

4.12.3.4 Auxiliary Power System

Auxiliary power substations will be located within the BOH areas in the stations, fed by the internal 20kV network. For redundancy purposes all auxiliary substations will be composed of two (No. 2) auxiliary transformers to feed the Mechanical, Electrical and Plumbing (MEP) of stations and other equipment along the route. The auxiliary power supply will comprise auxiliary transformers, MV switchgear and LV panels for all station loads.

A backup Uninterrupted Power Source (UPS) will be provided in each station for the use of all those services which require constant supply, including:

- Cable Transmission network;
- Signalling systems
- Access Control and Intrusion Detection (ACID) equipment;
- CCTV;
- Supervisory Control and Data Acquisition system (SCADA) equipment;
- Radio communication systems;
- Telephones;
- Public Address system;
- Passenger Information Screens;
- PSD monitoring;
- Fire detection;
- Automatic fare collection system; and
- Power sockets for computers and special equipment.

4.12.3.5 Control Facilities

All of the power systems will be monitored and controlled centrally from the OCC at Dardistown Depot (see Section 4.16.2 and also in Chapter 6 (MetroLink Operations & Maintenance) by a SCADA system. A duplicate system will also be provided within the back-up OCC located at Estuary Station. Local control will also be available at station control rooms within the individual stations.

4.12.4 Catenary System

The catenary system provides power from the traction power stations to the rolling stock via pantographs on their roofs. Two types of catenary system arrangements are proposed, and these are:

- OCR which is formed by a rigid aluminium contact bar incorporating a contact wire (Diagram 4.28); and
- OCS, which consists of a single tensioned contact wire and a single tensioned messenger or catenary wire supported from poles mounted with cantilevers and "steady arms" (refer to Diagram 4.29).

Diagram 4.28: Typical Example of an OCR in a Tunnel Section

Diagram 4.29: Example of Overhead Contact System

The sections of the alignment where the OCR and OCS systems will be installed are shown in Diagram 4.30. The OCR system does not require as much overhead space as an OCS system, which makes OCR the optimum system for confined spaces such as within tunnels. The OCR requires support structures at closer intervals than the OCS system. As a result, and in order to minimise the visual impact, three sections of the alignment at ground level and in shallow retained cut will have an OCS system to provide power to the rolling stock.

The OCR system will be used for the majority of the alignment, which includes all of the bored tunnel sections, cut and cover sections, part of the retained cut sections and within the Dardistown Depot stabling and maintenance buildings.

The OCR comprises a rigid aluminium bar incorporating a contact wire. The nominal (or typical) height of the OCR will be 4.5m and the minimum contact wire height considered is 4.2m. The height of the OCR required in the Dardistown Depot and workshop area will be greater than the minimum to allow maintenance activities and for any machinery operating near the tracks and will be 6.5m in the workshop and 5.5m for the stabling, and the minimum height of 4.2m outside the buildings.

The supports for the OCR will be placed every 10m to 12m. In the tunnels the OCR supports will be fixed to the roof of the tunnel. In the cut and cover and the retained cut sections, the OCR will be fixed to a rigid gantry anchored to the side walls. In the deeper retained cut sections the OCR may also be supported by a rigid gantry supported with wire ropes or galvanized steel tubes.

The auto-tensioned OCS is preferred for above ground sections where visual impact is a material concern. The nominal height of the contact wire above the rail level is 4.5m and the minimum contact wire height considered is 4.2m. The overhead system will be designed such that this minimum height will be achieved even in the event of a single pole collapse or a single overhead wire fixing failure. The OCS wires will be supported on poles not exceeding 8m in height with a cantilever and "steady arm" arrangement. The poles will be located on both sides of the track, approximately 45m apart.

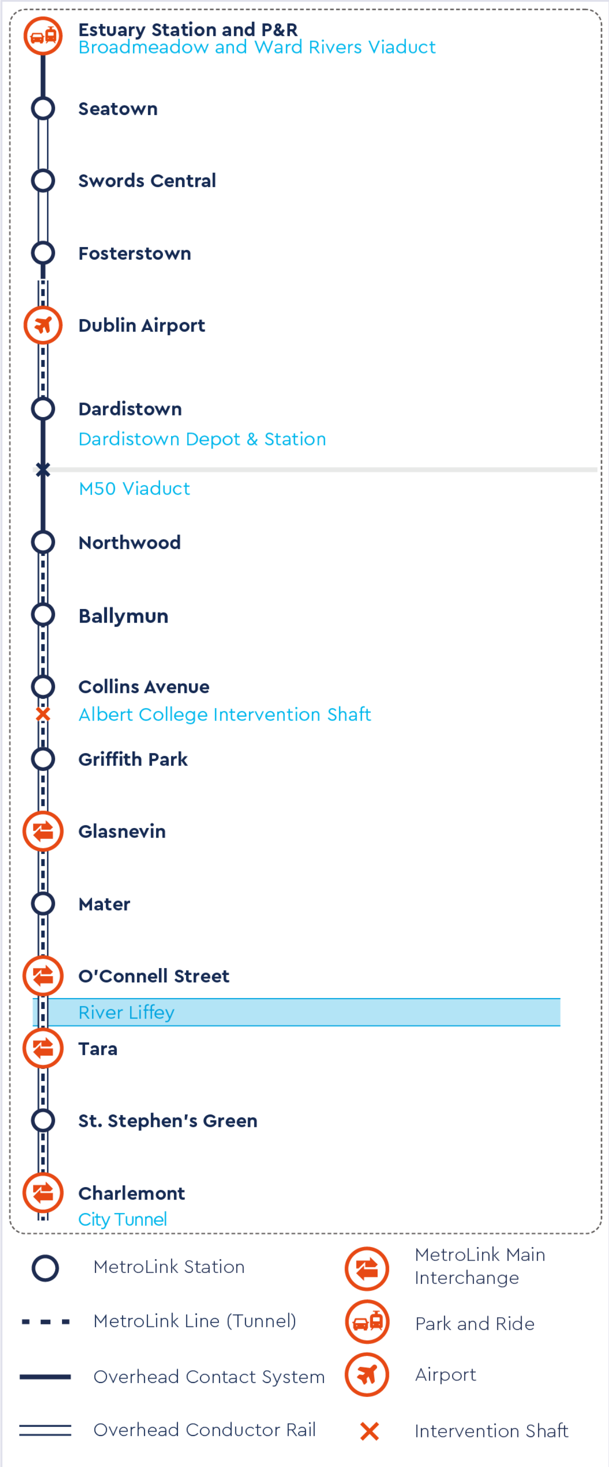


Diagram 4.30: OCS and OCR Locations

4.12.5 Communications-Based Train Control (CBTC) System

MetroLink will use Communications-Based Train Control (CBTC) as a railway signalling system that makes use of the communications between the train and track equipment to manage the movement of trains and control the infrastructure. CBTC systems locate the exact position of a train more accurately than traditional signalling systems, resulting in a more efficient and safe way to manage the service. The CBTC system comprises of:

- **Wayside equipment:** that is equipment along the railway which typically contains the wayside Automatic Train Protection (ATP) and Automatic Train Operation (ATO) systems;
- **On-board automatic train control (ATC = ATP + ATO):** the On-board (ATC) vital functions are performed by the On-board ATP subsystems, while On-board ATC non-vital functions are performed by ATO subsystems; and
- **Central automatic train supervision (ATS):** The overall supervision and control of the train service directed from the OCC.

The CBTC will provide for safe and reliable control, operation and monitoring of the entire train service under normal service provision. It will also safely manage the train service during 'degraded mode' that is disruptions to the service, for example as a consequence of the breakdown of a train, and during emergency conditions, for example following an incident.

The CBTC will communicate with other systems including the PSD, communications systems, and SCADA.

The CBTC system will control all the train movements along the proposed Project alignment including the Dardistown Depot, with the exception being the workshop area where the trains will be driven manually.

CBTC systems are well established and used on metros throughout the world.

4.12.5.1 Wayside Equipment

The communication between the train and the physical elements of the CBTC system is based on Wi-Fi antennae placed every 300m to 400m along the railway corridor route. Where the alignment is at the surface, the antennae will be placed on the catenary columns, one either side of the track, with one antenna for the CBTC system itself and the other serving the train (the screens, speakers). In retained cut and the tunnels, the Wi-Fi antennae will be placed on the side of the walls.

4.12.5.2 On-board Automatic Train Control

The three main on-board systems required for the CBTC are the CBTC radio (Wi-Fi), the ATP and ATO.

The CBTC radio communication system comprises Wi-Fi antennae on the train roof to allow communication between the wayside equipment and the train.

The On-board ATP system controls the train speed continuously according to the safety profile and applying the brake if necessary. The On-board ATP system also controls communications with the wayside ATP in order to exchange information needed for safe operation and calculates the position of the train continuously and precisely. The ATP system also ensures that the doors only operate when it is safe for passengers, with the train stationary, the propulsion system disabled, the brakes applied, and the train properly aligned with the station platform.

The On-board ATO system is responsible for the automatic control of the traction and braking effort to regulate train speed, operating the train in a fully automatic mode, while maintaining the traffic regulation targets and passenger comfort. It also controls the selection of different automatic driving strategies to adapt the runtime or even reduce the power consumption.

4.12.5.3 Central ATS

The central ATS will be located at the OCC at Dardistown Depot with a backup OCC at Estuary Station. The hardware will consist of several computer workstations with keyboards and screens connected to the wayside equipment. The ATS software platform will be an existing product that provides a single platform for all other Integrated OCC real-time services: SCADA, Human Machine Interface (HMI), development and deployment functions.

The ATS will have the capability automatically to track, maintain records of, and display, the locations, individual train IDs, the train schedule and other pertinent data of all the trains operating in service. The front and rear position of trains will be tracked continuously based on the CBTC train location reports and displayer on the ATS user interface. The ATS will also manage transitions between the mainline and the workshops at Dardistown Depot.

The ATS will be designed to maximise automation of the train services based on algorithms to define the service and can be used in manual mode when required.

4.12.6 Central Command and Control Systems

4.12.6.1 Communications, Information, Security and Control Systems

The proposed Project requires command and control systems to operate the train service in a safe, efficient and reliable manner. These systems provide remote control and monitoring of the stations and trains, voice and data communications, information to passengers and the security to ensure safe operation.

To ensure the efficient and safe operation of the proposed Project an integrated communication system will be implemented. The system is formed by several sub systems that will provide both operational and non-operational functions. This system will provide media for data, video, and audio transmission of the metro line, with the capability of supporting all the following systems considered critical for operation:

- Voice and data communications:
  - Fibre optic and transmission network system (Internet Protocol - IP)
  - Centralised Time Synchronisation Subsystem (Network Time Protocol NTP, IP)
  - Telephone and Intercoms System
  - Operational Radio System
- Systems providing information to passengers in the stations and on board the trains
  - Public Address and Voice Alarm (PAVA) system
  - Passenger Information System (PIS)
- Security systems in stations, tunnels and Dardistown Depot
  - CCTV in stations and tunnels (including evacuation shafts) and Dardistown Depot
  - Access control and intrusion detection (ACID) along the entire railway corridor
  - Control of the Platform Screen Doors (PSD) in stations
- Remote control, monitoring and management systems
  - SCADA
  - OCC at Dardistown Depot and a backup OCC at Estuary Station.

The central command and control system will connect the following sites: stations, tunnels and intervention shafts, traction substations, the OCC at Dardistown Depot and the backup OCC at Estuary Station, the auxiliary substations, and maintenance facilities at Dardistown Depot.

Communications between all systems on the metro is provided by a diverse fibre optic network. This allows for communication between the OCC and all of the communications system in the stations (e.g., CCTV, PAVA, PIS) and lineside, including signalling access points. The OCC will be equipped with the hardware, furnishings and software required, including technical equipment (servers, computers, video screens, and keyboards), computing, a dedicated fire protection system, HVAC equipment for the rooms housing the electrical installation and switchboards, equipment for the ACID system, and furniture for the operators The OCC will be operational 24 hours, 365 days of the year.

Along the alignment, the hardware will comprise the CBTC systems described in Section 4.12.5, two masts one at Estuary and one at Dardistown Depot, and networks of cabling along the alignment.

4.12.6.2 Automatic Fare Collection

The Automatic Fare Collection (AFC) system consists of the following elements: automatic ticket vending machines (ATVM), Smart Card Validators, portable control devices, and an intervention control unit and associated equipment, together with a central computer system and card initialisation machine and security. The AFC will:

- Protect revenue and prevent fraudulent travel;
- Be compatible with the current (and future) ticketing system in the Greater Dublin Area (GDA);
- Issue, accept and validate contactless smart media and magnetically encoded tickets and accept and validate magnetically encoded tickets from Luas and other metro lines, Iarnród Éireann (Irish Rail) and Dublin Bus;
- Be compatible with the passenger information system;
- Have a customer interface, functionality and operating sequence similar to the existing Luas AFC system;
- Comply with social inclusion standards and guidance;
- Have a dedicated interface configured to allow the information exchange with external AFC systems;
- Have a banking interface to provide electronic payment capability through an electronic payment transfer server or directly, and in the case of using the mobile application, be able to process payment through a payment gateway; and
- Have a communication interface with General Ledger application software used by the operator.

The AFC will be controlled centrally from the OCC. ATVMs will be located at each station and at the Estuary P&R in prominent locations that are easily visible to passengers but without obstructing passenger movements. ATVMs will have the basic function to issue a ticket or top-up a contactless card. All ATVMs will be covered and monitored by CCTV. Smart Card Validators will be placed within the stations to process and validate contactless cards. MetroLink staff will have handheld inspection terminals to check cards and issue onboard tickets and penalties.

4.12.6.3 Cable Containment Management

Along the open sections of the alignment, multiple cables, including power and signalling, control and communications systems, will be buried in cable ducts to suit the type of cable installed while providing a safe walking route along the railway. In subsurface sections, including retained cut, cut and cover, and tunnels, the cable route will be provided via cable trays fixed to the wall of the structure to ensure no obstruction along the track bed. On the viaducts and bridges, similar layout of cable trays will be provided to maintain a clear walking route.

4.12.7 Heating, Ventilation and Air Conditioning

The Heating, Ventilation and Air Conditioning (HVAC) system will be provided within the stations and on the trains to ensure comfort and fresh air for passengers and staff and prevent over-heating of sensitive equipment.

The surface station at Estuary and the stations in retained cut are open to the weather, so HVAC systems will not be provided to the public areas. HVAC systems will be limited to the BOH rooms housing sensitive electronic equipment.

In the underground stations, public areas will be ventilated, but not heated or cooled, because the temperatures underground tend to be relatively stable, with slight variations between summer and winter. Ventilation will also be provided in the BOH rooms. Fresh air providing ventilation will be filtered. Air conditioning will be provided in rooms used by staff and emergency services and in rooms housing sensitive equipment.

Tunnel ventilation has been designed to operate during normal conditions and in the event of a fire. Under normal conditions, the system will use the train piston effect to extract heat and renew the air in the tunnel. This approach has the benefit of reducing energy consumption. The air inlets and outlets at street level shall be sufficiently low so that it does not present a risk to people or surroundings and the position of the inlets and outlets will be such as to prevent recirculation of air or intake of polluted air. Should there be a need to remove heat from the upper levels of the station, which can occur in some peak summer months, the ventilation system can exhaust the hot air. The noise levels will also be limited to acceptable values through design.

The tunnel ventilation elements comprise the ventilation shafts, over-track exhaust systems and tunnel jet fans. The ventilation shafts are provided at both ends of the underground stations. In addition, there are two intermediate ventilation shafts, one in the Airport Tunnel between Dublin Airport and Dardistown Stations exiting by the DASP and a second between Collins Avenue and Griffith Park Stations exiting at Albert College Park. Each shaft contains three reversible axial fans, one of them on stand-by, which can inject air in or extract air out of the tunnel. The fans are fitted with silencers to attenuate operational noise.

During normal operation, ventilation will control the difference in temperature between the underground sections and the open air. This control will be based on real-time temperature measurements along the enclosed parts of the track and measures at street level near each station. During a fire emergency mode, if there is a fire on a stationary train in the station, the ventilation system will draw exhaust from above the train and from the platform. It is unlikely for a fire to occur on a stationary train in the tunnel, and the aim would be to move the train to the next station. However, if this happens, the ventilation will draw the smoke in one direction and evacuation should proceed in the opposite direction.

The HVAC will be controlled and monitored by the SCADA system at the OCC, as different information from sensors along the line and from the signalling system are essential to select the appropriate strategy, both during normal operations and in an emergency.

4.12.8 Route-wide Lighting

4.12.8.1 Station Lighting

All station lighting will comply with the European standards (EN-12464-1) and the IR (Irish Rail) recommendation, Station Design Guide Item 4 - Support Engineering Systems. The minimum lighting levels required for different areas of stations are based on achieving safety and security for these areas:

- Platforms: 50 lux;
- Stairways and Corridors: 100 lux;
- Concourse areas: 100 lux (50-200) and
- Ticket Offices: 250 lux.

All lighting fixtures will be chosen to ensure that they are of high efficiency and require low levels of maintenance.

The lighting design for each station has gone beyond minimum health and safety requirements and has been developed as part of an overall architectural design strategy for each of the stations based on the following principles:

- Task lighting is provided at levels equivalent to operational requirements as outlined above;
- Direct lighting is provided in soffits above platforms and the plaza areas (at ground level);
- Lighting will be integrated into balustrades and skirting;
- There is a strategy to use cooler lighting for directly lit spaces and warmer lighting within indirectly lit spaces, however this is dependent on the materials approach;
- Indirect lighting is provided from accessible areas at a low level; and
- Increased perception of space, legibility, and security is provided through the indirect lighting of space and volume.

4.12.8.2 Lighting along the Alignment

Two different lighting types have been included in the design and these are:

- Emergency lighting, which creates the minimum lighting level required along evacuation routes; and
- Reinforcement lighting, which provides a higher illuminance level in order to carry out maintenance works along the alignment.

Emergency lighting and reinforcement lighting will not be on during normal operations of MetroLink. Emergency lighting would only be turned on in the case of an emergency and reinforcement lighting will only be used during maintenance activity where it is required.

The emergency lighting along the tunnels will be placed at 1m height so that it will not be obstructed by smoke. The lighting will consist of a LED strip or equivalent situated along both sides of the tunnel. This form of lighting will continue along the retained cut sections, providing the height of the side walls allow it. In the open-air sections two LED luminaires angled to face opposite directions up and down the line will be placed on the catenary posts located every 50m at a height of 5m. In intervention shafts the LED luminaires will be located every 12m in the ceiling while on the emergency stairs, each flight will be illuminated by a pair of LED luminaires in the ceiling above.

Reinforcement lighting will be required for common maintenance tasks. Luminaires will be staggered every 20m at 4.5m height along both sides of the tunnel and in the deeper retained-cut sections. In the shallower sections of retained cut and open-air sections luminaires will be placed on 5m high posts every 50m providing a minimum level of 20 lux illumination. In the intervention shafts, luminaires will be placed in the ceiling 12m apart and alternate with the emergency luminaires. There will be one LED luminaire over every flight of emergency stairs in addition to the emergency luminaires.

All luminaires will be based on LED technology as part of an energy-saving design and will only be turned on when required, with the exception of lighting linked to continuous surveillance cameras.

4.12.8.3 External Lighting

The lighting class (and therefore the light level and uniformity targets) for each area to be lit, has been selected using BS5489-1:2020 with account made for the local ambient lighting and environmental zones, covering both roadways and pedestrianised/cyclist areas. Replacement public lighting will be provided in currently lit areas affected by the proposed Project. Where replacement lighting is needed the design uses the same or lower height columns, and generally replaces existing discharge light sources (e.g., High Pressure Sodium lamps) with LEDs, in order to offer an energy saving, extended service life, and reduced maintenance. The additional benefit of LED compared to traditional light sources is the enhanced control of light spill and reduced direct upward light, which helps reduce light spill beyond the roads and pedestrian areas wherever possible in compliance with the Institute of Lighting Profession GN01 Guidance Notes for the Reduction of Obtrusive Light document.

Public highways will be lit in compliance with BS5489-1:2020. Station entrances and plaza areas will also be lit. Lighting columns will be 8m to 12m high for highways and parking areas, with the height reducing according to need. For example, a residential road will have 8m columns, but a busy dual carriage way interchange will have 12m columns. The plaza and station access areas for pedestrians will have 6m to 9m columns, with 8m to 10m columns for the bus stop and drop-off areas.

The design will reduce light spill wherever possible. Luminaires will emit zero upward light, in compliance with the Institute of Lighting Profession GN01 Guidance Notes for the Reduction of Obtrusive Light. This is particularly important near to Dublin Airport and at specific locations identified in Chapter 15 (Biodiversity).

Areas with new tree planting and/or other variable obstructions to lighting will be lit accordingly, to account for future tree growth and seasonal changes.

Any potential impacts arising due to the lighting design on biodiversity has been assessed in Chapter 15 (Biodiversity).

4.12.9 Route-wide Fencing and Boundary Treatments

As the proposed Project will have the highest level of automation (GOA4), the alignment requires complete segregation from the surrounding environment, with fencing along both sides of the railway corridor and controlled access via the stations and platform screen doors. To ensure complete segregation between the railway and roads to prevent unauthorised access to the rail corridor and prevent any objects from falling onto the rail corridor, a secure and robust fence or boundary treatment is required along the sections of the alignment in AZ1 and AZ3 i.e., those sections of the alignment not in tunnel. In the tunnel sections through AZ2 and AZ4, the stations are designed for free-flow movement during operational hours, so the access from the platform and onto the trains is controlled by the full height PSDs, such that no-one can enter the tunnels. Technology systems such as Access Control and Intrusion Detection (ACID), obstacle detection systems on the trains, and intelligent CCTV will be used along boundaries, the railway, and key facilities, and will connect to alarms at the OCC.

Where the proposed Project will run close to and across the existing R132 Swords Bypass, a road safety hazard analysis has been undertaken to establish vehicle restraint system requirements to stop errant vehicles encroaching onto the railway below. As well as the vehicle restraint system requirements, there is also a risk that hostile vehicles, that is vehicles deliberately driven into people or structures, may encroach onto the alignment. A hostile vehicle restraint barrier will also be provided at all station entrance locations.

Fencing and barriers will be installed along the top of cuttings and embankments, as applicable. By following the top of embankments, the embankment slopes could be safely maintained from outside the railway corridor. Where required, access gates will be installed at the same height as the adjacent fencing.

A summary of the key locations for the barrier types is provided in Table 4.8 and the precise locations are depicted on Figure 4.1.

Table 4.8: Indicative Location of Fencing and Boundary Treatments

Location	Boundary Treatment
Estuary Station and P&R	▪ Timber post and rail along the west side of the R132, both carriageways of the Swords Western Distributer Road, Ennis Lane (west of the station).
Estuary Station and rail to the Broadmeadow and Ward Rivers Viaduct	▪ 1.8m high Meshweld fence along both sides of the railway to the north of the station. ▪ Full height PSDs along both platforms to control access onto the trains only. ▪ 1.8m high Meshweld fence along both sides of the railway from the south of the station to Broadmeadow and Ward Rivers Viaduct. ▪ 1.8m high Meshweld fencing around the two drainage attenuation ponds, one to the north of the Swords Western Distributer Road and one the sound of the P&R.

Location	Boundary Treatment
Broadmeadow and Ward Rivers Viaduct to Seatown	West boundary ▪ Metal fence along the viaduct. ▪ 1.8m high Meshweld fencing along the section in retained cutting next to Balheary Park and the section south of Seatown Roundabout to the crossing under the R132. East boundary ▪ Metal fence along the viaduct. ▪ 1.8m high boundary wall with H4a containment along the line close to the R132.
Seatown to Swords Central	West boundary ▪ 1.8m high boundary wall with H4a containment along the western boundary in retained cut which adjoins the R132 and above the entrances to the cut and cover sections which carry the side roads and the R132 junction arms over the metro line beneath. East boundary ▪ 1.8m Meshweld fence around the drainage attenuation feature at Seatown Station and along the retained cut. ▪ 1.8m high boundary wall with H4a containment where the metro line passes close to Ashley Avenue.
Swords Central Station to Fosterstown	West boundary ▪ 1.8m high boundary wall with H4a containment along the retained cut sections where the alignment is next to the R132 and above the entrances to the cut and cover sections which carry the side roads and the R132 junction arms over the metro line beneath. East boundary ▪ 1.8m Meshweld fence along the retained cut sections. ▪ Short lengths of 1.8m high boundary wall with H4a containment where the boundary ties in with the cut and cover sections.
Fosterstown to DANP	West boundary ▪ 1.8m high boundary wall with H4a containment along the retained cut sections on the western boundary where the alignment is next to the R132 and above the entrances to the cut and cover section to the R132 underpass. ▪ From the R132 underpass to the DANP: (a) 1.8m Meshweld fence along the alignment, and (b) timber post and rail fence to the outside of the access roads along the alignment and the Fosterstown Accommodation Bridge to the Naul Road around the ESBN station and DANP. East boundary ▪ 1.8m high boundary wall with H4a containment along the retained cut section from Fosterstown to the L2305 into the Airside Retail Park. ▪ Short section of timber post and rail fence on the south side of the L2305. ▪ Short section of 1.8m Meshweld fence along the retained cut between the L230 and the R132 underpass. ▪ From the R132 underpass to the DANP: (a) 1.8m Meshweld fence along the metro line, and (b) timber post and rail fence to the outside of the access roads along the alignment and the Fosterstown accommodation bridge approaches to the Naul Road. Fosterstown Accommodation Bridge ▪ 1.8m high boundary wall with H4a containment on both sides of the accommodation bridge.

Location	Boundary Treatment
DASP to Dardistown Depot	West boundary ▪ 1.8m Meshweld fence along the top of the retained cutting. ▪ 1.8m Meshweld fence around Dardistown depot. East boundary ▪ 1.8m Meshweld fence along the top of the retained cutting. ▪ Short section of 1.8m high boundary wall with H4a containment along the embankment leading up to the M50 viaduct by the Northside Test Centre.
Dardistown Depot to Northwood	West boundaries ▪ 1.8m Meshweld fence along the top of the retained cutting. ▪ Timber post and wire fencing along both sides of the re-aligned Charter School Hill. East boundary ▪ 1.8m Meshweld fence along the top of the retained cutting. ▪ Timber post and wire fence along both sides of the Old Ballymun Road.

4.12.9.1 Vehicle Restraint Adjacent to Roadways

TII standards which relate to National Roads (TII-DN-REQ-03034 and TII-DN-REQ-03079), and which are available to view on the TII website (www.tii.ie) specify that at roadways adjacent to or over railway lines, a H4a vehicle restraint system is required. This means that in the event of a vehicle colliding with the barrier, the barrier withstands the impact of the collision. Vehicle restraints are required along parts of the AZ1 and AZ3 sections of the alignment as identified in Table 4.8.

In addition to the requirement to act as a H4a barrier, TII standards specify the requirement for a barrier height of 1.8m on sections of roads adjacent to or over railway lines, where the barrier is within the vehicle restraint system clear zone of a road. This height is consistent with the guidance contained within Network Rail – A Guide to Overhead Electrification (Document Reference Number 132787-ALB-GUB-EOH-000001). These requirements are met by providing a 1800mm H4a concrete barrier solution where necessary i.e., wherever the alignment runs adjacent to or passes over a public road.

Suitable finishes similar to those in Diagram 4.31 will be adopted for the barrier. The precise details of the façade will be determined at the next design stage.

Diagram 4.31: Typical Finish on Vehicle Restraint System

4.12.9.2 Alignment Fencing with Vehicle Restraint

To meet the security requirements, a 600mm high concrete parapet will be provided along the retained cut sections of the route to act as the vehicle restraint system with a 1200mm Meshweld fence on top of the parapet. This will result in an overall fence height of 1800mm. This arrangement is proposed where the fence is outside the vehicle restraint system clear zone of a road but there is still a potential risk from errant vehicles.

The Meshweld fence grid size will be small enough to prevent foot/handholds, to ensure wire cutters could not be used and to prevent larger loose objects from entering the railway.

Diagram 4.32 shows an example of a concrete parapet with Meshweld fence.

Diagram 4.32: Example of Concrete Parapet and Fence

4.12.9.3 Alignment Fencing without Vehicle Restraint

In sections not adjacent to roads i.e., along the alignment south of Estuary, but where security provision is required for the proposed Project, there will be a 1.8m high, Meshweld fence. The height of 1.8m has been adopted based on international best practice. This fence will deter potential trespassers and manage the risk of items falling onto the railway. It will be less visually intrusive than a solid barrier. Diagram 4.33 shows an example of this fence type. In some locations where additional safety is required, the upper part of the Meshweld fence will be angled by 45° towards the railway line to inhibit trespass and throwing of objects onto the line.

Diagram 4.33: Example of 1.8m High Meshweld Fence

4.12.9.4 Post and Rail Fencing

In areas where the boundary is not related to railway security, such as around the perimeter of the Estuary P&R and along maintenance access roads, a timber post and rail fence will be provided (Diagram 4.34).

Diagram 4.34: Example of a Timber Post and Wire Fence

4.12.9.5 Ball-stop Netting

Diagram 4.35: Example of Ball-stop Netting

The alignment travels above ground along the eastern edge of Balheary Park, where there are a number of sports pitches. Due to the proximity of the pitches, there is a risk of objects falling onto the rail corridor. In this area, a ball-stop netting will be provided above the 1.8m Meshweld Fence, up to a total height of 12m, with supporting poles at 12m intervals. Diagram 4.35 provides an example of this type of boundary treatment.

4.13 Ancillary Roads, Footpath and Cycling Provision, and Utilities

4.13.1 Roads

The proposed Project will impact a number of existing roads during both the Construction and Operational Phases of the proposed Project. As a result, there is a requirement for the realignment of roads and the provision of some new roads to form part of the proposed Project.

Where required, the stations and surrounds have been designed to include the realignment of nearby roads and pavements to provide access for vehicles, pedestrians and cyclists, improve the urban realm around the station and modify traffic circulation on the local road network. Other features such as drop-off points (DOPs), taxi ranks, and bus stops have been incorporated into the design of some stations to integrate access with the surrounding road network (existing and proposed).

The majority of road modifications are along the AZ1 section of the alignment. Details of specific road and pavement realignment and enhancement are provided for AZ1 to AZ4 in Sections 4.14 to 4.17 of this Chapter. All road modifications, including full details of all road and pavement realignment and enhancement works, are shown in the drawings that accompany the RO. All temporary traffic measures are detailed in the Scheme Traffic Management Plan (STMP) available in Appendix A9.5 and assessed in Chapter 9 (Traffic & Transport).

Where access to private or public property will be disrupted by the proposed Project, temporary/permanent alternative access is included in the design based on replacement on a like-for-like basis, subject to agreement with the affected landowners and the relevant local authority.

The RO will apply for the replacement of any access arrangement extinguished on a like for like basis.

4.13.2 Footpath and Cycling Provision

4.13.2.1 Footpaths and Footbridges

The needs of pedestrians and cyclists have been considered in the choice of location for the stations and the connections with local footpaths and cycle paths. In the northern part of the proposed Project between Estuary and Malahide Roundabout, the proposals for the R132 Connectivity Project to improve the R132 for vehicles occupants, cyclists and pedestrians, have also been taken into consideration in developing the design.

Four existing footbridges along the R132 Swords Bypass will be demolished as part of the proposed Project because they conflict with the MetroLink alignment:

- 142m long footbridge over R132 adjacent to Fingallians GAA (Gaelic Athletic Association) club, north of Estuary Roundabout;
- 101m long footbridge over the R132, north of Seatown Roundabout;
- Chapel Lane 64m long footbridge over the R132, in Swords; and
- 120m long footbridge over the R132, south of Malahide Roundabout.

In each case the railway alignment crosses beneath these footbridges either in retained cut or cut and cover and it is not possible to maintain the footbridge above the railway. The R132 Connectivity Project will provide that access across the R132, which received planning approval on 20 January 2022 (Ref: JP06F.310145) and will progress ahead of this proposed Project.

Further details are provided for each station later in this Chapter from Section 4.14 onwards and the R132 Connectivity Project is described in Section 4.14.2.

4.13.2.2 Cycle Parking Provision

One of the key design requirements for the proposed Project is the provision of cycle parking facilities at and near each station to facilitate passengers who wish to cycle to/from the station.

An analysis was undertaken to determine the potential demand for cycle parking for the proposed Project and the available space for the provision of cycle parking at each station. On this basis cycle parking determined for each station is identified in Table 4.9 and the location of cycle buildings and stands are indicated in the station layout diagrams in Sections 4.14 to 4.17. Due to space constraints in the vicinity of stations in the DCC area, it has not been possible to provide 100% of cycle parking required for the opening year of the project at every station location. The proposed Project provides an amount of cycle parking that meets opening year (plus a margin) at all stations where there is sufficient space to accommodate this requirement. At stations where space is constrained the cycle provision provided is the maximum number having regard to spatial constraints. Refer to Appendix A4.1 Methodology for Potential Cycle Demand for more details on the assessment undertaken to determine the appropriate cycle provision at each station.

Within FCC, the full forecast demand for the opening year will be accommodated within the designs for the urban realm at the stations for the proposed Project.

Cycle parking provision at station along the alignment of the proposed project falls into a number of categories which are as follows:

- *Open Air:* The provision of simple Sheffield stands/hoped design or bollards set in the ground;

- *Sheltered:* The provision of cycle parking covered by a canopy to ensure that the cycles and users are covered;
- *Overhung:* The provision of cycle parking sheltered by station roofs to ensure that the cycles and users are covered; and
- *Semi-enclosed:* The provision of cycle parking covered by a large roof structure with glass or solid walls. These spaces are double stacked with a secure gate system.

Table 4.9: Station Cycle Parking Predicted and Proposed

Station	2030 Predicted Demand		2030 MetroLink Proposals		
	Total Cycles	Stands	Total Cycles	Stands	% Provision
Estuary*	0	**0**	**254**	**127**	**N/A**
Seatown	433	**216**	**480**	**240**	**111%**
Swords Central	941	**471**	**942**	**471**	**100%**
Fosterstown	373	**186**	**422**	**211**	**113%**
Dublin Airport**	0	**0**	**72**	**72**	**N/A**
Northwood	538	**269**	**204**	**204**	**38%**
Ballymun	656	**328**	**292**	**292**	**45%**
Collins Avenue	1,003	**502**	**370**	**370**	**37%**
Griffith Park	248	**124**	**176**	**88**	**71%**
Glasnevin – Metro Only	185	**92**	**120**	**120**	**65%**
Glasnevin – Metro + Rail	278	**139**			**43%**
Mater	150	**75**	**70**	**70**	**47%**
O'Connell Street	215	**107**	**0**	**0**	**0%**
Tara – Metro Only	470	**235**	**256**	**256**	**54%**
Tara – Metro + DART	1,940	**970**			**13%**
St Stephen's Green	560	**280**	**82**	**82**	**15%**
Charlemont – Metro Only	544	**272**	**162**	**162**	**30%**
Charlemont – Metro + Luas	928	**464**			**17%**

* As the vast majority of passengers using this station will arrive via the P&R there are no predicted cycle demand calculations available for this station.

** As the vast majority of passengers using this station will arrive via the airport there are no predicted cycle demand calculations available for this station.

4.13.3 Utility Diversions

Where there is interaction between the proposed Project and existing utility infrastructure, the locations of the interactions have been identified and planned for, consequently the potential for any service disruption is limited. Designs for diversions and/or protection of infrastructure have been agreed in principle with the relevant utility providers. An overview of the required utility diversions is provided in Table 4.10. A breakdown of the utility diversions in specific areas is provided in Sections 4.14 to 4.17. Construction works required to divert utilities are detailed in Chapter 5 (MetroLink Construction Phase). Impacts of utility diversions have been assessed in Chapter 22 (Infrastructure & Utilities) and other specialist chapters.

Table 4.10: The Sum of Utility Diversion Requirements

Utility	Approximate length of diversions/quantities (m)
Communications Ducts (1x100mm duct)	6,985
HV Electricity	750

Utility	Approximate length of diversions/quantities (m)
MV/LV Electricity	7,630
Gas MP/LP	2,380
Water Main <300mm	1,590
Water Main >300mm	2,338
Foul Water <600mm	1,680
Surface Water <600mm	5,755
Foul Water >600mm	290
Surface Water >600mm	620

As well as utility diversions, the proposed Project also requires the provision of new connections to services for the proposed Project during both Construction and Operational Phases:

- Pre-application enquiries for water supply and foul discharge connections have been submitted to Irish Water for each station;
- An application for consent of the Operational Phase power supply will be made by ESBN (but is evaluated in this EIAR on the basis of the best and most up-to-date available information). Consent for the Construction Phase power supply is included in the RO application and is discussed in Chapter 5 (MetroLink Construction Phase) and evaluated in this EIAR; and
- Discharge locations of surface water have been identified subject to discharge licence from the local authority.

Refer to the Utilities Diversion Book and the New Utilities Book in the RO Drawing Pack for full details of all utility diversions for the proposed Project.

4.14 AZ1 Northern Section: Estuary Station to Dublin Airport North Portal

Sections 4.14 to 4.17 below describe the main features of the proposed Project in relation to their geographical location and the local context. As introduced in Table 4.2**, t**he route is subdivided into the four Assessment Zones, AZ1 Estuary Station to DANP, AZ2 Airport Section (in tunnel), AZ3 Dardistown to Northwood, and AZ4 Northwood to Charlemont (in tunnel). The features described are illustrated with diagrams and are located on Figure 4.1.

This section presents a description of the proposed Project alignment and the Project elements within AZ1 Estuary Station to DANP. This section is approximately 5.1km long. Diagram 4.36 shows the location of the stations and Estuary P&R along a schematic alignment from north to south while the right-hand part of the diagram lists the different types of structures under the key headings, which in addition to the stations and P&R, include the railway alignment in retained cut and cut and cover, the Broadmeadow and Ward River Viaduct, culverts on the Sluice River and Forrest Little Stream, and works to highways and utilities. The locations of specific features are shown on Figure 4.1 Sheets 1-8.

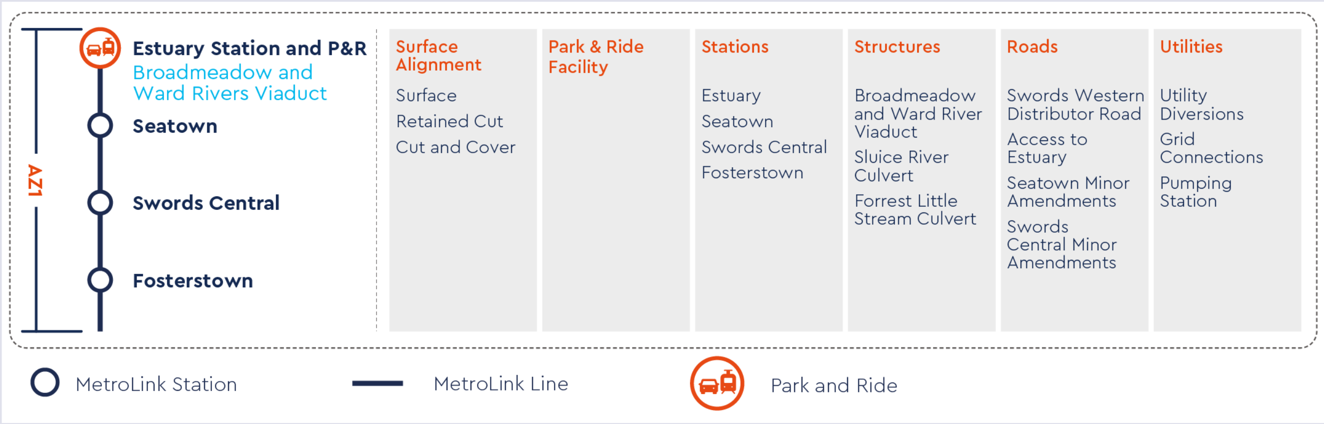


Diagram 4.36: AZ1 Location and Features

The following subsections are laid out in the following order:

- AZ1 Alignment Description;
- R132 Connectivity Project;
- Estuary Station and P&R;
- Broadmeadow and Ward River Viaduct;
- Football Pitches at Balheary Park;
- Seatown Station;
- Swords Central Station;
- Fosterstown Station;
- Fosterstown Accommodation Bridge;
- Sluice River and Forrest Little Stream Culverts;
- AZ1 local access roads; and,
- AZ1 Utilities.

4.14.1 AZ1 Alignment Description

The Estuary Station and P&R facility will be located in the Lissenhall area approximately 560m south-west of Junction 4 of the M1. From Estuary Station and P&R facility, the proposed Project alignment will head south, passing over the Broadmeadow and Ward Rivers on the Broadmeadow and Ward River Viaduct. It will then pass to the east side of Balheary Park before going into a section of cut and cover under Estuary Roundabout on the R132 Swords Bypass.

South of Estuary Roundabout, the alignment will be in open cut for a short distance before entering another section of cut and cover to cross to the eastern side of the R132 Swords Bypass. This section of cut and cover will continue to a point south of Seatown Road Roundabout where Seatown Station will be located.

The alignment between Seatown Station and Swords Central Station will be east of the R132 Swords Bypass. It will consist of sections of retained cut, with localised cut and cover sections under the Malahide Road Roundabout and at specific locations to allow reinstated access to some private properties.

The alignment between Swords Central Station and Fosterstown Station will similarly consist of sections of retained cut, with cut and cover sections to support future eastern development access, and as required to pass under Pinnock Hill Roundabout. It will then cross to the western side of the R132 Swords Bypass just south of the existing junction of the R132 Swords Bypass, Nevinstown Lane and Boroimhe Road, in a further section of cut and cover construction.

Diagram 4.37 and Diagram 4.38 provide illustrative cross sections of the proposed Project in cut and cover and retained cut sections to indicate the location of the Project relative to the R132, landscaping and nearby housing.

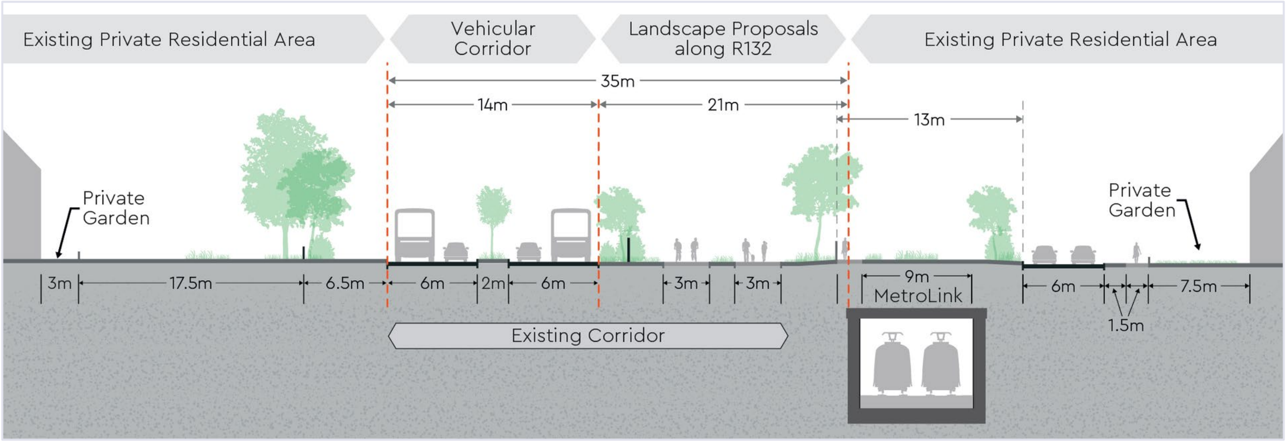


Diagram 4.37: Illustrative Cross Section of the R132 and the Railway in Retained Cut between Seatown and Swords Central

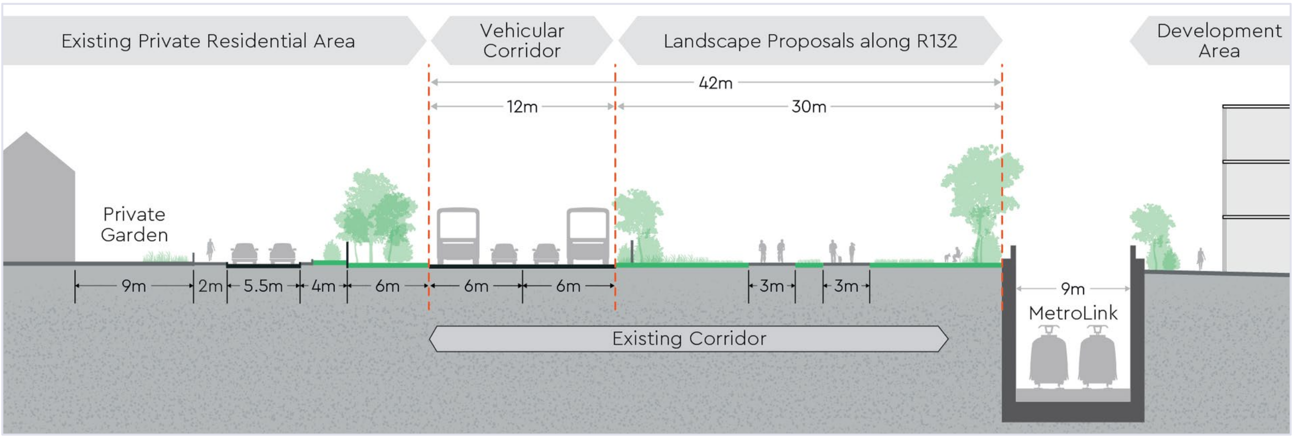


Diagram 4.38: Illustrative Cross Section of the R132 and the Railway in Retained Cut between Swords Central and Fosterstown

The alignment will then pass through existing agricultural lands, initially in retained cut, then on low embankments and cuttings, and will cross the Sluice River and Forrest Little Stream, which will be culverted.

Just north of the Naul Road, AZ1 will end where the DANP will be constructed as part of the single bore tunnel under Dublin Airport.

4.14.2 R132 Connectivity Project

The proposed Project has been designed taking into account the R132 Connectivity Project promoted by Fingal County Council. The R132 Connectivity Project received approval by An Bord Pleanála on 20 January 2022 (planning application reference number JP06F.310145). The R132 Connectivity Project aims to improve the connectivity and safety of pedestrians and cyclists moving along, and across, the R132 and enhance facilities for all road users with particular benefits for those choosing sustainable modes of transportation such as bus users, cyclists and pedestrians.

The R132 Connectivity Project includes the following works:

- Upgrade works along the R132 Carriageway between the north of Pinnock Hill Roundabout and north of Estuary Roundabout, to facilitate installation of new protected cycle and pedestrian facilities, comprising 2m wide cycle lanes and 2m wide pedestrian lanes on both sides of the carriageway, retention of one bus and one general traffic 3m wide lane in each direction, removal of hard shoulders and/or general traffic lanes, and reduction in speed limit to 50km/h.

- Three new signal-controlled crossing points provided along the R132 Swords Bypass located as follows:
  - North of Pinnock Hill Roundabout;
  - Adjacent existing Chapel Lane/Ashley Avenue overbridge; and
  - North of Estuary Roundabout.
- The following three existing Roundabouts will be changed to signalised intersections to facilitate pedestrian and cyclist facilities:
  - Malahide Road Roundabout;
  - Seatown Roundabout; and
  - Estuary Roundabout.
- Reconfiguration of Drynam Road arm of the Malahide Roundabout to link directly to Malahide Road as a one-way road.
- Installation of turning areas at two separate points along the R132.

As noted in Section 4.13.2, four existing footbridges over the R132 Swords Bypass will be demolished as part of the MetroLink project potentially resulting in severance of pedestrian and cycle movements. Connectivity across the R132 road corridor will be maintained with the signal-controlled crossing points to be incorporated as part of the R132 Connectivity Project works promoted by FCC.

Although the two projects will be consented through different statutory processes and as such, either project can proceed without the other, the assumption made for the purposes of the MetroLink RO and EIAR is that the MetroLink project will progress after the R132 connectivity project is in place.

4.14.3 Estuary Station and P&R Facility

4.14.3.1 Estuary Station and P&R Facility Location, Setting and Access

Estuary Station and the adjoining P&R facility will be located in the townland of Lissenhall, to the north of Swords. The locations of the station and P&R facility are illustrated on Figure 4.1 Sheets 1 and 2. The site is situated to the west of the R132 Swords Bypass and north of Ennis Lane. The Emmaus Retreat Centre is located to the west of the Estuary Station with the southern entrance about 50m from the station. The site itself is open countryside and the agricultural interest at this location is described in the EIAR Chapter 23 (Agronomy) and the affected landholding is illustrated on Figure 23.1. To the south-east and separated by the R132 is the Lissenhall Industrial Estate while to the south of the station and P&R lie the Broadmeadow and Ward Rivers, with the Balheary Industrial Park about 250m from the station on the outskirts of Swords. A description of the existing landscape character of this area is provided in the EIAR Chapter 27 (Landscape & Visual).

The site for Estuary Station and P&R Facility is zoned under the Fingal Development Plan 2017-2023 and the draft Fingal Development Plan 2023 - 2029 as "Metro Economic Corridor". This area is designated for mixed use development as discussed in Chapter 11 (Population & Land Use) and in Figure 11.17.

Diagram 4.39 illustrates the layout of Estuary Station and P&R, the access and traffic circulation. The site could be accessed from the south via the R132 and a modified Ennis Lane, from the north via the R132 and the Swords Western Distributor Road (SWDR) and from the west via the SWDR and Ennis Lane. Estuary Station and the P&R have been designed as a multi-modal transport hub to connect vehicle travellers (private car, taxi and bus), cyclists and pedestrians with the rail service.

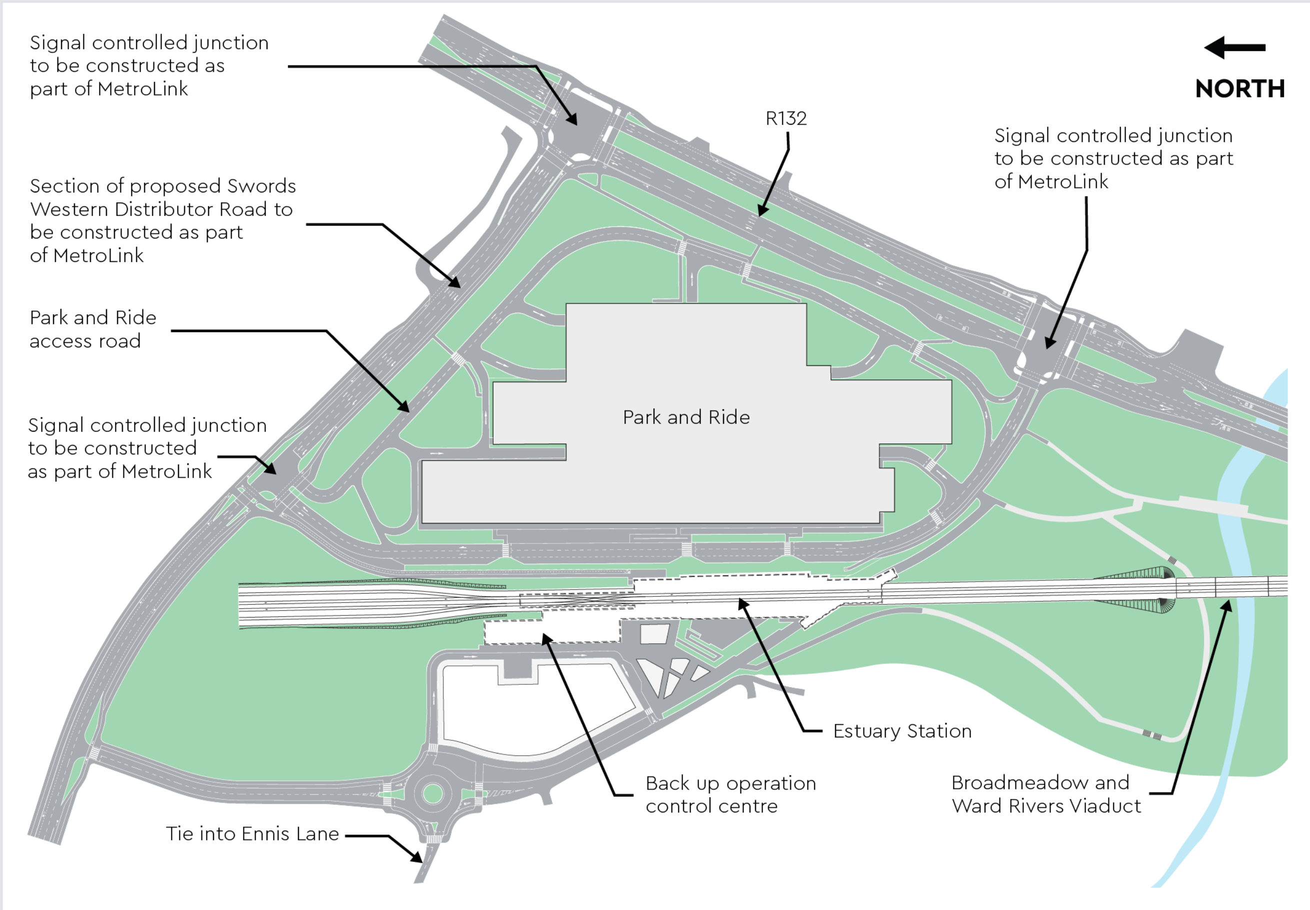


Diagram 4.39: Layout of Estuary Station and P&R Facility

The main vehicle access to Estuary Station for buses, taxis and cars going to the drop off point (DOP) will be from the south via the R132 and modified Ennis Lane onto the new one-way perimeter road around the P&R. The existing uncontrolled junction of Ennis Lane with the R132 will be upgraded to a fully signalised junction incorporating a controlled pedestrian crossing. Vehicles joining the perimeter road via this route will have priority over vehicles already on the perimeter road. This gives public transport vehicles in particular, priority on their approach to the station. A section of the existing Ennis Lane will be permanently closed to traffic where it passes under the railway south of Estuary Station in a pedestrian/cyclist underpass.

The SWDR will be used as the main access road to the Estuary P&R Facility from the north. A 700m section of the SWDR will be constructed as part of the proposed Project. The starting point will be a new signalised junction with the R132 Swords Bypass extending to a signalised junction off the SWDR onto the one-way perimeter road around the P&R Facility (see Sheet 1 on Figure 4.1). A second priority junction on the SWDR will provide access to Ennis Lane on the western side of the station and railway, relieving the severance created by the closure of part of Ennis Lane to accommodate the railway line south of Estuary Station. Access from the west will be facilitated by a DOP on Ennis Lane next to the station.

The section of the SWDR to be built for the proposed Project will consist of a single carriageway with a grass verge, cycle lane and footpath in each direction. Pedestrian and cycling crossing arrangements will be provided at the junction with the R132 Swords Bypass and the SWDR junction with the perimeter road. These measures will allow good pedestrian and cycling permeability across the R132 Swords Bypass to the P&R facility and Estuary Station via the SWDR from the surrounding environs. FCC is responsible for the construction of the remainder of the SWDR proposals. In the longer term, the SWDR is intended to provide the access needed to facilitate the development of areas to the west of Swords.

A two-lane perimeter road will wrap around the P&R facility providing one-way traffic circulation in a clockwise direction to access the station, the P&R Facility, and connect with SWDR and the R132 via fully signalised junctions. The perimeter road will provide access to six bus stops at the station. There will also be a taxi rank and DOP for private vehicles.

The road signage to the P&R Facility will be consistent with that used across the rest of the proposed Project while also being sympathetic to its environment. Signage will be provided in both English and Irish.

To avoid community severance from the closure of part of Ennis Lane, a pedestrian/cyclist underpass will be provided where the proposed Project alignment crosses Ennis Lane. This underpass will maintain the pedestrian and cycling connectivity between Ennis Lane to the west and Balheary Park to the south-east.

Pedestrian and cyclist access to the station will be segregated from vehicular traffic. Provision will be made for parking 254 cycles next to the station. Pedestrian and cycle access to the station is also provided for by way of footpaths and cycle paths accessing the site and controlled pedestrian crossings on the new junctions on the R132 and SWDR.

Pedestrians and cyclists can access the station's northbound platform via a stairway at the southern end or continue along a new underpass under the railway to access the station via stairs to the southbound platform or the entrance on the east side of the station.

Further details on the operation of Estuary Station and P&R are provided in the EIAR Chapter 6 (Operations & Maintenance). Chapter 9 (Traffic & Transport) describes the existing baseline and the impacts of the proposed Project on traffic and transport during construction and operation.

4.14.3.2 Estuary Station Urban Realm and Landscaping Design

The specific urban design principles for Estuary Station and P&R are to:

- Integrate the urban realm and landscaping design around Estuary Station and the P&R facility;
- Extensive landscaping along the R132 and rail corridor through AZ1 to be provided as part of the proposed Project;
- Connect with north-south pedestrian movements towards Seatown, the public footpaths along the Broadmeadow River, and east-west roads; and
- Integrate with future development plans for the area.

The landscaping design encompasses the development area surrounding Estuary Station, P&R and the extensive landscaping along the R132 and railway line, integrating the stormwater drainage requirements based on SuDS principles (hard and soft) that tie the scheme together. These SuDS interventions are interlinked and feed into the larger detention basin to the south of the site.

The landscape design comprises the following features.

- Integration of the new station and associated bus stops/taxi rank/vehicle DOPs, P&R, new perimeter road, highway modifications, new signalised junctions, and the new pedestrian and cycle subway with the hard landscaping and new planting around the site (Diagram 4.40). Improved pedestrian connectivity with the wider public rights of way and nearby residential areas. Provides ease of access for all users through step free access between the bus stops/taxi rank/ vehicle DOPs and the platforms.
- A split-level plaza to the west of the station connecting the ground level with the platforms.
- A sculpted landscape interface with the R132 to the east, incorporating stormwater drainage features consisting of large ponds or detention basins for drainage from the P&R which will be connected to a new outfall to Broadmeadow River. The surrounding grounds will form an undulating landscape creating a sculptural setting for the P&R building to sit in. This area will consist of a biodiverse rich species of planting and will tie into the water management network through a series of interlinked, rain gardens, detention basins and wetland park/ponds.

- Extensive landscaping along the R132 and MetroLink alignment from the station and P&R to the south that interfaces with the Broadmeadow and Ward Rivers corridor. This landscaping will consist of a pond and wetland park and connections southwards, integrating Estuary Station and P&R facility with the open space of the river corridor and beyond. In the context of the Broadmeadow and Ward Rivers just to the south and the Broadmeadow Estuary lying approximately 1km to the south-east, the landscape design will be interlinked with SuDS elements that create and define the landscape.

Diagram 4.40: View of the Eastern side of Estuary Station

The planting will be of local provenance and site specific to enhance the biodiversity of the area whilst fulfilling the principles of the design. There will be some loss of existing hedgerows and trees on the site, with retention of existing trees targeted mainly to the eastern and southern fringes and surrounding the Medieval Bridge at Lissenhall. The assessment of the loss of vegetation and the need for mitigation are presented in Chapter 15 (Biodiversity) and Chapter 27 (Landscape & Visual). The impacts on heritage features are discussed in Chapter 25 (Archaeology & Cultural Heritage).

4.14.3.3 Estuary Station Description

The layout of the main features of Estuary Station are illustrated in Diagram 4.41 and a summary of key features is provided in Table 4.11. Section 4.9.2 also sets out the general principles and features for the design of this surface station together with a longitudinal cross section of Estuary Station in Diagram 4.13.

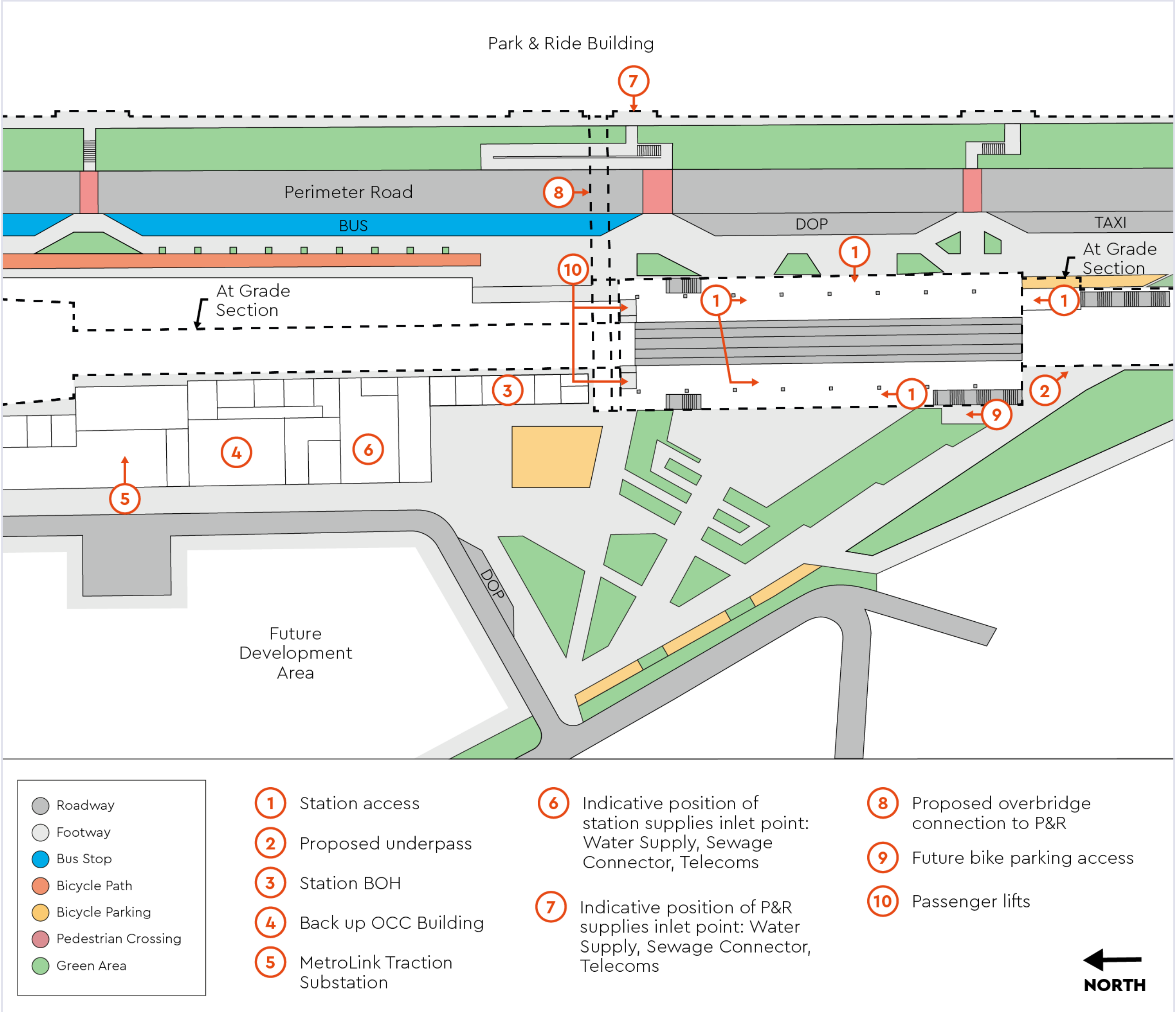


Diagram 4.41: Layout of Estuary Station

The station will be built at ground level. The main entrance on the east side of the station will comprise a new forecourt along the ground floor leading to the two platforms both 65m long and 8m wide, reducing to about 5m by the stairs to the pedestrian overbridge, on either side of the railway. The approach from the west side will be via a split-level plaza.

The station will be fully protected overhead from the weather by a canopy with a green roof incorporating a longitudinal central glazing strip along its length to provide natural light to the platforms underneath, supported on piers. Two sets of stairs and two lifts, one on the Northbound platform and one on the Southbound platform, will lead between the northern end of the station and a pedestrian bridge linking with the P&R building at Level One.

A building located on the west side of the station will provide shelter for 127 cycles, with a further 127 cycle stands located nearby.

The BOH, back up OCC building and traction substation will be built to the north of Estuary Station and to the west of the final section of rail providing the turnback for trains. These areas will only be accessible by staff and not the travelling public.

A 30m high radio mast will be erected at Estuary Station.

Table 4.11: Estuary Station Details

Estuary Station	
Station Location	Lissenhall, west of R132.
Station Type	Surface Station
Access/Interchange	P&R facility, Bus, Taxi and DOP, Pedestrian and Cycle.

4.14.3.4 Architectural Form and Landscaping of the Estuary P&R Facility

The architectural and landscape design of the P&R facility and surroundings is both in keeping with the existing landscape and is designed to integrate with future proposals.

The form of the P&R facility adapts to the surrounding landscape. The building's ground level is dropped below the track alignment level, with glass panels and louvres.

A general visualisation of the P&R is shown in Diagram 4.42.

Diagram 4.42: General Visualisation of the Estuary P&R Facility

4.14.3.5 Estuary P&R Facility Description

The P&R facility will be located next to Estuary Station, bounded to the north by the SWDR, to the east by the R132 Swords Bypass, and Ennis Lane to the south as shown in Figure 4.1. The overall site covers an area of approximately 11 hectares. The P&R facility will be linked with Estuary Station by a pedestrian bridge and steps and lifts to the platforms.

The overall height of the P&R facility is a key factor in influencing the visual impact of the structure, which is assessed in Chapter 27 (Landscape & Visual). A balance has been struck between the building height and the building footprint, which in turn dictates the distance passengers have to walk to Estuary Station.

The P&R facility comprises three modules with the following number of storeys in each module:

- **Module 1:** 3 storeys;
- **Module 2:** 4 storeys; and
- **Module 3:** 3 storeys.

These building heights offer a graduated increase in height towards the centre of the structure reducing the visual impact as viewed from the R132 Swords Bypass.

In addition, the building will be visually softened by landscaping including the provision of trees along existing roads and earth bunding to reduce the perceived height.

The P&R facility is designed to provide 3,000 car parking spaces. A breakdown of the parking spaces is given in Table 4.12. Further information on how the P&R would operate is provided in the EIAR Chapter 6 (Operations & Maintenance).

Table 4.12: Parking Spaces at the Estuary P&R

Type of Parking Space	Number of Spaces
Wheelchair accessible parking spaces	208 In accordance with the guideline Building for Everyone A Universal Design Approach (Centre for Excellence in Universal Design, Booklet 1 – External Environment and Approach, undated) 6% of total capacity, BS8300:2018 and TGD part M (at least 5% of total number of spaces). The parking spaces will be designed to meet the guidance on access zones to the sides and rear of the vehicles, minimum vertical clearance to allow the passage of high-top conversion vehicles, and ease of access to the lifts.
Staff parking spaces	10 Close to office with restricted access
EV charging spaces	694 Facility for charging EVs. The P&R has been space proofed to ensure that further EV charging points can be provided as needed.
Total car parking spaces	3000 This number includes the above-listed special parking spaces

Potable water will be supplied to the P&R facility from a new connection to the building subject to a new connection application to Irish Water. The potable water system will supply hot and cold water for the staff facilities.

The wastewater (grey water and sewage) arising from the staff facilities on site will be discharged into the sewerage network. Public toilets will not be provided at the P&R.

At present two ditches cross the station and P&R facility site. The P&R facility will be built over the southern ditch which will be replaced by artificial drainage which will drain to a new attenuation pond at the southern end of the site. The western ditch will be diverted in open channel and culverted through the site.

The whole site has been subdivided into six sub-catchments, each one collecting rainwater drainage from the new impermeable areas (from the new roads, P&R building and track drainage) within the sub-catchment and conveying the water to a new attenuation pond. The attenuation ponds have been sized to contain the drainage from the sub-catchment for a design storm defined by 1% AEP (1:100-year annual chance) plus climate change and a freeboard. Drainage from the attenuation ponds is capped by a control structure to maintain discharges at greenfield rates, resulting in negligible change in flood risk. The attenuation pond at the southern end of the site will discharge to Broadmeadow River, while the other five ponds will drain to the western ditch on site. Pollution control will be provided by silt and oil traps and petrol interceptors incorporated into the drainage system. Further assessment of the site drainage on flood risk is provided in Chapter 18 (Hydrology).

The lighting systems for all the areas of the P&R Facility, has been designed in accordance with the relevant standards and good practice. The MetroLink logo will be illuminated at night and will not cause excessive light pollution. The lighting in the parking area will be controlled automatically, based on day light levels (multi-level lighting or dimming) and occupancy and designed for the safe circulation of people and vehicles, and to help to reduce vandalism and crime. The lighting in the offices and utilities rooms will be controlled locally with presence detection and automatic switch-off after a time delay.

Emergency lighting will be provided throughout the P&R facility:

- At each exit from the building;
- At each protected set of stairs, in order for it will be easily identifiable as an escape route in emergency;
- At each change of direction;
- Outside each exit from the building;
- Close to all fire-fighting equipment; and
- At lift shafts.

4.14.4 Broadmeadow and Ward River Viaduct

The proposed Project will need to cross the Broadmeadow River and Ward River. This is an environmentally sensitive location where the design of the viaduct needs to address both engineering requirements and environmental constraints. The crossing needs to be designed to avoid adversely affecting the flood risk. There are ecological interests associated with these watercourses which are discussed and assessed in Chapter 15 (Biodiversity). The site is also close to the Medieval Lissenhall Bridge and Balheary Bridge which are of heritage and landscape interest and discussed in Chapter 25 (Archaeology & Cultural Heritage) and Chapter 27 (Landscape & Visual). There are also interests in developing future pedestrian and cycle routes along the Broadmeadow valley in the FCC Development Plan 2017 – 2023 and the draft Fingal Development Plan 2023 – 2029.

In order to raise the infrastructure out of the flood zones and to avoid an adverse effect on flood flows, a viaduct of approximately 260m in length will be provided for this area. The structure is shown in Diagram 4.43.

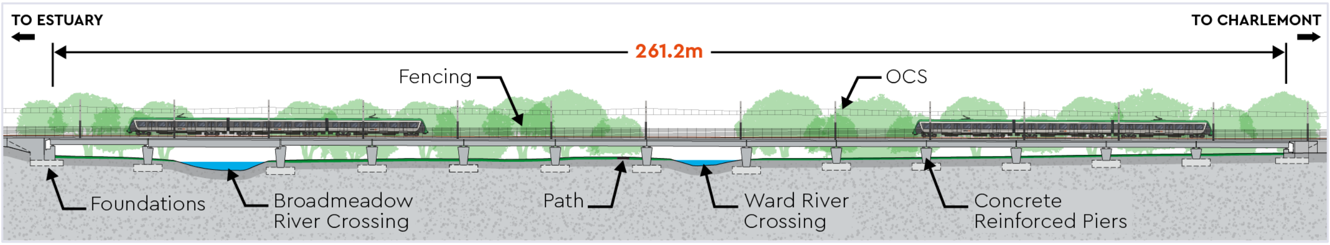


Diagram 4.43: Broadmeadow and Ward River Viaduct

The visual appearance of the Broadmeadow and Ward River Viaduct is of particular importance. The plan form of the viaduct is set out on a curve, so the structure has been designed to have the appearance of a continuous smooth curve from the side. The viaducts spans will be an equal width (except where longer spans are required to cross the two rivers) to maintain a coherent look and the deck soffit will provide a clean, smooth and continuous profile. The visual mass of the viaduct will also be minimised in relation to the setting. The clearance beneath the viaduct has been designed to increase permeability and reduce visual obstruction. The embankments at either end of the structure will be landscaped to look as simple and natural as possible, with the earthworks softened to tie in with the existing landform. The overall effect is to produce a low-lying, elegant structure that sits within the landscape setting.

The viaduct will comprise concrete precast beam sections under the track using small spans that decrease the deck thickness requirements to allow a better water crossing. The crossings over both the Broadmeadow and Ward Rivers are achieved by way of a single span over each river with no piers in either watercourse.

The foundations for each support column are defined as shallow foundations. A typical cross section of Broadmeadow and Ward River Viaduct is provided in Diagram 4.44.

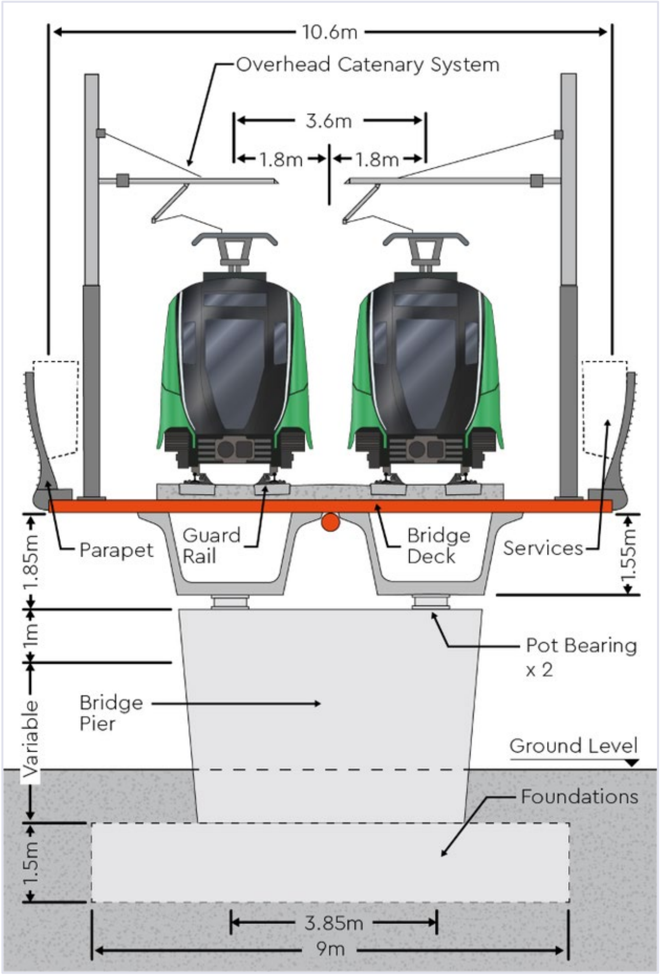


Diagram 4.44: Broadmeadow and Ward Viaduct Cross Section

4.14.5 Football Pitches at Balheary Park

Two football clubs have facilities in Balheary Park, which will be affected by the permanent land-take required for the proposed Project. Temporary arrangements during construction are described in Chapter 5 (MetroLink Construction Phase). The use of the pitches is based on a licence system, issued by FCC who owns the land. The recreational land is bounded by the Ward River to the west and north, the R132 to the east, and the R125 to the south. Swords Rovers FC has two full-sized pitches in the northern part of this site and Fingallians GAA has a full-sized grass pitch and a training pitch in the southern part of the site. Fingallians GAA also has a clubhouse and playing facilities to the east between the arm of the R132 and Seatown West both accessible via a footbridge over the R132.

From the Broadmeadow and Ward River Viaduct, the alignment passes diagonally across the northern end of Balheary Park before tying in closely against the R132 in retained cut. As a result, both pitches at the Swords Rovers FC will be realigned due to the loss of land to the north and eastern boundaries of the park. The southernmost soccer pitch is to be relocated to suit the proposed MetroLink works. The northernmost pitch is to be converted to a 7-a-side pitch. The surface intervention is to be kept to a required minimum so as to provide the minimal disruption to the pitch operation. Ball netting is to be installed between these pitches and the proposed alignment where appropriate. It is proposed to include these works as part of the RO. These lands shall generally be temporarily acquired by MetroLink (except where permanent acquisition is needed locally at specific areas to accommodate MetroLink infrastructure).

There is an area between the rivers within the northern part of Balheary Park that Swords Rovers uses for training purposes. FCC has confirmed that this is a temporary arrangement arising due to COVID-19 and any alternative will need to be sourced by FCC. This land shall be acquired by temporary possession by

MetroLink and used during the construction phase. No works in relation to accommodating an alternative to this training ground are proposed.

The Fingallians GAA pitches also need to be re-positioned and reduced in size. The southernmost pitch (the full-size GAA pitch) is to be locally reconfigured following the utility diversion works. This pitch is to remain a natural grass pitch. The northernmost GAA pitch is to be replaced with all-weather artificial pitch. The pitch is to be provided with Class II flood lighting and to be fully fenced off. Ball netting is to be provided between the pitches and the pond and the proposed alignment, where appropriate. These works are to be included as part of the RO. The lands shall be acquired by temporarily possession from FCC and returned when construction is completed.

4.14.6 Seatown Station

4.14.6.1 Seatown Station Location and Access

Seatown Station will be located on the southeast side of Seatown Roundabout, which connects the R132 Swords Bypass with Seatown Road. The setting is urban, with extensive residential areas to the west of the R132 and the main centre of Swords itself, while the Swords Business Park lies on the east side of the R132. Seatown Station will be in retained cut, aligned north-south parallel with the R132, with a single entrance to the station at the northern end. Near neighbours include the Hertz Europe Service Centre to the immediate east and Woodies DIY store to the north of Seatown Road. The location of Seatown Station is shown on Sheets 3 and 4 of Figure 4.1.

The design of access to Seatown Station has been integrated with the proposals for the R132 Connectivity Project. The existing footbridge over the R132 on the north side of Seatown Roundabout will be demolished to make way for the new railway in retained cut. As part of the R132 Connectivity Project Seatown Roundabout will be replaced with a signalised junction, with new pedestrian and cyclist crossings facilitating north-south and east-west movements. Some pedestrians may arrive by bus and walk from nearby bus stops to the station.

4.14.6.2 Seatown Station Urban Realm and Landscaping Design

The specific urban design principles for Seatown Station are to:

- Design the front of the station to accommodate north-south movements and an east-west movement;
- Create urban edges between the surrounding development and the urban realm of the station;
- Separate pedestrian and cycle routes from the R132;
- Integrate with the R132 Connectivity Project;
- Align with future development plans for the area; and
- Integrate stormwater attenuation into the urban realm.

The Seatown Station landscape design is defined by the station architecture and the need for a plaza arrival area to the front of the station for pedestrians and cyclists. This, in conjunction with the amendments to the Seatown Road layout as part of the R132 Connectivity Project, provides surface interface with the surrounding urban framework. The public realm is framed by access points and desire lines for both cyclist and pedestrians, which in turn form the main elements of the landscape design. The landscape features of the plaza include large mature feature trees, swales, raised planters with integrated benches, ornamental shrub planting, cycle parking, benches and allocated play and amenity spaces. A view of Seatown Station is illustrated in Diagram 4.45.

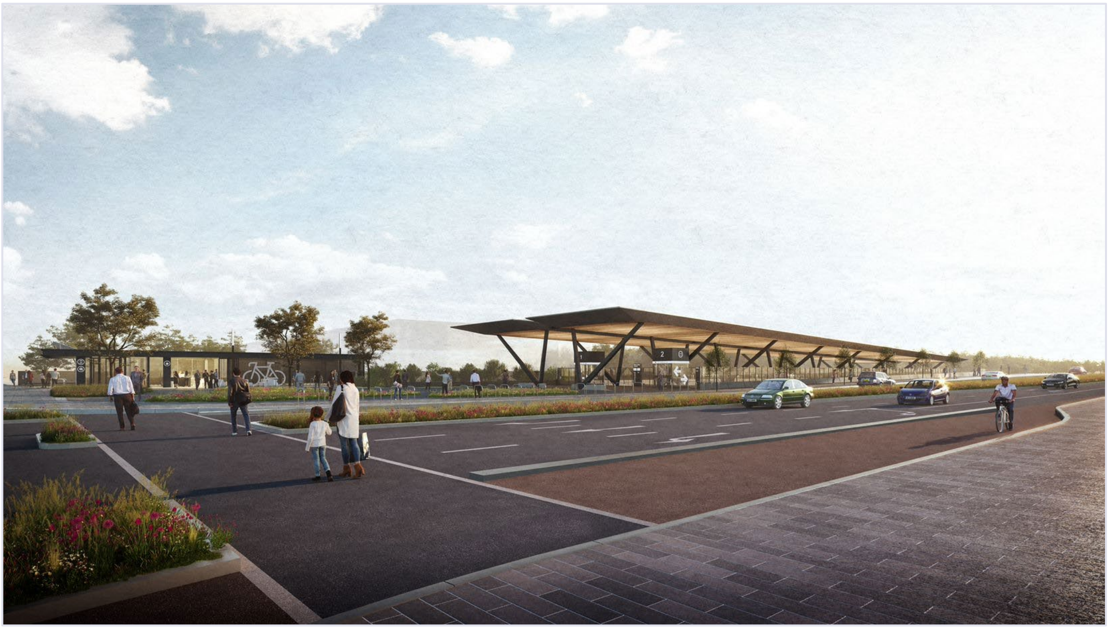


Diagram 4.45: Seatown Station Indicative Public Realm Views

4.14.6.3 Seatown Station Description

The general features of retained cut stations are described in Section 4.9.2 and a generic longitudinal cross section is illustrated in Diagram 4.14. The principal surface elements of Seatown Station are illustrated in Diagram 4.46 and Table 4.13 summarises the key features.

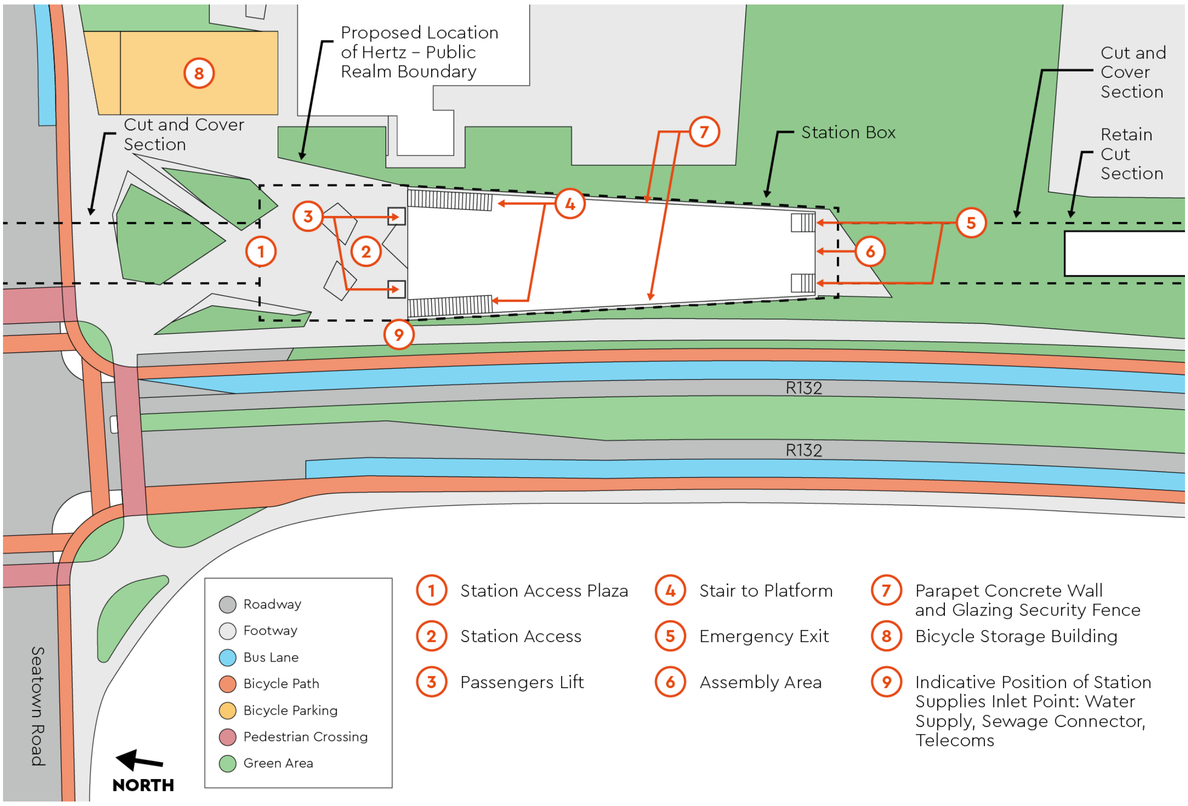


Diagram 4.46: Seatown Station Layout

Table 4.13: Seatown Station Details

Seatown Station	
Station Location	South-east of existing Seatown Roundabout with the R132 and Seatown Road
Station Type	Retained cut
Access/Interchange	Pedestrian and cycle

A landscaped plaza is located in front of the entrance to the station with a building for cycle storage offset to the east side of the plaza with provision for 240 cycles. A further 240 cycle stands will be provided, located along the landscaped boundary with the R132 and on the east side of the station building.

The station will be covered by a canopy with a green roof, covering the concourse and the full length of the platforms, with natural light illuminating the platforms through the glazing along the centre of the roof canopy.

Passengers will be able to move between the platforms via pair of lifts or stairs. There will be two platforms, both 65m long and varying in width to accommodate the stairs, with full height PSDs for safe entrance and egress between the platform and the train. Two emergency exits between the platform and the ground level are located at the southern end of the station, together with a meeting area outside the station at ground level.

BOH technical rooms and staff facilities will be located at the northern end of the station at platform level and underneath the station entrance and plaza. These facilities will not be visible to passengers. This station will not have a traction substation. Stormwater drainage will be collected and stored temporarily in an underground retention tank in the green space to the east of the station which itself will be landscaped, with discharge to the nearby stream controlled by green runoff rates.

4.14.7 Swords Central Station

4.14.7.1 Swords Central Station Location and Access

Swords Central Station will be located to the south of Malahide Roundabout and eastern side of the R132 Swords Bypass (see Sheets 4 and 5 on Figure 4.1). On the east side of the R132, the location for the station itself is undeveloped agricultural land, which is designated for mixed use and general development. Further information on the agricultural land is presented in Chapter 23 (Agronomy) and the agricultural land holding is shown on Figure 23.1, while information on future development is discussed in Chapter 11 (Population & Land Use) and land used designations are illustrated on Figure 11.17. Residential areas are located to the north along both Drynam Road and the R106 which exit off the Malahide Roundabout on the east side. Industrial and commercial units are located to the south of the station site off Lakeshore Drive. To the west of the R132, Pavilions Shopping Centre and car park served by the R106 off the Malahide Roundabout and situated opposite the station site with residential areas further west.

This station will be located within a retained cut. To facilitate access for pedestrians and cyclists, consideration has been taken of the proposals for the R132 Connectivity Project. Under the R132 Connectivity Project, Malahide Road Roundabout will be modified to a signalised intersection to facilitate north-south and east-west pedestrian and cycle movements (see Section 4.14.2). These modifications will also offset the loss of severance resulting from the demolition of the R132 Malahide Road footbridge, which is required to build the railway line in retained cut/cut and cover on the east side of the R132.

Some additional minor road alterations to the R132 Swords Bypass will be required in the vicinity of the station to ensure that the proposed Project ties in appropriately with the existing infrastructure. These will include the upgrade of the protected cycle and pedestrian facilities provided as part of the R132 Connectivity Project to a permanent solution along the length of the station.

Swords Central Station and the Swords Pavilions Shopping Centre will be linked with a new zebra crossing providing public access to both sides of the R132 for pedestrians and cyclists (Diagram 4.47). The new pedestrian crossing will require alterations to the existing left-in left-out junction to the Pavilions Shopping Centre.

4.14.7.2 Swords Central Urban Realm and Landscaping Design

The specific urban design principles for Swords Central Station are to:

- Design the front of the station to accommodate north-south movements and an east-west movement across the R132;
- Create a defined edge to the eastern boundary of the station through planting;
- Separate routes to and from the R132 crossing points;
- Accommodate the R132 Connectively Project improvements;
- Align with plans for future roads; and
- Co-ordinate with the future vision for the area as set out in development plans.

Swords Central has an associated streetscape and plaza with further integration into the extensive landscaping which links to the north towards Seatown and to the south towards Fosterstown. The station plaza consists of an active plaza, linking to cycle parking facilities, neighbourhood pedestrian routes and connectivity into the wider network of existing and new paths. The extensive landscaping is flanked on the west with the upgraded R132 with improved pedestrian, cycle and bus networks. The landscape features of the plaza include large mature feature trees, raised planters with integrated benches, ornamental shrub planting, cycle parking, benches and allocated play and amenity spaces. To the east of the station the landscape interfaces with the Barrysparks and Crowscastle Masterplans. Diagram 4.47 illustrates a view of the concourse.

Diagram 4.47: Swords Central Station - Indicative Public Realm Views

4.14.7.3 Swords Central Station Description

The general features of retained cut stations are described in Section 4.9.2 and a generic longitudinal cross section is illustrated in Diagram 4.14. The principal surface elements of Swords Central Station are illustrated in Diagram 4.48 and Table 4.14 summarises key features.

Diagram 4.48: Swords Central Station Layout

Table 4.14: Swords Central Station Details

Swords Central Station	
Station Location	East of R132 near junction of R132 and Seatown Road
Station Type	Retained Cut
Access/Interchange	Pedestrian and Cycle.

The landscaped plaza is located in front of the entrance to the station with a cycle storage building designed to accommodate 471 cycles, offset and slightly in front of the plaza on one of the access routes to the station. A further 471 cycle stands, or racks will be provided around the station. These parking provisions are designed to reduce conflict between pedestrians and cyclists in the immediate vicinity of the station entrance.

The station entrance and canopy will be styled with the branded entrance and green roof with longitudinal glazing to allow natural light onto the station platforms.

Entrance and egress to the station platforms is via a pair of lifts and stairs. Emergency stairs are located at the further end of the station with exit to an emergency assembly area. There will be two platforms serving the north and southbound trains, 65m long and varying in width to accommodate the main stairs between the platforms and the entrance. Full height PSDs will be installed along both platforms to separate passengers from the track and provide safe access between the platform and the train. The depth between the local ground level and the TOR is approximately 7.5m.

BOH technical rooms and staff facilities will be located below ground and under the plaza and station entrance. These facilities will not be visible to passengers. There will be no traction substation at this station.

4.14.8 Fosterstown Station

4.14.8.1 Fosterstown Station Location and Access

Fosterstown Station will be located on the eastern side of the R132 Swords Bypass between Pinnock Hill Roundabout (connecting the R132, R836 and R125) and the next junction to the south (connecting the R132, L2300 and L2305). The station will be located by the Airside Retail Park. The location of this station is shown on Sheet 6 of Figure 4.1.

The setting of the station at Fosterstown comprises a pocket of farmland surrounded by urban development dominated by retail and residential land uses. Several fields are clustered either side of the R132 to the south of Pinnock Hill Roundabout. The Airside Retail Park and Airside Business Park lie between the R132 and the R125. The farmland to the west of the R132 currently provides a buffer between the highway and extensive residential areas of Swords, but this land has been designated for new housing. The station site straddles farmland (which has been designated for future office/business/technology park development) and the Airside Retail Park. Further information on this agricultural holding is provided in Chapter 23 (Agronomy) and the land holding is shown on Sheet 2 of Figure 23.1. Future land use designations are illustrated on Sheet 2 of Figure 11.17 and discussed in Chapter 11 (Population & Land Use).

The location for Fosterstown Station will require the demolition of a large retail unit at the west end of the Airside Retail Park and the realignment of the internal road network within Airside Retail Park. The realigned internal road network will also be used to provide access to the station, associated drop-off and relocated Airside Retail Park substations and telecommunications mast.

The road alignment takes into consideration BusConnects plans for the provision of a core bus corridor along this section of the R132, with a new bus stop on both sides of the R132 carriageway close to the station.

The proposed Project design was cognisant of the planned development on the west side of the R132 Swords Bypass at this location within the Fosterstown Local Area Plan (LAP) land bank. To ensure the safe passage of pedestrians and cyclists wishing to use the station from the Swords area, a new pedestrian crossing across the R132 will provide access to the station.

To reduce community severance on the east side of the R132, a new walkway on the east side of the alignment will connect the station with the Airside Retail Park.

4.14.8.2 Fosterstown Urban Realm and Landscaping Design

The specific urban design principles for Fosterstown are to:

- Take account of improvements for the R132 Connectivity Project to provide two new bus stops and a crossing on the R132 next to the station;
- Integrate the urban realm with the Airside Retail Park;
- Provide a DOP via a new road from the Airside Retail Park;
- Create the station forecourt and plaza as a central node;
- Encourage multi-modal interconnections linking people arriving by bus and car, cyclists, and pedestrians with the train service; and
- Co-ordinate with the future vision for the area as set out in development plans.

Fosterstown Station has an associated streetscape and plaza with further integration into a network of paths and the extensive landscaping which links to the north towards Swords Central Station and to the south Airside Retail Park and Nevinstown. The station plaza consists of an active plaza, linking to cycle parking facilities, neighbourhood pedestrian routes and connectivity into the wider network of new paths (Diagram 4.49). The extensive landscaping is flanked on the west with the upgraded R132 with improved pedestrian cycle and bus network. The landscape features of the plaza include large mature feature trees, ornamental shrub planting, cycle parking, benches and allocated play and amenity spaces.

Diagram 4.49: Fosterstown Station Indicative Public Realm Views

4.14.8.3 Fosterstown Station Description

The general features of retained cut stations are described in Section 4.9.2 and a generic longitudinal cross section is illustrated in Diagram 4.14. The principal surface elements of Fosterstown Station are illustrated in Diagram 4.50 and Table 4.15 summarises key features.

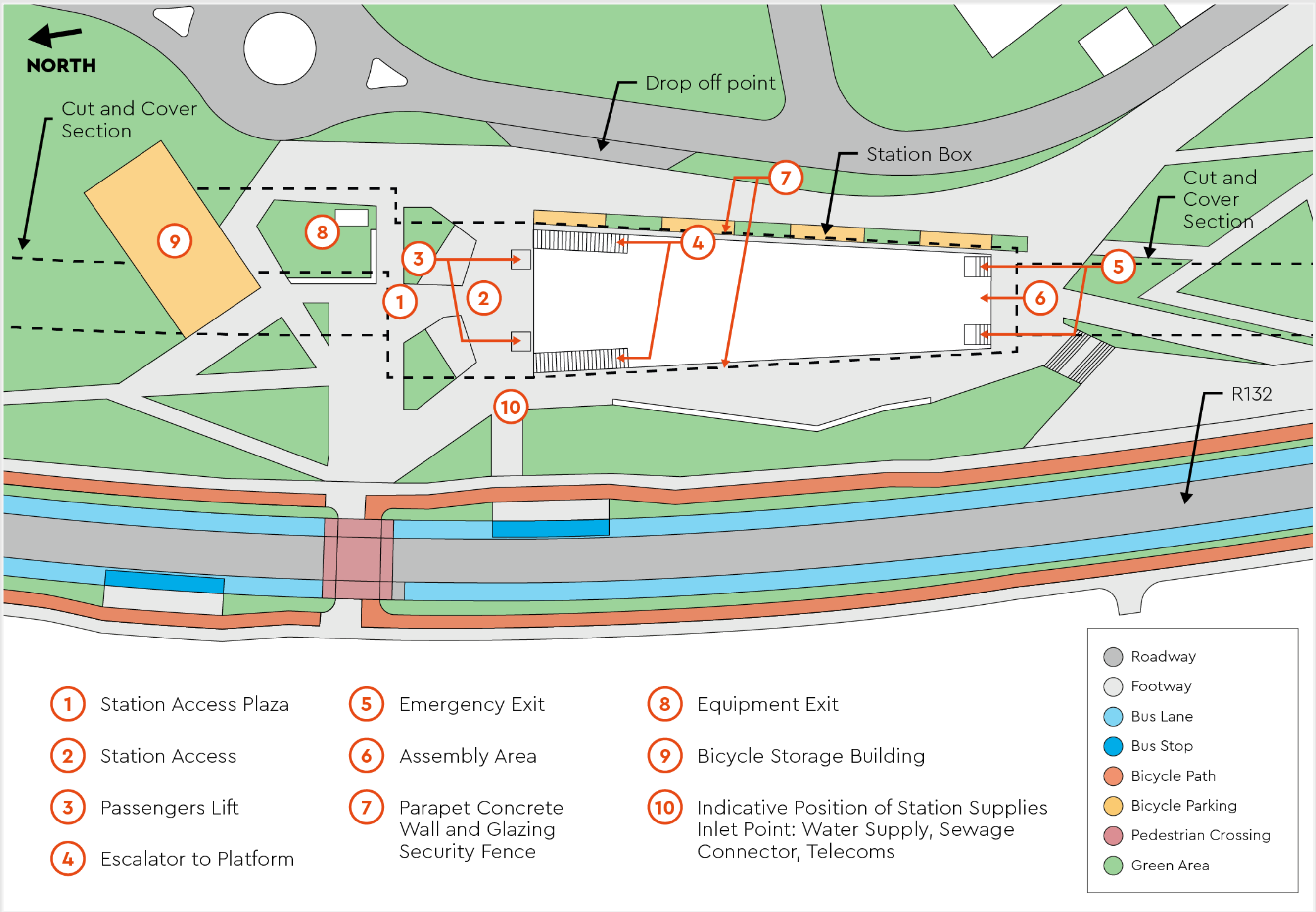


Diagram 4.50: Fosterstown Station Layout

Table 4.15: Fosterstown Station Details

Fosterstown Station	
Station Location	North of Airside Retail Park
Station Type	Retained Cut
Access/Interchange	Bus, DOP, pedestrian and cycle.

A new road access through the existing Airside public car park off the L2305 will be constructed to provide vehicle access to the east side of Fosterstown Station. Foot and cycle paths will lead to the plaza in front of the station entrance.

The station entrance and canopy will be styled with the branded entrance and green roof with longitudinal glazing to allow natural light onto the station platforms. A cycle storage building will be provided in front of the station building, separated by the plaza and angled to reduce its dominance overlooking the plaza and station entrance. The building will provide covered storage for 211 cycles, with a further 211 cycle stands provided at locations around the station but set back from pedestrian desire lines.

Access to Fosterstown Station will be via a single entrance at the northern end to platforms at a lower level. Due to the higher predicted passenger numbers, Fosterstown will be provided with two escalators to the platforms instead of stairs as well as a pair of lifts. There will still be two emergency sets of stairs to the rear of the station leading to an emergency assembly area at ground level.

The station platforms will be 65m long and vary in width to accommodate the escalators. The depth between the local ground level and the TOR is approximately 7.5m.

BOH technical rooms and staff facilities will be located below ground and under the plaza and station entrance. Fosterstown is one of the stations that will include a traction substation within the station, based on traction simulations explained in Section 4.12.3.2. These facilities will not be visible to passengers.

4.14.9 Fosterstown Accommodation Bridge

The proposed Project alignment will intersect the access road to McComish Limited property as shown Diagram 4.51 and on Figure 4.1. This will require a new bridge over the proposed Project alignment in order to maintain full access to this property.

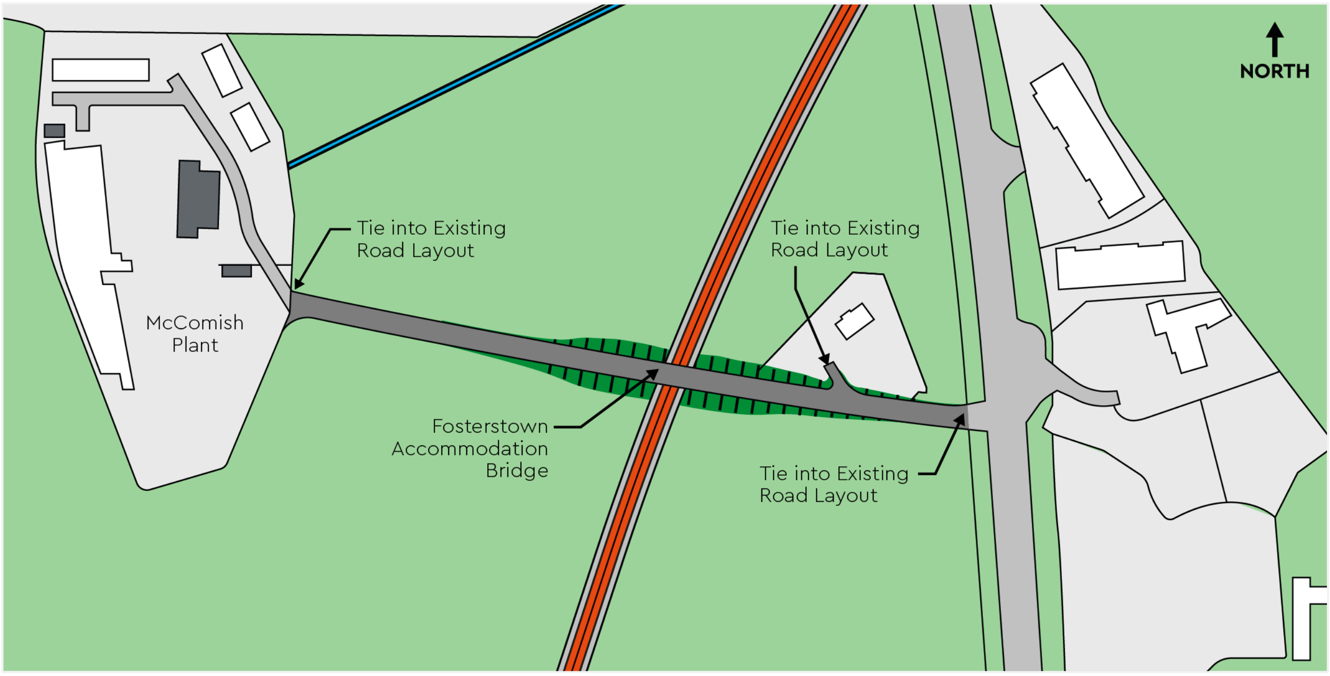


Diagram 4.51: Fosterstown Accommodation Bridge

The railway is in retained cut through this section, with the vertical alignment rising from north to south. While the bridge needs to provide sufficient clearance for the trains to the bridge soffit of 5.6m, the height of the bridge above the surrounding, relatively flat land, is a lot less should the railway been at the surface at this location, resulting in a less visually intrusive structure. The road will comprise a 3m wide lane in each direction (6m wide for both lanes), with a 2m verge on both sides. The approaches to the bridge will comprise embankments formed with engineering fill. The bridge itself will be 12m wide and consist of a modular, precast concrete portal frame incorporating precast concrete wingwalls abutting the shallow retained cut structures either side of the bridge. Parapets at least 1.85m high will be provided on both sides of the bridge for safety reasons, comprising pre-cast reinforced concrete. Strained wire fencing will be provided from the bridge to ground level along the top of the retained cut to restrict access to the railway alignment.

4.14.10 Sluice River and Forrest Little Stream Culverts

The proposed Project alignment crosses the Sluice River and the Forrest Little Stream, in the agricultural land to the north of the Naul Road. The locations of the culverts are shown on Figure 4.1 and cross-sections for both culverts are illustrated in Diagram 4.52 and Diagram 4.53. These rivers are contained in bank with very little natural floodplain. Consequently, both watercourses will be culverted under the railway. The culvert for the Sluice River will incorporate a farm underpass in order to prevent severance of the farming unit.

The culverts are designed to comply with the hydraulic design contained in OPW Section 50 Consent Form, as follows:

- A culvert must be capable of passing a fluvial flood flow with a 1% annual exceedance probability (AEP) or 1 in 100 year flow without significantly changing the hydraulic characteristics of the watercourse;
- If the land potentially affected does not include dwellings and infrastructure, a culvert must be capable of operating under the above design conditions while causing a hydraulic loss of no more than 300mm (excluding the culvert gradient);
- If the land potentially affected includes dwellings and infrastructure, it must be demonstrated that those dwellings and/or infrastructure are not adversely affected by constructing the bridge or culvert;
- A culvert diameter, height and width must not be less than 900mm to facilitate maintenance access and reduce the likelihood of debris blockage;
- The number of barrels for culverts in minimized to reduce the likelihood of debris blockage;
- Culverts invert are set below the bed level of the existing channel. This reduces the likelihood of scour under culvert barrels; and
- Culverts are designed to operate without a reliance on excessive head loss across the structure.

The culverts for the proposed Project therefore have the following design parameters:

- The diameter is greater than 900mm for the passage of fish, operational purposes and reduce the risk of blockage;
- Constant slope, usually less than 1%;
- Water velocity is less than 1.2m/s at the discharge apron for three times the daily flow;
- The bottom (invert) is 500mm below the grade line of the natural stream bed, to permit fish passage;
- The width is similar to the natural low-flow channel;
- Is laid at a level and grade which allows the upstream invert to remain drowned (by back-watering) under low-flow conditions, to a depth suitable for the easy passage of the largest species frequenting the stream;
- Permit mammal passage; and
- Capacity shall be sufficient to ensure no risk of flooding to the line in the 0.1% AEP flood and no impact on flood risk to other properties.

Based on the criteria above a design for the culvert at the Sluice River has been developed and a cross-section can be seen in Diagram 4.52. This culvert includes an underpass and will be 30m in length. A mammal ledge to allow for otter and badger passage across the alignment is also provided to mitigate severance. Further discussion on mitigation is provided in Chapter 15 (Biodiversity).

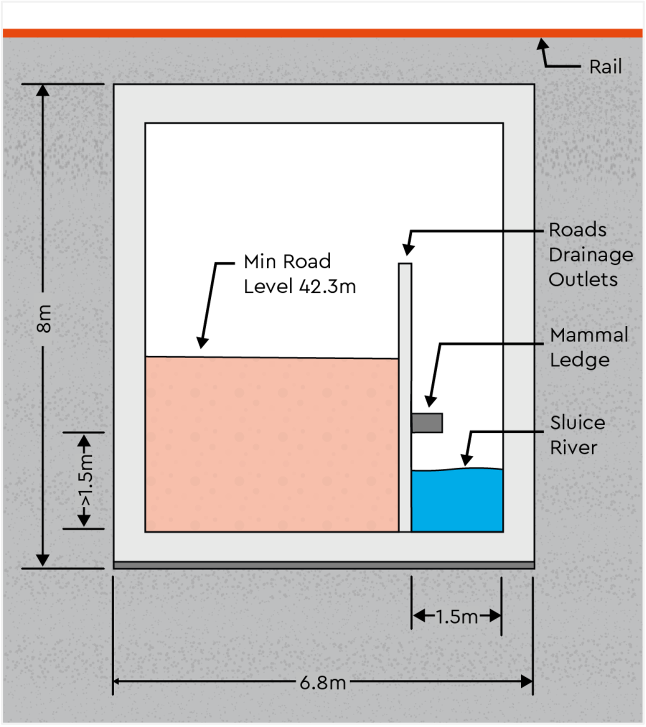


Diagram 4.52: Sluice River Culvert Cross-Section Including Road Underpass at Ch 5+762

In the case of the culvert-underpass of the Forrest Little Stream, this structure will consist of single culvert which will be 26m in length and includes a mammal ledge to allow for otter and badger passage across the alignment (Diagram 4.53).

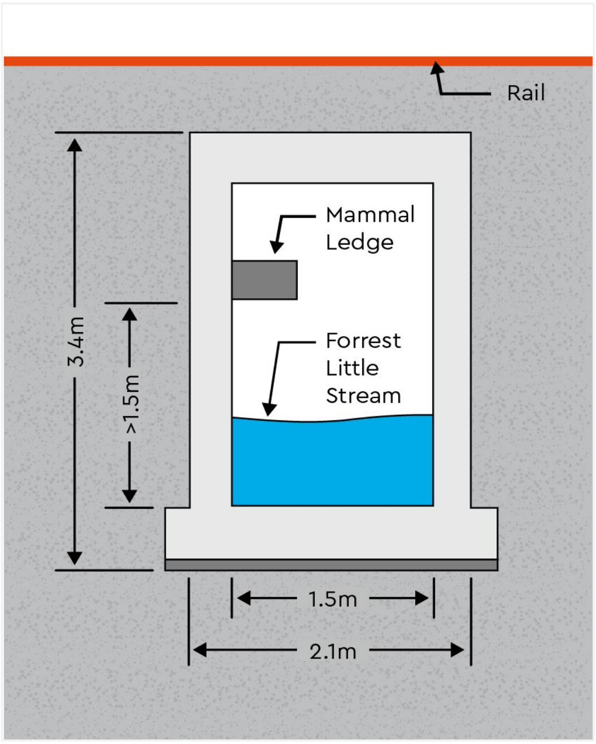


Diagram 4.53: Forrest Little Stream Culvert Cross-Section at Ch 5+963

4.14.11 AZ1 Local Access Roads

A number of road and pedestrian access arrangements will be reorientated to ensure full access to public and private lands through the AZ1 section as detailed below. An assessment of these changes on traffic are assessed in Chapter 9 (Transport & Traffic).

- The alignment of the SWDR results in the requirement to provide an alternative access to the existing farmyard to the north of the SWDR. Further east along the SWDR, a field access is required to avoid farm severance.
- Between the Broadmeadow River and Ward River crossings, the proposed Project alignment severs a pedestrian walkway which runs along the river though Balheary Park to the south and to Lissenhall Bridge to the north. The walkway will be remediated after the construction of the Broadmeadow and Ward River Viaduct.
- South of the Broadmeadow and Ward River Viaduct, an emergency service access point is provided. A footpath is provided to this point from the R132 Swords Bypass.
- South of Estuary Roundabout, an access road is provided to the Irish Water Pump Station and attenuation tanks located on the west side of the alignment adjacent to the Swords Bypass.
- A footpath is provided to an emergency services access point to facilitate access from the R132 on the south-west corner of Estuary Roundabout.
- Remediation of the existing left in left out junction access to North Dublin Business Park is accommodated through the provision of a short section of cut and cover.
- Pedestrian access to the Airside Business Park from the R132 Swords Bypass will be maintained through the provision of short section of cut and cover.
- Existing field accesses from the R132 Swords Bypass along the alignment will be remediated through the provision of cut and cover sections.
- The proposed Project alignment will cross under the east side of Pinnock Hill Roundabout requiring a section of cut and cover. The road and the entrance to the private dwelling further south will be remediated. This entrance will also serve as an access to fields currently accessed off the R132 Swords Bypass.
- Where the alignment crosses under Nevinstown Lane, the road over the alignment will be remediated through the provision of a short section of cut and cover.
- Access and a hardstanding area are provided at the DANP.
- A new access off the Naul Road will provide access to the ESBN and substation compound.

4.14.12 AZ1 Utilities

A number of critical utilities are affected by the proposed Project in area AZ1 (Estuary – Fosterstown). The water supply network throughout the AZ1 area includes the Irish Water distribution network and arterial water network. Potable water mains range from 80mm to 762mm in diameter. Foul water collection from domestic and commercial premises is provided by Irish Water. Foul sewers range in diameter from 300mm to 1,600mm. There is also a privately owned 450mm foul sewer at the Fujitsu Ireland Limited building. Surface water sewers are owned by FCC and range from 375mm to 1,200mm in diameter.

A number of communication companies operate networks within the AZ1 area. These include Eir, BT Ireland and Virgin Media who supply telephone and broadband services.

The Electricity Supply Board (ESB) operates HV underground and MV underground and overhead electricity cables within the AZ1 area. Gas Networks Ireland (GNI) operates medium pressure gas pipe assets in the AZ1 area of various sizes.

The diversion of existing utilities is required throughout the AZ1 section where the alignment and station locations clash with existing utilities. The principal diversions are outlined in Table 4.16. These include diverting a water main crossing over the Broadmeadow River below ground at the site of the Broadmeadow and Ward River Viaduct. An underground pump station will be required at the southwest of the Estuary Roundabout as shown on Figure 4.1 Sheet 3 to collect wastewater from the gravity sewers and pump sewage over the corridor to reconnect to the existing wastewater network and on to the wastewater treatment facility. Further information on utility diversions is provided in Chapter 22 (Infrastructure & Utilities).

Table 4.16: Utility Diversions Overview for AZ1

Station	Infrastructure/ Utility	Type/Size/Material	Owner	Mitigation Measures
Estuary	Foul sewer	300mm - concrete	Irish Water	Divert outside alignment
Seatown	Foul sewer	1,000mm - concrete	Irish Water	Divert outside alignment
Seatown	Foul sewer	355mm - concrete	Irish Water	Over-pump during works, reinstate following completion of works
R132	Foul sewer	Various: 225mm to 1,600mm - concrete	Irish Water	Diverted or replaced via new main and associated pumping station
Swords	Foul sewers	225mm and 300mm - unknown	Irish Water	Reinstated or decommissioned and diverted
n/a	Foul sewer	450mm - unknown	Private (Fujitsu Ireland Ltd.)	Tied into diverted sewer
Seatown	Surface water sewer	600mm - concrete	Fingal County Council	Decommission, to be replaced by new sewer
Seatown	Surface water sewer	375mm - concrete	Fingal County Council	Connect to storage tank
R132	Surface water sewer	Various: 225mm to 1,200mm - concrete	Fingal County Council	Decommission. To be replaced by new sewer
Fosterstown	Telecoms mast	n/a	Vodaphone	Relocate north of current location
n/a	Communications cables	Various underground	Eir/BT Ireland/Virgin Media	Cables to be either decommissioned and replaced, diverted outside the alignment or permanently decommissioned, depending upon each situation
Estuary	Electricity – high voltage	HV UG - 3x1x630	ESB	Provide new cable crossing under track
Fosterstown	Electrical substations at Airside Shopping Centre	2 x MV substations	ESB	Substations to be decommissioned and relocated
n/a	Electricity – medium voltage underground and overhead cables	Various	ESB	Cables to be either decommissioned, diverted outside the alignment or provided with a new crossing

Station	Infrastructure/ Utility	Type/Size/Material	Owner	Mitigation Measures
n/a	Gas pipelines – medium pressure	Various; 32mm, 63mm, 125mm, 250mm	GNI	Pipes to be either diverted outside station alignment, provided with a new crossing or decommissioned, depending upon each situation.
Broadmeadow and Ward Rivers Viaduct	Water main	762mm - CO	Irish Water	To be diverted below ground, beneath the rivers
n/a	Potable water	Various; 80mm, 100mm, 160mm, 225mm	Irish Water	Divert outside alignment

4.15 AZ2 Airport Section: Dublin Airport North Portal to South Portal

The AZ2 section of the proposed Project is relatively short at 2.3km and covers the Airport Tunnel between the DANP and DASP, including Dublin Airport Station. Diagram 4.54 shows the schematic alignment of this section on the left-hand side while the right-hand side of the diagram summarises the principal features by category.

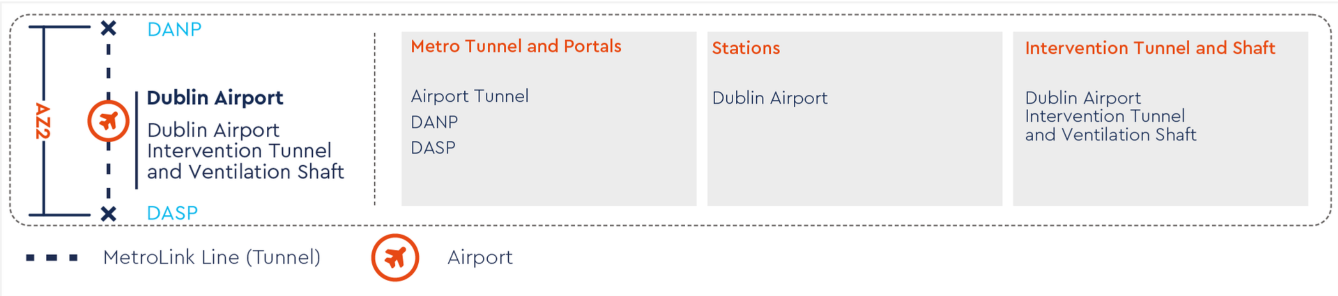


Diagram 4.54: AZ2 Location and Features

This sub-section describes the main features of the proposed Project from north to south and is structured as follows:

- AZ2 Alignment Description;
- DANP;
- Grid Connection at the ESBN substation by DANP;
- Dublin Airport Station;
- Airport Tunnel;
- DASP;
- AZ2 Access Roads; and
- AZ2 Utilities.

4.15.1 AZ2 Alignment Description

The proposed Project alignment through the AZ2 section will enter the Airport Tunnel, north of Naul Road, via the DANP and proceed south underneath Dublin Airport to exit at ground level via the DASP south of the Old Airport Road (see Figure 4.1 Sheets 8 to 10). The 2.3km tunnel will pass under the northern part of the airport apron, hangar areas, and internal roads before arriving at the new Dublin Airport Station located under an area currently occupied by the Terminal 2 Surface Car Park within the area designated as a Ground Transportation Centre in the Dublin Airport Central Masterplan (FCC 2016). The Airport Tunnel continues south from the Dublin Airport Station, passing between Terminal 1 and Terminal 2 before emerging through DASP in agricultural land south of the airport in Dardistown.

4.15.2 Dublin Airport North Portal (DANP)

The DANP is located north of Dublin Airport's land boundary at Ch 6+780. The location takes advantage of the naturally rising ground, which allows for a shorter portal length. The plan form of the portal has been designed as a square enclosure, having internal dimensions of 28m long and 17m wide as illustrated in Diagram 4.56. In cross-section, the DANP will comprise concrete diaphragm walls 1.2m thick and 25.5m deep, encasing an inner concrete structure to support the horizontal precast beams. Ground treatment is required to improve the foundations for the diaphragm walls, similar to the DASP.

In addition to forming the egress for trains to the Airport Tunnel, the DANP will also be used for emergency services access as well as for the evacuation of passengers in the event of an incident. Space has also been provided for the installation of the ventilation fans.

The construction methodology for the DANP is described in Section 5.6.3.1 of Chapter 5 (MetroLink Construction Phase). The Tunnel Boring Machine (TBM) will tunnel from the DASP northwards to exit at the DANP where it will be disassembled.

Diagram 4.55: Typical Tunnel Portal

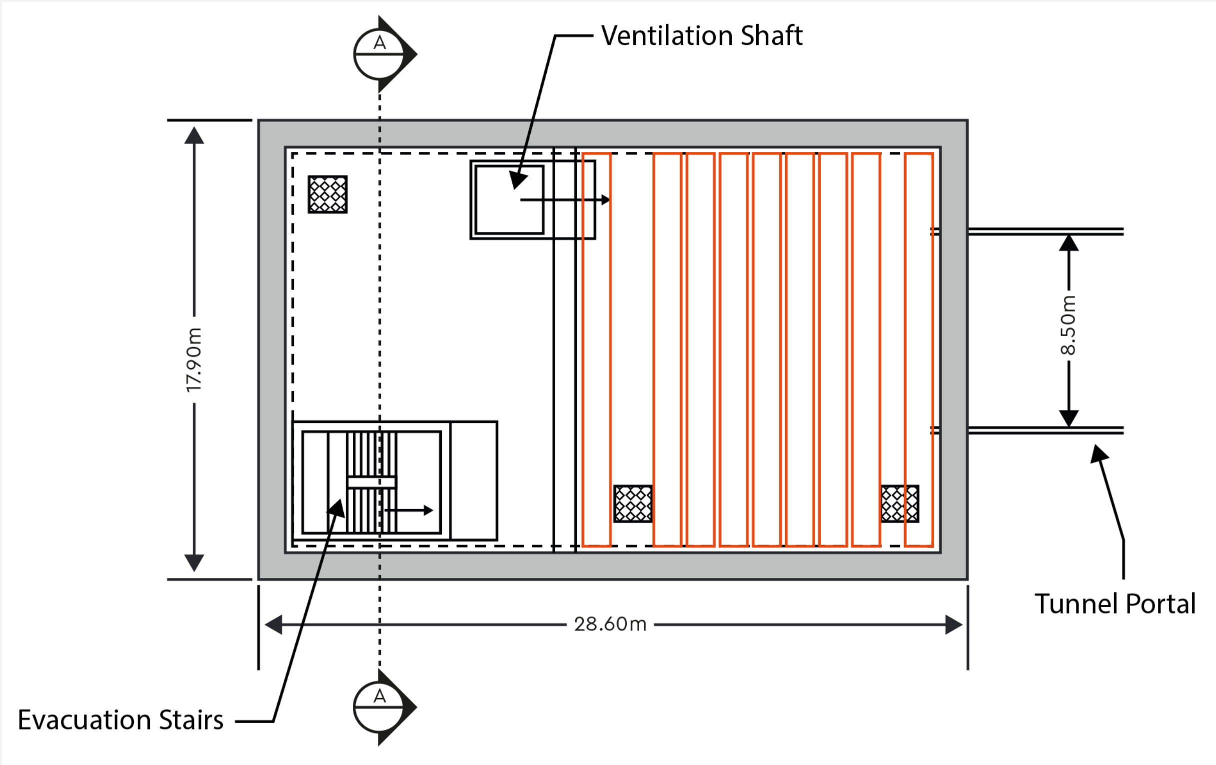


Diagram 4.56: Cross Section of Dublin Airport North Portal

4.15.3 Grid Connection at the ESBN Substation by DANP

As described in Section 4.12.3.1, one of two GIS transmission power substations will be located near the DANP which will transform the incoming HV power supplied by ESBN to MV power to operate the proposed Project.

The substation compound will be located immediately north of the Naul Road and east of the DANP and will include both the ESBN substation, MetroLink substation and associated transformers. An underground power line will connect the MetroLink substation to the alignment. An access road to the GIS transmission power substation will be provided from the Naul Road as shown on Diagram 4.57.

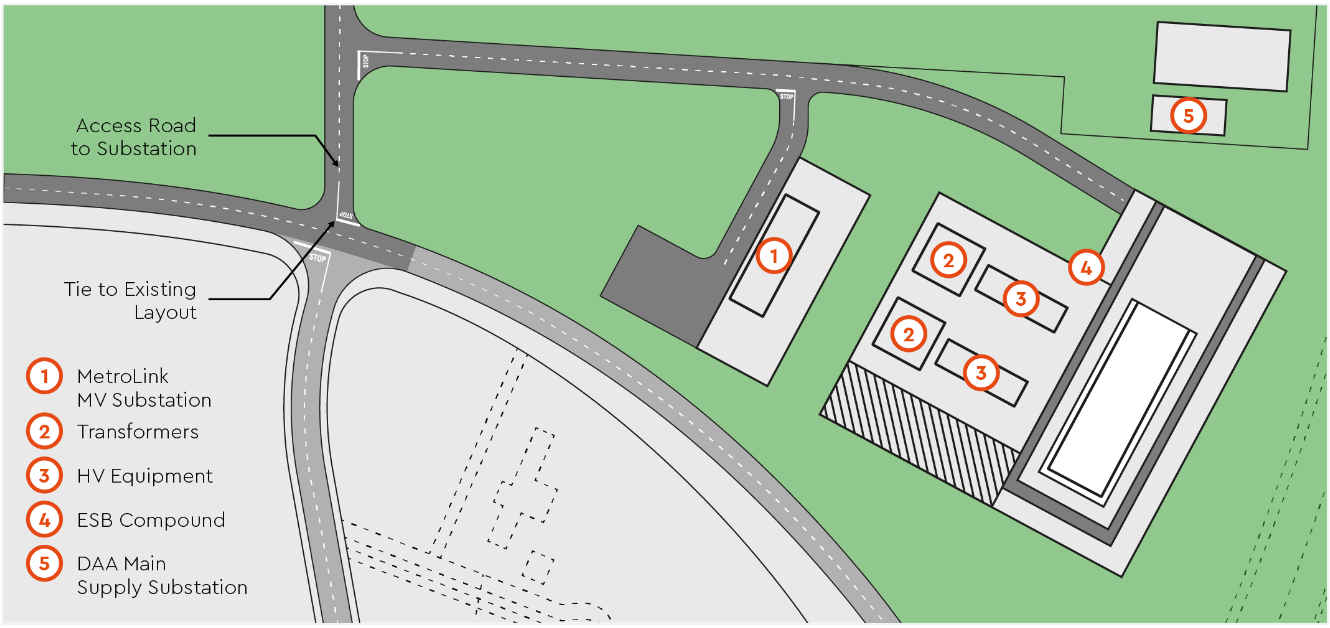


Diagram 4.57: Layout of the Transmission Substation near DANP

4.15.4 Dublin Airport Station

4.15.4.1 Dublin Airport Station Location and Access

Dublin Airport Station, illustrated in Diagram 4.58, will offer a strategic connection for air passengers to areas within Dublin City and north to Estuary. The station will be located within the ground transportation hub.

The underground station will be located under what is currently the Terminal 2 Surface Car Park. The station entrance will be located close to Terminal 2, which would facilitate rapid connection between the terminal and the train service.

4.15.4.2 Dublin Airport Station Urban Realm and Landscaping Design

The urban design principles for Dublin Airport Station are to:

- Integrate with DAA's proposals for the redevelopment of Dublin Airport;
- Accommodate the station features at ground level; and
- Provide a single pavilion as the building entrance, harmonised with the external environment, footpaths to the airport terminals and car park.

Diagram 4.58: Indicative View of Dublin Airport Station

The Dublin Airport Station comprises a large arrival building on the top of the station box. This building interfaces with the streetscape with exit doors to the north and south. The Dublin Airport Station northern entrance will allow access to the public realm with links to the bus and taxi drop off zones, the church Our Lady Queen of Heaven and wider carparking facilities. Within this public realm there are proposals for mature tree planting, seating, cycle parking, covered walkways and an interface with the skylights to the station below. The main circulation routes are defined, and active plazas are created at each entrance. Footpaths between the station entrance and the terminals will be clearly signposted to provide clear, safe direction for pedestrians.

Dublin Airport Station urban realm is conditioned by the final definition of the DAA Master Plan and the Ground Transportation Centre (GTC) options, currently still under discussion by the stakeholder involved in the future development of the airport. The Project design accommodates the station features rising to ground level with enough flexibility to dove tail with the final design for the DAA Master Plan.

4.15.4.3 Dublin Airport Station Description

The principal surface elements of Dublin Airport Station are illustrated in Diagram 4.59 and Table 4.17 summarises the key features. The general features of underground stations are described in Section 4.9.2 and a generic longitudinal cross section is illustrated in Diagram 4.10.

The station box will be constructed by cut and cover and align with the bored tunnels. A description of the construction of Dublin Airport Station is provided in Chapter 5 (MetroLink Construction Phase).

In cross section, the station will be stratified into the following levels, the street level, the concourse, the mezzanine and the platforms. The station will be about 23m deep below the surface to TOR.

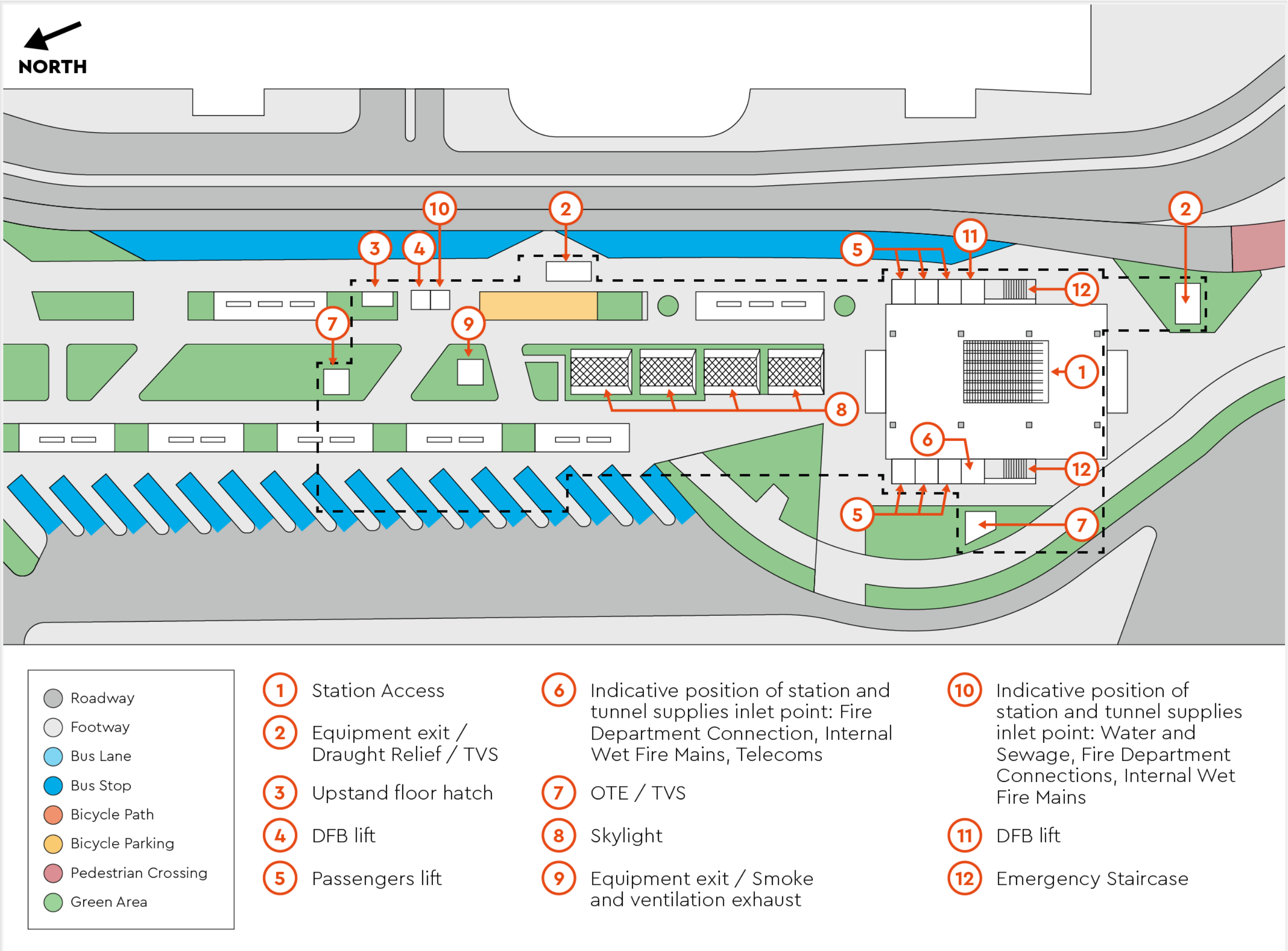


Diagram 4.59: Dublin Airport Station Layout

Table 4.17: Dublin Airport Station Details

Dublin Airport Station	
Station Location	Dublin Airport
Station Type	Underground cut and cover
Access/Interchange	Car, taxi, bus, pedestrian and cycle.

The station will be accessed from a single entrance pavilion located at the southern end overlying the station box. Passengers will be able to descend and ascend between the street and the platform using escalators and lifts. Six escalators will connect the street level with the concourse level and the concourse with the mezzanine, and four escalators will link the mezzanine and platforms. Six high-capacity escalators will connect the street with the platforms and another six lifts will connect the concourse and the platforms. There will also be three lifts for the DFB to use in the event of an incident and four sets of stairs between the platform and the street for emergency access only.

There will be two platforms each 65m long. The northbound platform will be about 10m wide and the southbound platform about 8m, reflecting the greater numbers of passengers expected to travel northwards.

BOH facilities will be located in rooms below the ground surface on the concourse and mezzanine levels at the northeast end of the station and separated from public view.

The surface expression of Dublin Airport Station includes the pavilion for the station entrance, skylights to allow natural light into the mezzanine level, ventilation vents, and the emergency accesses.

4.15.4.4 Terminal 2 Surface Car Park

Terminal 2 Surface Car Park will be redesigned to accommodate station infrastructure such as ventilation shafts and emergency accesses and will incorporate provision for new coach parking off a public plaza, facilitating passenger interchange between bus, metro and Dublin Airport. The design includes 20 bus bays which will connect with the new road to tie into the existing road network along the existing bus bays in front of the Terminal 1.

Parking for 72 cycles is provided and links to the existing cycle network around the airport road. Appropriate pedestrian connectivity is provided to Terminal 1 and Terminal 2 buildings from the station by means of a pedestrian crossing and path.

4.15.5 Airport Tunnel

An overview of the bored tunnels, including a summary of the Airport Tunnel, is provided in Section 4.10 of this Chapter and a description of the tunnel construction is provided in Chapter 5 (MetroLink Construction Phase). The tunnel alignment is shown on Figure 4.1 sheets 8-10.

The Airport Tunnel is approximately 2.3km long between DANP and DASP. There will also be two galleries, one on either side of the main tunnel, an intervention tunnel for the evacuation of passengers and egress of emergency staff in the event of an emergency and one for ventilation.

The intervention tunnel will be located on the west side of the main tunnel about 15m apart and will extend from the DASP at Ch 8+408 for approximately 315m. The intervention tunnel will have an inner clearance of 2.3m width and 2.4m height, which will allow people to walk along. The intervention tunnel is required for the southern part of the tunnel, as the distance between Dublin Airport and the DASP at c 1.4km exceeds the design requirement for emergency access at least every 1km. Furthermore, the intervention tunnel exits outside Dublin Airport lands to avoid train passengers crossing the land airside.

The ventilation shaft will be located on the east side about 15.4m from the main tunnel and extend from the DASP northwards for approximately 582m. The ventilation shaft will be provided with an inner cross-sectional area of 22m².

4.15.6 Dublin Airport South Portal (DASP)

The DASP is located south of Dublin Airport's boundary at Ch 8+408. The location of the DASP is shown on Sheet 10 Figure 4.1. A description of the construction activities is presented in Chapter 5 (MetroLink Construction Phase).

The DASP will comprise a concrete box 70m long, of variable width, and 16m high surrounded by concrete diaphragm walls 1.2m thick and 31m deep. A plan form of the DASP is shown in Diagram 4.60. It will be covered with a concrete top slab 1.3m thick. Internally, the diaphragm walls will be covered by a second stage concrete 0.3m thick to provide a smooth finish.

DASP will be similar to the DANP. The Airport Tunnel close to the southern portal will incorporate the evacuation shaft and ventilation shaft as illustrated in Diagram 4.61.

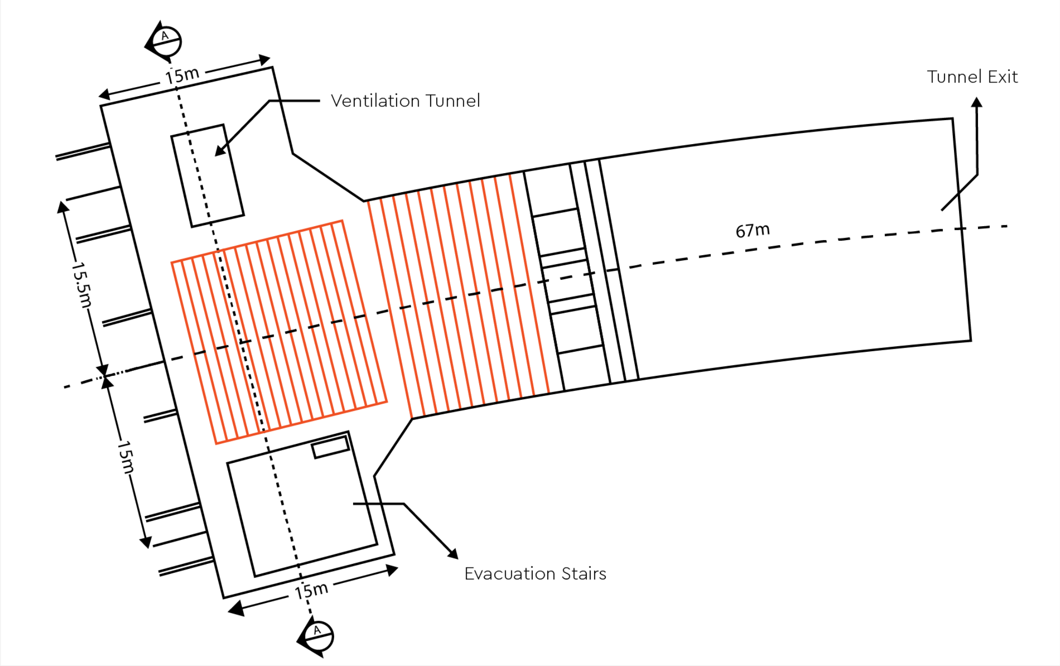


Diagram 4.60: Plan View of DASP

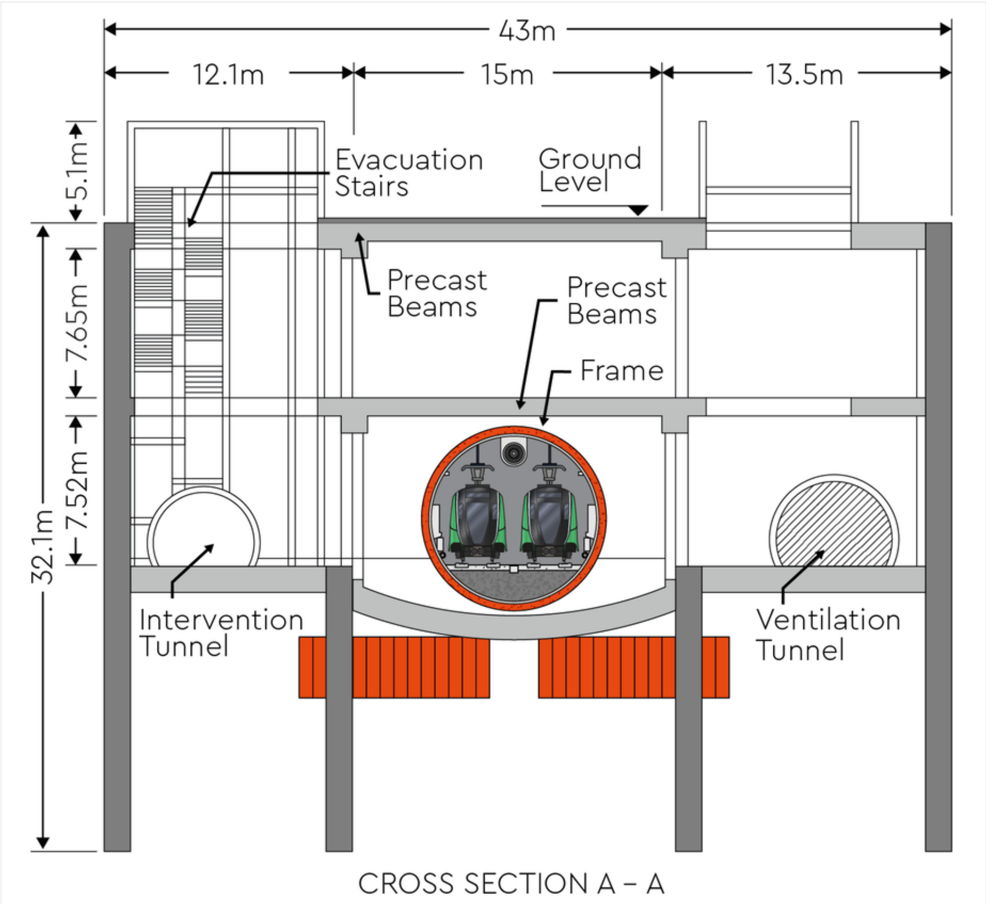


Diagram 4.61: Cross Section of DASP Showing the Evacuation and Ventilation Tunnels

The length of the DASP has been designed to incorporate the TBM launching shaft because the TBM will be launched from here and drive northwards to DANP. The DASP will lead into the next section of the alignment in cut and cover.

4.15.7 AZ2 Access Roads

An access road off Naul Road and hardstanding will be provided at the DANP. This is described in Section 4.15.7 and illustrated on Diagram 4.56.

4.15.8 AZ2 Utilities

A number of critical utilities are affected by the proposed Project in area AZ2. The main utilities are summarised here and further discussion of the impact of the proposed Project is provided in Chapter 22 (Infrastructure & Utilities).

Within the airport complex, foul water and surface water drainage and low voltage electricity cables are privately owned by DAA. There are also communications cables owned by DAA. ESB operates MV underground electricity cables within the airport complex. GNI operates a medium pressure gas pipe of 180mm diameter.

Most of the land for the DANP construction site and the DASP main compound is currently unoccupied farmland and thus minimal utility interventions are required in this section. Underground tunnelling will connect both the north and south portal sites, so for this section of the alignment surface construction works are only associated with ventilation tunnels, intervention shafts and Dublin Airport Station.

All affected utilities at Dublin Airport will be remediated, in agreement with the airport authority. Where required, utility diversions will be undertaken in advance of the main Construction Phase for the proposed Project.

Power for operation of the proposed Project will be provided from the national grid (ESBN). Grid Connections will be provided from two existing electrical substations at Newbury and Belcamp via new cable routes principally located along existing highways to two new 110kV substations, one to be located at DANP and the other at Dardistown. The options for the ESBN cable routes are shown on Figure 22.5. An application for consent of the Operational Phase power supply will be made by ESBN (but is evaluated in this EIAR on the basis of the best and most up-to-date available information).

4.16 AZ3 Dardistown Section: Dublin Airport South Portal to Northwood

This section of the proposed Project is relatively short at 2km, extending from the Airport Tunnel DASP to the City Tunnel portal at Northwood (Diagram 4.62). The section is notable for the depot at Dardistown, which will include the main OCC, maintenance services and stabling of trains. The station at Dardistown will be built and operated initially for the convenience of staff working at the depot and will not be available to members of the public until a future date. The alignment will cross the M50 on viaduct. There will also be a need for modifications for the road network, utility diversions and stream diversions.

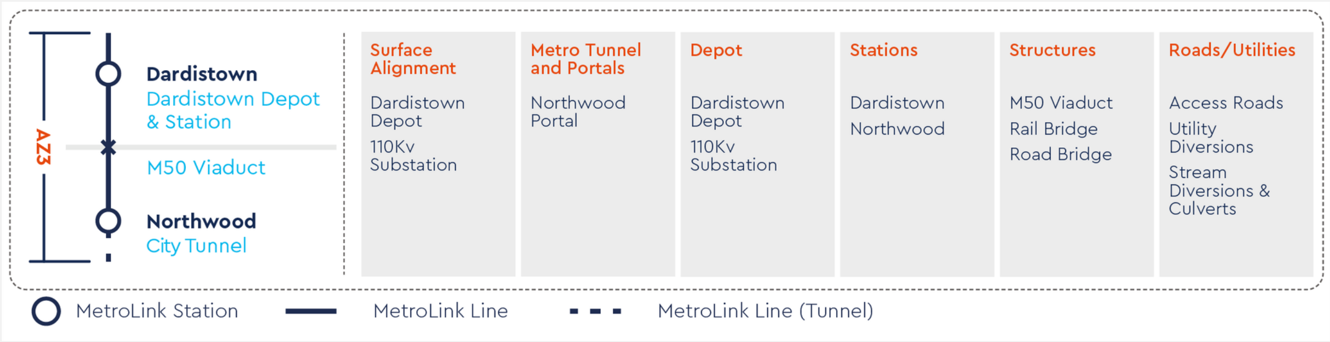


Diagram 4.62: AZ3 Location and Features

This subsection describes the key features largely following the alignment from north to south:

- AZ3 Alignment Description;
- Dardistown Depot;
- Dardistown Station;
- M50 Viaduct;
- Northwood Station;
- Northwood Portal;
- AZ3 Stream Diversions and Culverts;
- AZ3 Roads; and
- AZ3 Utilities.

4.16.1 AZ3 Alignment Description

From the DASP, the alignment continues in a cut and cover section, rising in retained cut to Dardistown Station. The Dardistown Depot and associated buildings will be located to the west of the railway and the station. Depot side lines will extend from Dardistown Station to the Depot to provide rail access.

From Dardistown Station the alignment will continue south, rising out of cut to cross over the M50 to the east of Junction 4 on a viaduct before descending to ground level, turning to the south-west and descending below ground level in cut and cover to pass under the R108 Ballymun Road to Northwood Station. The Northwood Portal for the City Tunnel will lie immediately south of Northwood Station from where the alignment will continue in tunnel southwards toward the underground Ballymun Station.

4.16.2 Dardistown Depot

4.16.2.1 Dardistown Depot Description

The Dardistown Depot will cover an area of 19.5ha located between the Old Airport Road to the north and the M50 Motorway to the south. To the east are various sports and amenity facilities and a previously used airport parking site and to the west the R108 and a golf club. The location is shown on Sheets 11 and 12 on Figure 4.1. The current land use comprises a mix of agricultural land and football playing fields. A map of the agricultural land holdings is provided on Sheet 4 of Figure 23.1 and further information on the affected landholder is discussed in Chapter 23 (Agronomy). The flat terrain and hedgerows crossing the area restrict views and the quality of the local landscape character and views is considered to be low, as described in the EIAR Chapter 27 (Landscape & Visual).

Dardistown Depot will adjoin the railway alignment, with Dardistown Station in retained cut, as shown in Diagram 4.63. The Depot will be linked to the main railway via short sections of track.

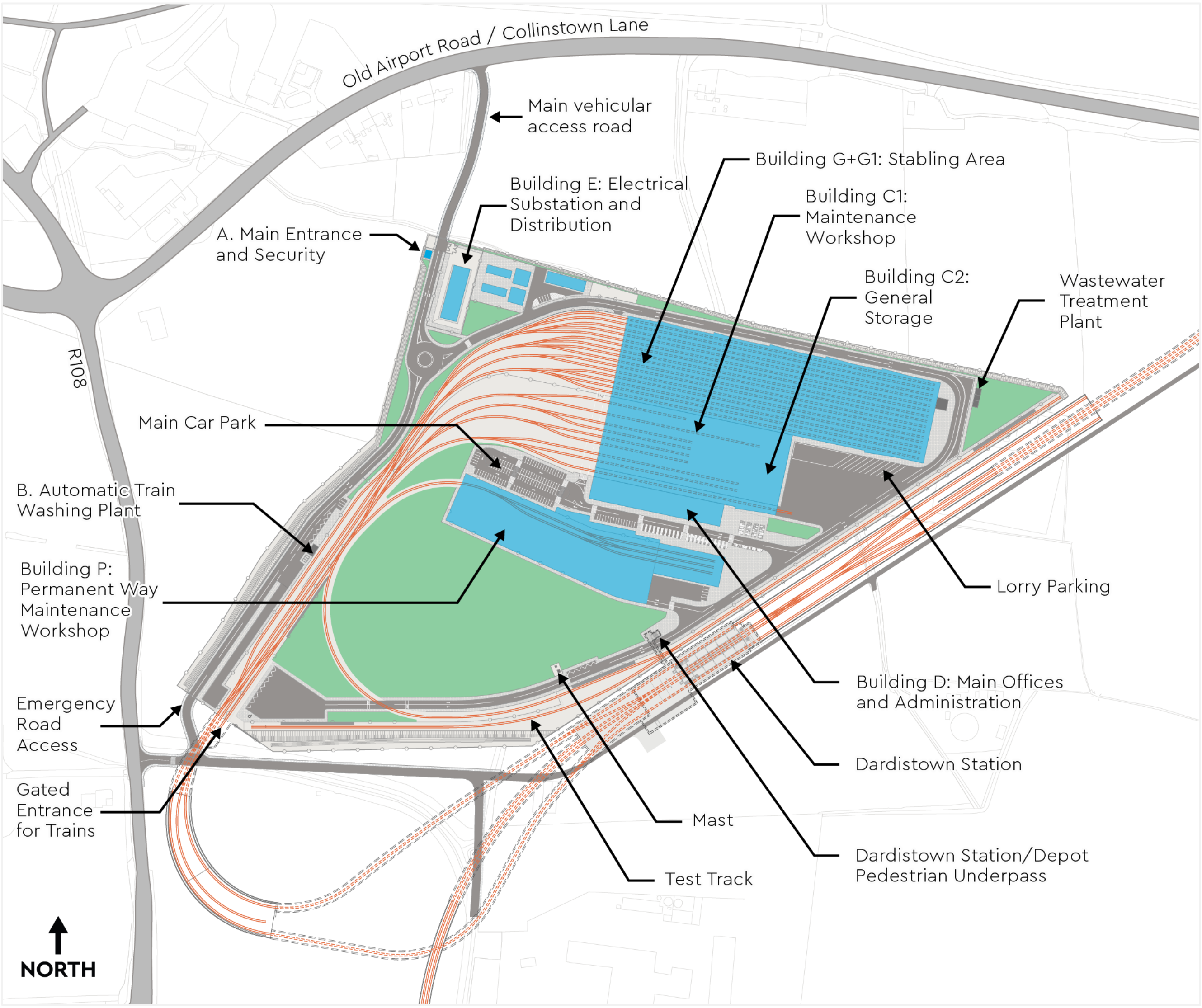


Diagram 4.63: Dardistown Depot Location

The Dardistown Depot will house the main stabling area for the proposed Project rolling stock, all the train maintenance facilities and the OCC for the safe operation of the proposed Project. Further information on the operation of the Dardistown Depot is described in the Section 6.8 of Chapter 6 (Operations & Maintenance).

The Dardistown Depot has been designed based on the following criteria:

- To facilitate the maintenance of a fleet size of 40 trains with potential for future operations to a fleet size of 60 should this be required for future scenarios;
- The constraints imposed on the depot layout by adjoining land uses and planning to the south by the M50, to the north by the Old Airport Road, and to the west by the alignment and also restrictions on potential future development land associated with Dublin Airport and the Dardistown LAP;
- The efficient movement of rolling stock between the main line and the Depot;
- Nine maintenance tracks in the workshop to allow for the full required daily, preventive and corrective maintenance; and
- The different functional areas in the depot which are arranged to suit the planned operations with consideration of normal and emergency train movements and associated staff requirements.

The following subsections describe the access to the depot, the layout of the depot and the plant and equipment to be housed there, the landscaping and urban realm, and modifications required for the local playing fields and sports clubs which currently occupy the site.

4.16.2.2 Access to Dardistown Depot

Adjacent to and south of Dardistown Station two new independent depot side links will be provided between the main line and Dardistown Depot (see Figure 4.1). The two links will be single track, one for each direction of traffic, and will connect to the main line via turnbacks and a Brettelle crossing. The general arrangement of the main line and depot side links at Dardistown Station is described in Section 4.16.3. The outer depot side link will pass under the main line in a cut and cover section. The main line would be in retained cut (U-section) at this point, rising to ground level and embankment to cross the M50 viaduct. The inner depot side link does not cross the main line. The rail access into the depot will be secured by a high security automated access gate which will be interfaced with the MetroLink signalling system to open automatically in advance of an approaching train and close behind it.

The main vehicular access to the site is via Collinstown Lane (also known as the Old Airport Road) to the northwest of the depot (Diagram 4.63). The access road will be raised slightly above existing ground level due to the provision of a culvert over Turnapin Stream, a tributary to the River Mayne. The depot access road will also serve as an access to the HV ESB substation that will serve the proposed Project.

The main vehicular access point will be secured from the public road by way of sliding roll gates and an automatic raising barrier across each carriageway inside the depot. Turnstiles and a double full height accessible gate will be provided for pedestrian access (Diagram 4.64).


Diagram 4.64: Examples of Vehicular and Pedestrian Access Gates

A secure pedestrian access will be provided between the Depot and Dardistown Station (for staff only). This will comprise an underpass from Dardistown Station, with a lift in order to be fully accessible, with turnstiles and full height accessible gates before entering the depot and a footpath leading to the Permanent Way Building next to the main offices.

A secondary access for emergency use is provided at the south-western corner of the depot site, with access from the R108 (Diagram 4.63).

4.16.2.3 Dardistown Depot Layout

The layout within Dardistown Depot is illustrated in Diagram 4.63, which shows the location of the buildings, building reference letters, the trackways, and the internal road layout. Diagram 4.65 shows an elevation across the entrance to the main buildings. The main features are described below.

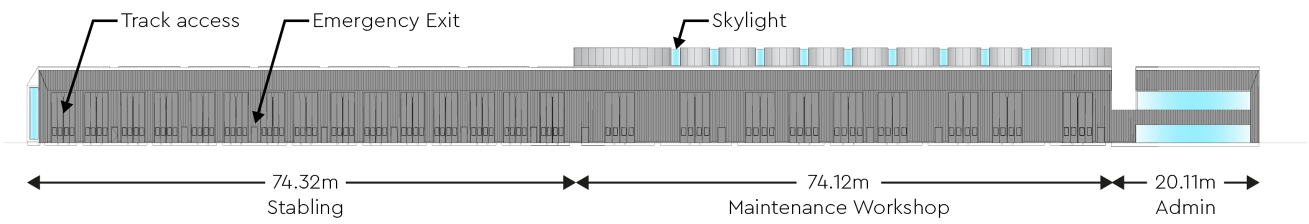


Diagram 4.65: Elevation of the Main Depot Buildings

4.16.2.3.1 Main Buildings and Structures

The main buildings and structures within Dardistown Depot are summarised below.

- A. Main Entrance and Security: The principal vehicular entrance to the depot is located to the north-west corner and comprise two sliding roll gates, two mobile barriers, and a small gate house (about 20m^2) equipped with video monitors, computer, and telephone to monitor and control movements.
- B. Automatic train washing plant (about 1,130m^2): Trains will be routed via switches from the main access railway to a bypass close to the track entrance that leads through the automatic train washing plant. The plant would comprise a single storey structure, not dissimilar in concept to a car wash machine, with mobile brushes, spray poles, a blowing system to reduce water and warm air dryers. Trains would move through the plant automatically. The plant would incorporate a water collection and recycling unit capable of recycling 80% of water, storage for cleaning products, facilities for water treatment, a technical room and changing rooms for cleaning personnel. A Diagram of a train washing plant is provided in Chapter 6 (Operations & Maintenance).
- C. Main maintenance workshop C1 and general storage (C2) (about 12,400m^2: Building C is the most important building for train maintenance work and for the storage of spare parts. The plan form of the building will be about 73m by 161m, with an eave height of 12.50m and a duo-pitch roof falling into the middle of the building at 10° leading to a central gutter height of about 10m. The train entrances to the building will comprise automatic bi-folding doors. This workshop will be equipped to repair and replace all train equipment, to overhaul and repair the bogies and wheels, and to test and analyse the operating systems. Storage will be provided for spare parts, light and heavy maintenance tools, components. Nine rail tracks into the building will be provided. This building will include offices and welfare facilities for staff. Facilities for the temporary storage of different waste streams, including sensitive and dangerous products such as grease, oils and flammable products, will be provided together with access for the vehicles to the rear of the building to remove waste by road.
- D. Main offices, administration building and OCC (about 9,330m^2). The building will provide office functions for the operational control of MetroLink and the maintenance and stabling activities at the depot. The building will have a plan form of about 115m by 19m. The building is assumed to comprise two storeys up to about 13m in height, with a mix of workshops, storage, facilities for the workforce and general administrative spaces (conference rooms, first aid room) on the ground floor and training and the OCC on the first floor. An outdoor car park will be located next to this office building, providing parking for about 140 cars, and include electric vehicle charging stations based on current guidance of at least once charging point for 20% of car parking spaced (Part L Building Regulations 2020 Conservation of Fuel and Energy – Buildings other than Dwellings).
- E. Electrical substation (900m^2). This building will incorporate a 20kV switchgear and transformers room, a traction room, and a low voltage room. The equipment will include 20kV switchgear, 20 No. 0.4kV transformers, traction transformers, and traction equipment (rectifier, circuit breakers and disconnectors). The building will be two storeys high, with the power equipment on the ground floor and the mechanical and electrical plant that require natural ventilation on the first floor. The building will be rectangular in plan form about 10m by 30m, with the maximum height of

9m and a mono-pitch roof along its length. Emergency electricity supply will be provided by a diesel generation, 400Vac in a room located close to the low voltage room.

- F. Inspection, sand bay and manual train washing area (about 1,150m²). Central and lateral pits will be provided to check the undercarriage of trains. Sand boxes are incorporated on most trains, so that sand can be dropped onto the rails in front of the wheels during wet and slippery conditions. A system to fill sand boxes on the trains will include a sand silo for on-site storage connected via pipes to the sand filling station. Filling nozzles will be used to pump the sand into the train sand boxes. Dust and sand spillage will be avoided by measures such as ensuring that the diameter of the filling nozzles fits the inner diameter of the train's sand inlet points and automatic cessation of sand filling. The manual train washing area will be equipped to facilitate cleaning the outside of the trains when the automatic train washing plant is not operational and cleaning the interior of the trains. The trains will be stationary during these cleaning operations.
- G. Stabling building (about 20,450m²); This will be the main train storage/parking area where the trains will be protected from weather and vandalism when out of service. The rail approaches to this building will subdivide to create 15 parallel tracks within the building designed to stable the initial fleet of 40 trains, although this could be expanded for a fleet of 60 trains in the future. The train entrances to the building will comprise automatic bi-folding doors. Platforms will be provided along the entire length of the stabling lanes for ease of access to the trains by cleaning and maintenance staff. The interior cleaning of the trains will also take place in here. The building will comprise a covered shed about 73m wide and 280m long, with an eave height of about 10m and a duo-pitch roof falling into the middle of the building at a slope of 10° with a central gutter at 7m elevation. Inside the building there will be six parallel bays.
- P. Permanent-Way maintenance building (about 1,615m²): This building will provide workshop and storage areas for wayside installations (that is equipment installed along the rail corridor), maintenance, and offices and welfare facilities for staff. The permanent-way maintenance building will be about 26m by 58m, with an eave height of about 12m and a duo-pitch roof falling to the middle of the building at 8° slope to a central gutter at about 10m high. The area around this building will be separated from the automatic area and the manual area by fences and gates.
- A 20m high radio mast will be located at Dardistown Depot near the main line. Its location is shown on Sheet 12 Figure 4.1.

4.16.2.3.2 Operational Areas for the Trains

The entry point for the trains is located at the south-west corner of the depot with the tracks following the western boundary and leading into the stabling sheds, maintenance building and workshops. The tracks provided within the Depot site are designed to ensure efficient movement of rolling stock between the various areas and to and from the rail links to the main line. All trackwork inside the depot is designed as slab track (see Diagram 4.21).

The operational areas within the depot are divided into four zones depending on the mode in which the trains will be operated: the automatic area, the manual area, mixed area, and the neutral area.

An 800m long test track will be located along the southern and eastern perimeter of the site in the manual area near the workshop (Building C). It is equipped with two transition platforms with buffer stops at the end of the track. The two platforms will be reached via a dedicated walkway from Building C or the depot road network. Access into the test track will be restricted by fences controlled by interlocking access. The test track is long enough to accelerate a train up to 60% of 80km/h and test its braking distance.

4.16.2.3.3 Internal Road and Pedestrian Movements

The site is designed to allow efficient access and circulation of vehicles and pedestrians within the Depot site. The internal road network is shown in Diagram 4.63. From the main entrance to the north-west corner, the internal road leads to a small Roundabout, where the first exit leads along the northern boundary to the back of the stabling sheds, workshops and administrative building and car park. The second exit leads along the western boundary to the emergency exit and onto the R108.

Car parking will be provided at the site for about 140 vehicles in the main car park area adjacent to the Administration Building with EV charging points provided. This parking provision is for MetroLink staff with an additional 20 car parking spaces provided for visitors. Cycle parking will also be provided beside the administration building. Car parking areas are shown on Diagram 4.63.

Diagram 4.66 shows a cross section of the internal road and pavements. Swept path analysis has been undertaken to ensure that the curves on the internal roads are sufficient to allow the safe movement of heavy goods vehicles (HGVs). Pedestrians arriving at the main entrance gate can walk along pavements to their places of work. Staff arriving by train at Dardistown Station will have safe access to the depot via an underpass which will exit in front of the Permanent Way Maintenance Building.

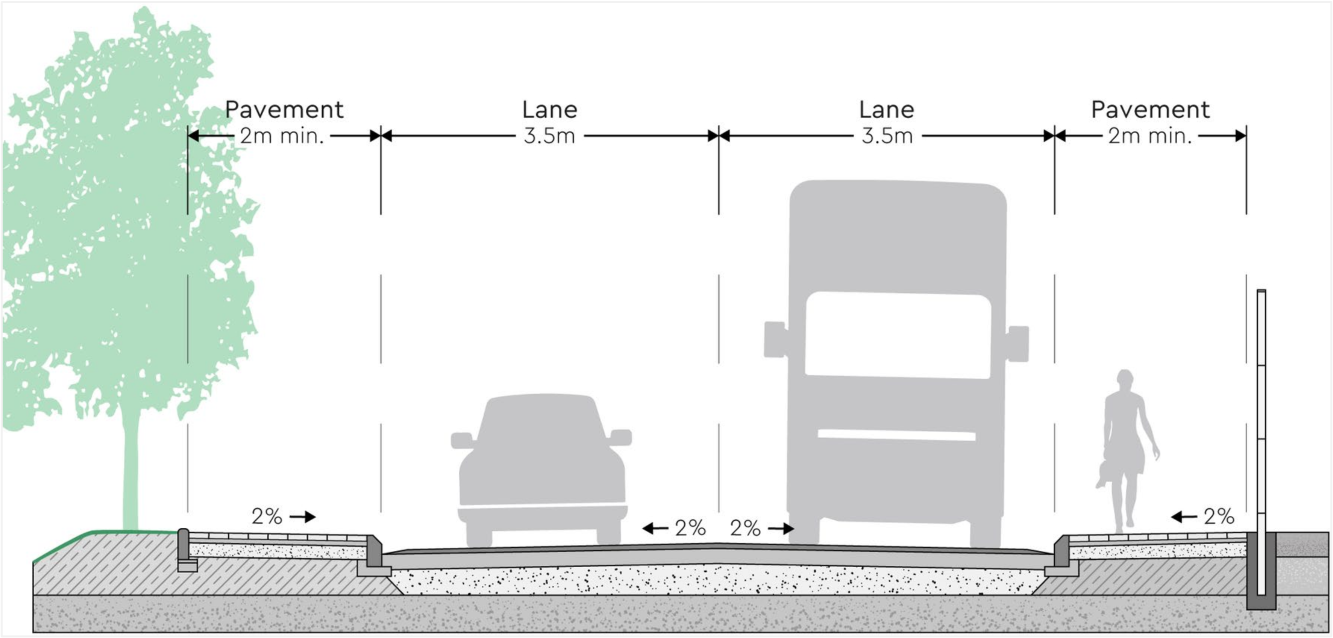


Diagram 4.66: Typical Cross Section of the Depot Access Road

4.16.2.4 Dardistown Depot Services

4.16.2.4.1 Water and Sanitation

Dardistown Depot will be serviced with potable water supply distribution system comprising a ring main to distribute water to the various buildings connected to the public water supply network. The demand will be based on requirements for welfare (drinking water, canteens, and sanitation), industrial water used on site, and fire-fighting.

Two different sewerage systems will be provided, one to collect industrial water from the automatic train washing plant and the workshop and the other to collect domestic wastewater from the canteen facilities, showers, and toilets. The industrial wastewater will be collected and treated in the Water Treatment Plant (oil/sand/grease trap and hydrocarbon interceptor) located in the south-east corner of the site. The treated water from the plant and the domestic wastewater will be discharged to the public sewer.

The site will be serviced by the public drinking water supply and the public sewer authorised by the utility companies.

4.16.2.4.2 Drainage and Stream Diversion

The current topography at the site ranges in elevation from approximately +68masl in the southwest to +58masl in the south-east of the site. Turnapin Stream a tributary of the Mayne River, crosses the north-east corner of the site. The site will be levelled to 62masl subject to minor variations for drainage and the stream diverted around the north-east of the depot. The current stream network and diversion are shown on Figure 18.8. These construction works are described in Chapter 5 (MetroLink Construction Phase).

A 3m wide deep cut-off drain will be excavated approximately 4m inside of the external security fence around the southern, western and northern boundaries of the depot to allow for a landscaping strip between the fence and the drainage channel.

The stormwater drainage system will incorporate drains, SuDS and discharge via soakaways to groundwater and surface discharge to the Turnapin stream. The SuDS will incorporate:

- Rainwater harvesting to collect water off the roofs of buildings and paved areas and stored in an underground tank for reuse in irrigation of the soft landscaping;
- Control of runoff for a 1:100year storm event plus a climate change allowance, temporary storage in underground modular storage systems, concrete tanks or oversized pipes, with infiltration to groundwater or discharge to surface waters at green field discharge rates;
- Grassed filter strips that drain water from impermeable areas and promote sedimentation and infiltration into the ground; and
- The use of pervious pavements to enable runoff to soak through structural paving into underground storage or to groundwater.

Drainage from the internal highways will be collected in the road drains and connected to the drainage network.

An irrigation system will be installed to water landscaped areas during dry weather. Water will be collected off roofs, supplemented with water from the water supply network if required, and piped to a water tank to be located near Buildings G and F. A network of pipes will deliver the irrigation water to landscaped areas.

4.16.2.4.3 Solid Waste Disposal

Waste storage facilities for the different waste streams will be provided to the rear of Buildings C, D and P, accessible to waste disposal vehicles. Wastes will be disposed to licensed facilities.

4.16.2.4.4 Electricity Substation

The main electricity supply to the depot will be provided by ESBN via a 110/20kV substation located outside, but close to, the depot. The 20kV incoming and outgoing lines of the 20kV ring will be connected to the E building and the 20kV switchgear.

4.16.2.4.5 Dardistown Depot Lighting

External lighting will be provided along the tracks, railway yards and marshalling areas; internal road network; car parks; and storage areas. The luminaires will be LED where possible with an indicative lighting level of 10 to 15 lux. This will be sufficient for safety and security objectives without affecting activity at Dublin airport.

Lighting within reception areas, welfare facilities, offices and building services areas such as the workshops, will be sufficient for the activities taking place with lighting levels typically between 100 to 300 lux.

4.16.2.5 Architectural Treatment of the Buildings

There will be a common architectural treatment for all buildings using similar construction materials. The industrial buildings will comprise steel frame structures, covered in a "metallic envelope" as a continuous skin from the roof to the walls. The envelope will be of a ribbed steel sheeting structure, with a vapour barrier, thermal insulation and a standing steam system with a coated steel or zinc as a liner material. Surfaces will be finished to a dark metallic finish (see Diagram 4.67). The industrial buildings will contain linear glazing strips to introduce natural light into the building.

The Administration Building and the Electrical Substation will have a concrete frame structure to provide adequate fire protection to these buildings. The outer façade will have the same tone and composition as the industrial buildings.

The interior finishes for the floor, walls and ceilings will vary according to the use of the different parts of the buildings.

Diagram 4.67: Façade Examples

4.16.2.6 Plant and Equipment at Dardistown Depot

Plant and equipment are required for operational cleaning and maintenance. The location, main elements of plant and equipment, and a brief description are presented in Table 4.18.

Table 4.18: Proposed Plant and Equipment at the Dardistown Depot Site

Location	Plant & Equipment	Description
Railway Yard (External track area)	Buffer stops	Buffer stops for the track ends in the Stabling Building, the Permanent Way Building and on the inspection line
	Petrol Station	Underground Petrol and diesel tanks and corresponding pumps.
	Water Storage Tank	Water Tank for Firefighting.
	Rainwater Tank	Rainwater Storage Tank
Stabling	Cleaning Equipment	Equipment including high pressure washers, portable industrial vacuum cleaners, cleaning trollies
Automatic Train Washing Plant	Train Washing Machine	Mobile gantry or fixed facility washing machine with lateral, frontal and superior brushes.
	Hydrocarbon Separator with Pourer	Equipment design to contain the hydrocarbon in suspension in the water from train washing with a pourer to contain heavy particles.
	Water reuse and recycling facility	Water recycling facility to collect, treat and reuse water from train washing.
	Blowing Facility	Equipment to help dry off the train
General Equipment in the Workshop	General	Diesel operated shunting vehicle to move trains in areas without catenary.

Location	Plant & Equipment	Description
		Scissor platform with to allow access the train roofs. Eye-cleaning emergency equipment. Mobile workbenches Electric forklifts for light and heavy maintenance.
	Oil and Greasing	Equipment for the supply/application of oil and grease to trains operating within a fixed facility for oil and grease collection.
	Sand Supply	Sand silo and equipment for the supply and application of sand to trains.
Workshop rooms	Compressor Room	A compressor, air tank and air dryer provided in each workshop.
Maintenance aeras of the Workshop	Wheel measurement device	Automatic monitoring of the wheel status through optical geometry change detection systems in the wheel geometry.
	Bogie washing	Mobile equipment for bogie washing
	Washing cabin for spare parts	To wash large steel parts.
	Filter washing	Washing cabin for HVAC filters
	Wheel Lathe	Wheel lathe with shunting vehicle, tool to mechanise disc brakes, equipment to measure the wheel profile through laser activation.
	Pit area	Lifeline along the track to secure staff while working on the roof of trains hung from the ceiling over the track. 5 tonne gantry cranes over the platform to inspect equipment on the roof of trains. High pressure water facility. Forces ventilation systems. Oil recycling.
Maintenance	Lifting jack area	Lifeline along the track to secure staff working on the train roofs. 6.3 tonne gantry cranes. Block and tackle. Mobile lifting jacks. Bogie turntables Bogie lifters.
Maintenance	Bogie Maintenance Area	6.3 tonne gantry cranes Block and tackle. Bogie turntables Bogie lifters. Bogie presses. Mechanical work benches. Bogie adjusting equipment. Shelving for bogie storage.
Maintenance	Mechanical, Electromechanical and Electrical Workshops.	Plant and equipment for the repair and maintenance of elements of the trains housed in workshops including

Location	Plant & Equipment	Description
		equipment such as fixed and mobile work benches, welding equipment, electrodes oven, mobile fume hood, mobile protection screens, drill press, milling machine, industrial vacuum cleaner.

4.16.2.7 Dardistown Depot Landscape and Urban Realm

Landscaping at Dardistown Depot is to be provided in all external areas between the facility buildings and site boundary. Planting will be concentrated in areas such as the administration building, internal roads and parking areas, where shade and screening is required.

The site will be surrounded by a perimeter fence approximately 1,960m in length, consisting of cast in situ reinforced concrete foundations supporting 1.8m high Meshweld panels. An example of this type of fencing is illustrated in Diagram 4.33.

There will also be internal fencing whereby areas of operation are fenced off for safety and security reasons. This fencing will be 1.8m high and consist of chain link fencing with line steel posts and a concrete footing.

4.16.2.8 Local Playing Fields and Sports Clubs.

Three football clubs have facilities in the location of Dardistown Depot; Starlights GAA, Na Fianna GAA and Whitehall Rangers FC. In order to accommodate the necessary land take for the Dardistown Depot and access, it will be necessary to modify or relocate the football facilities at this site. Temporary arrangements during construction are described in Chapter 5 (MetroLink Construction Phase).

The Starlights GAA facilities comprise a grass playing pitch, floodlit training and warm up areas, a car park and changing facilities. There are also ten floodlights around the training area on 8m to 10m high columns. The new access road off the Old Airport Road into Dardistown Depot will cross the Starlights GAA lands, separating the car park and changing rooms from the pitches. The new access road will be raised above existing to culvert a stream underneath, so the carpark and changing facilities on one side of the road and the pitches on the other will lie at lower levels. The access arrangements to the recreational facilities will comply with Building for Everyone (Centre for Excellence in Universal Design, undated). A raised pedestrian zebra crossing with beacons will be constructed over the new access road at least 23m from the junction with the Old Airport Road and shallow gradients will be adopted along the pedestrian access between the car park, changing facilities and football pitches. The speed limit on the access road will be 50km/hr. The main pitch will be moved slightly to the northeast. As the pitch will be closer to the Old Airfield Road, new ball netting will be required behind the north goal. The proposed layout for the main pitch will not affect the existing floodlighting in the training area. One new floodlit training pitch with ball netting will be provided. The existing changing facilities will be replaced, comprising changing rooms for two teams and officials, toilets and a storage area of a similar size to the existing facility. Showers will not be provided. These works will be included in the RO. The land is owned by DAA, and temporary land take will be returned to them at the end of the construction phase.

Na Fianna GAA club has three full-sized grass playing pitches and a smaller floodlight training pitch at the site of Dardistown Depot. All the main playing pitches have ball stop netting behind the goalposts. The training pitch includes juvenile sized goalposts and floodlighting along both side-lines, spaced at 20m centres, but it does not have ball stop netting. The entrance to the playing pitches is from the Old Airport Road. Car parking and the club house with changing facilities, toilets and storage are located to the north of the site adjacent to the entrance. It is proposed to reconfigure the two southern pitches to create one full sized GAA pitch (natural grass) and one training pitch (natural grass with improved drainage), with both pitches to have new floodlights and ball netting installed. The remaining two pitch layouts to the north are unchanged and shall have floodlighting and ball netting installed. Overgrown lands in the site, outside the current pitch locations will be converted to playing surface. These works are included as part of the RO. The lands shall be acquired by temporarily possession from DAA and returned when construction is completed.

At present Whitehall Rangers FC has two full sized football pitches, a single storey building for changing rooms, and parking for approximately 20 cars. The grounds of Whitehall Rangers FC are required for the development of Dardistown Depot and will be included in the RO. The land is owned by the Trustees of Whitehall Rangers FC. Arrangements are in place between Whitehall Rangers FC and TII to provide alternative playing facilities, but this will not form part of the RO.

4.16.3 Dardistown Station

4.16.3.1 Dardistown Station Location and Access

Dardistown Station is located along the south-east boundary of Dardistown Depot, between Dublin Airport and the M50 Motorway and on the east side of the R132, in retained cut. The site is currently agricultural land. The landholding affected is illustrated on Sheet 4 of Figure 4.1 and a description of the agricultural interests and potential impacts is provided in Chapter 23 (Agronomy). The land between the Old Airport Road and the M50 Motorway is designated for mixed/general commercial/enterprise/industrial uses and office/business/technology park development as shown on Sheet 3 of Figure 11.17.

A public access road will not be provided as part of the proposed Project as there will be no public access to and from this station in the opening year. The station will open to the public when plans for the development of adjoining lands are in place. In the interim period the station will be available solely for the use of personal working in the Dardistown Depot who will be able to arrive and depart via MetroLink.

A maintenance access road will be constructed to facilitate routine maintenance of the station and surroundings. This will include a hardstanding area to enable the maintenance or replacement of station equipment when necessary.

Provision will be provided for a pedestrian route from the station into Dardistown Depot for the workforce via an underpass as described in Section 4.16.2.

4.16.3.2 Dardistown Station Urban Realm and Landscaping Design

The landscaping treatment around the station at ground level will be relatively simple, with large mature trees, blocks of shrub planting and a pedestrian network paved for future use. As there will be no access to the station at ground level in the opening year, the station will be fenced off from public access.

4.16.3.3 Dardistown Station Description

As explained in Section 4.9.2.2, the retained cut stations all have the same over-arching configuration, although there are variations in some details of the engineering design and the urban realm. Dardistown Station is complicated by the need to provide rail links into the Depot. A layout of Dardistown station is illustrated in Diagram 4.69, and a summary of key features is provided in Table 4.19. The general features of retained cut stations are described in Section 4.9.2 and a generic longitudinal cross section is illustrated in Diagram 4.14.

Dardistown Station will be constructed as part of the proposed Project and will be fitted out sufficient for it to be used safely as an operational facility for staff working at Dardistown Depot. At this stage, no provision has been made for connections with bus/taxis, DOPs or cycle parking.

There will be a single entrance to the station which will be covered by the branded canopy structure. Access between the entrance and the platforms will be provided by two sets of stairs and two lifts. Two sets of emergency stairs and an external meeting area will be provided. The depth from the local ground level to TOR will be about 7.4m. The platforms will be 65m long and about 6m wide.

The platform level will also provide BOH facilities and a traction sub-station which will be separated from public access areas.

There will be an underpass to allow workforce access from the southbound platform to the depot. Passengers alighting on the northbound platform would have to use the lifts or the stairs to cross over to the southbound platform via the station concourse.

Table 4.19: Dardistown Station Details

Dardistown Station	
Station Location	Dardistown between the Old Airport Road and the M50 and alongside the proposed Dardistown Depot
Station Type	Retained cut
Access/Interchange	Pedestrian underpass connecting the station with Dardistown Depot

The general arrangement for the main line and Depot side tracks at Dardistown Station is illustrated in Diagram 4.68. The outer Depot side track (comprising tracks 2A and 2B in this diagram) forms a separate link extending from a point opposite about Ch. 8+648 on the main line, running parallel to the main line on the east side, before swinging around to pass under the main line and into the Depot. The outer Depot side track also connects with the main line via turnbacks and a Bretelle crossing. Similarly, the inner Depot side track (track 1) forms a separate link along the west side of the main line from about Ch. 8+648 into the Depot and also interconnects with it via turnbacks and the Brettelle crossing. This arrangement provides flexibility in the movement of trains in and out of the Depot and transitions in both the northbound and southbound directions.

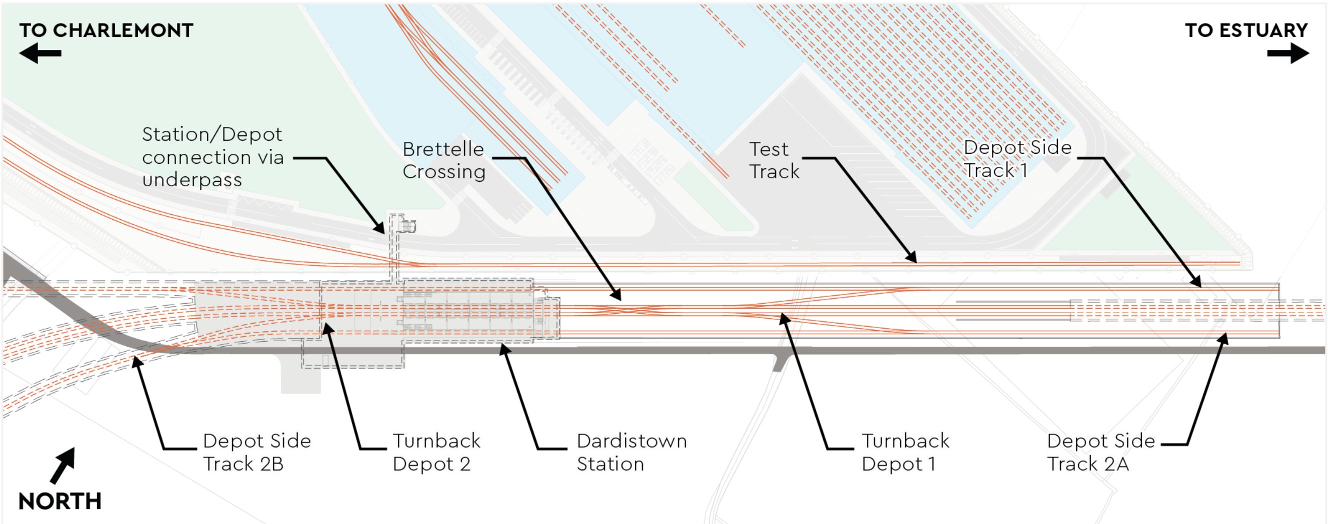


Diagram 4.68: Crossovers and Turnbacks at Dardistown

While the design concept follows the template for a retained cut station, one main difference will be that walls will separate the station and the Depot side tracks, screening views of trains going to and from the depot as shown in Diagram 4.69.

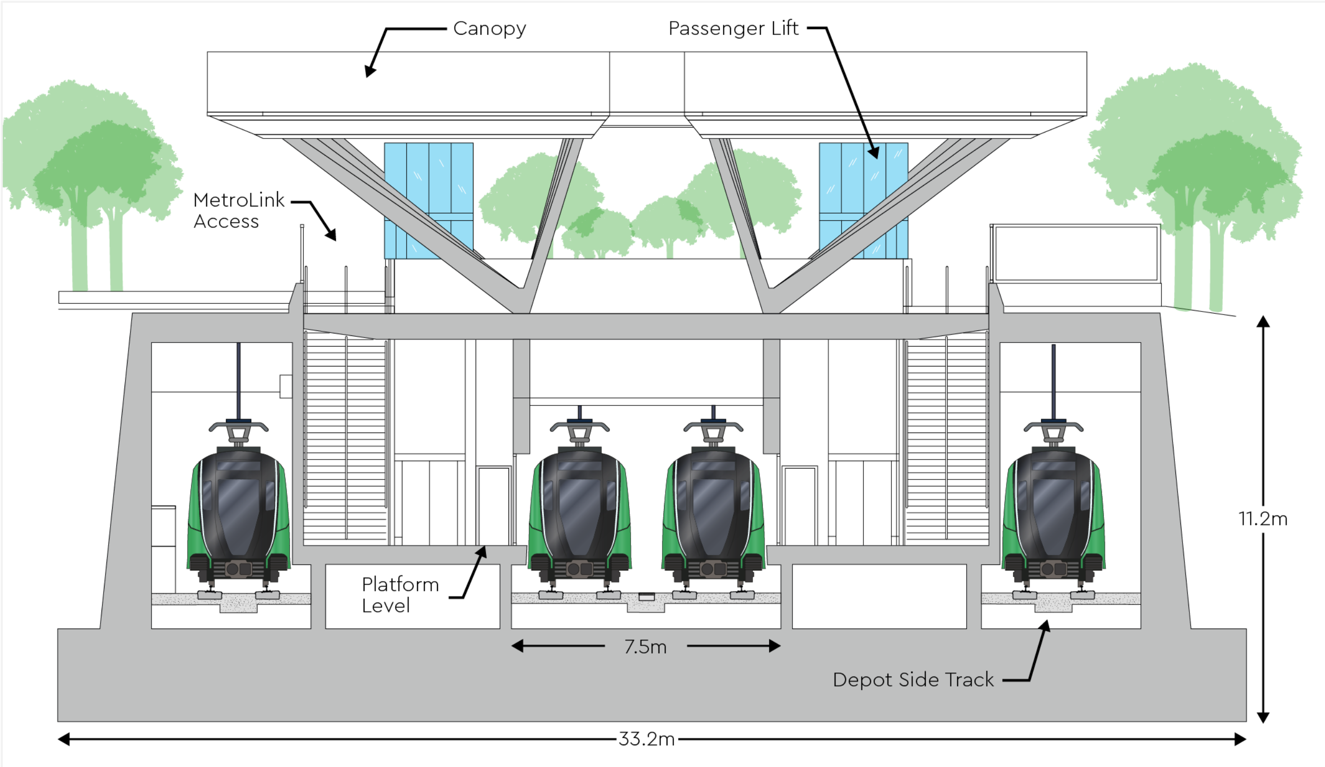


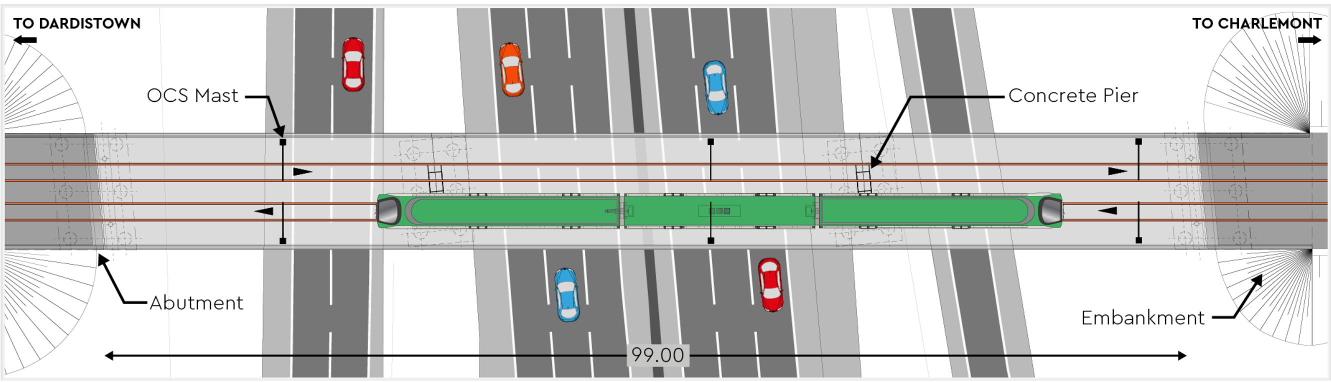
Diagram 4.69: Cross-section of Dardistown Station

4.16.4 M50 Viaduct

The proposed Project will cross the M50 on a viaduct. The crossing will be located east of Junction 4 on the M50 Motorway, which is the intersection of the M50 Motorway and the R108 Ballymun Road. The viaduct will cross over the M50 Motorway eastbound slip road from the R108 Ballymun Road, both mainline carriageways of the M50 Motorway and the westbound slip road from the M50 Motorway onto the R108 Ballymun.

The location of the M50 Viaduct is shown on Sheet 13 Figure 4.1. The plan form is illustrated in Diagram 4.70.

and a longitudinal plan and profile is illustrated in Diagram 4.71.



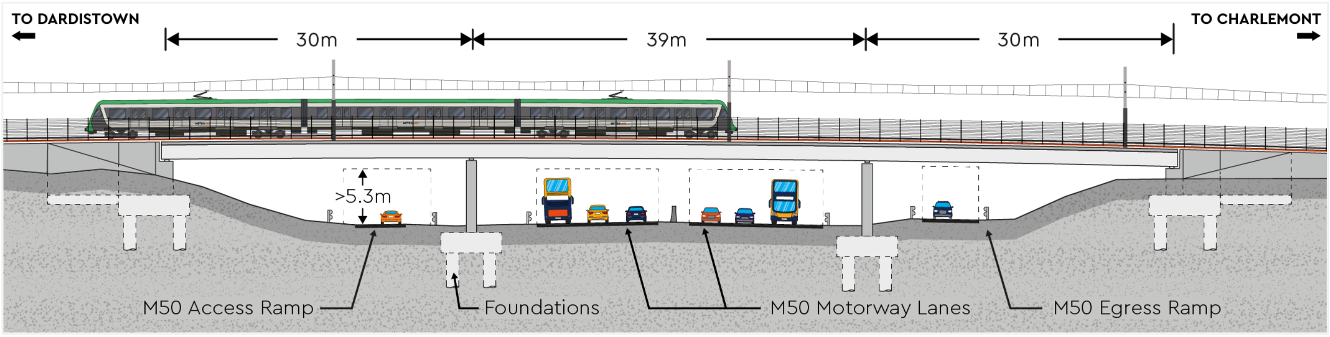


Diagram 4.71: Long Section Plan and Profile of the M50 Viaduct

The viaduct will consist of a composite platform structure, supported by a steel and concrete substructure on which the railways will be laid. The bridge deck will rest on a support structure consisting of two abutments at either end of the bridge and two piers situated in the median strips between the M50 mainline and ramps at Junction 4 as shown in Diagram 4.71.

An analysis was also undertaken to identify whether a pedestrian and cycle lane could be added to the M50 Viaduct. However, it was determined not to be feasible because, there would need to be significant separation from the running train alignment for safety reasons and this would result in a much more significant bridge structure spanning the M50 than that required for the proposed Project.

4.16.5 Northwood Station

4.16.5.1 Northwood Station Location and Access

Northwood Station is located diagonally under the R108 Ballymun Road close to the junction with Northwood Avenue and close to Gulliver's Retail Park on the east side of the R108, with the north-eastern and south-western ends extending into undeveloped areas. The location is shown on Sheets 13 and 14 on Figure 4.1. The immediate surrounds are zoned for mixed use, general development, opportunity, proposal site as illustrated on Sheet 4 Figure 11.17 in the EIAR Volume 4 Book of Figures.

In the vicinity of Northwood Station, the R108 Ballymun Road southbound carriageway is a dual two-lane carriageway, with a slip road for the left hand turn into Gulliver's Retail Park, which continues as a three-lane carriageway south of the junction with Gulliver's Retail Park. The northbound carriageway comprises a three-lane carriageway, with the inside lane providing the right hand turn into Gulliver's Retail Park at the junction. It then continues as a two-lane carriageway, widening to a third lane for the slip road onto the right hand turn into St Margaret's Road. There is also a cycle path and footpath on both sides of the R108 Ballymun Road and an existing bus stop on the northbound carriageway between the junction into Gulliver's Retail Park and the turning for St Margaret's Road.

The station layout and accesses at this location take into consideration the BusConnects proposals, comprising a bus lane, two general traffic lanes and a segregated cycle track provided in each direction from the junction of the R108 Ballymun Road with St Margaret's Road and Shangan Road to the south (see Figure 4.1 Sheets 14 and 15 for the general location). The cycle paths will link up to cycle parking facilities close to the station entrances on both sides of the R108. Similarly, the pedestrian footpaths will lead to the pedestrianised plazas in front of the station entrances. There would already be direct access to the bus network on the R108 Ballymun Road given the existing bus stop, with a new bus stop provided on the southbound carriageway. A DOP will be provided to the east of the station off the Old Ballymun Road, close to the Northwood Avenue junction.

4.16.5.2 Northwood Station Urban Realm and Landscaping Design

The specific urban design principles for Northwood station are to:

- Provide access on both sides of the highway;
- Interface with the proposals for BusConnects; and

- Accommodate potential over-site development on the western side of the station in the future.

Diagram 4.72 shows that the entrances to Northwood Station will be styled with the branded entrance canopies, one to the east and one to the west of the R108. The corresponding pop ups for the canopies then have associated streetscape and landscape treatments. These include mature street trees and feature trees, shrub planting, swale planning, street furniture and cycle parking. There is interaction between the BusConnects project and the wider cycle network as well as improved pedestrian connectivity across the road network. The landscape design is cognisant of future potential adjacent development, with temporary schemes in place coinciding with future development plans and approved planning application.

Diagram 4.72: Indicative View of Northwood Station

4.16.5.3 Northwood Station Description

The layout of the main features of Northwood Station is illustrated in Diagram 4.73 and a summary of key features is provided in Table 4.20. Section 4.9.2.3 also sets out the general principles and features for the design of the underground stations. The Northwood Station design will differ from the typical underground cut and cover design as the vertical alignment is in transition between the elevation of the M50 Viaduct and the TBM launch pad and portal to the City Tunnel to the south-west of the station. Consequently, the station being shallower compared with the other underground stations and Northwood Station will only have two lower levels, the mezzanine level and platform level.

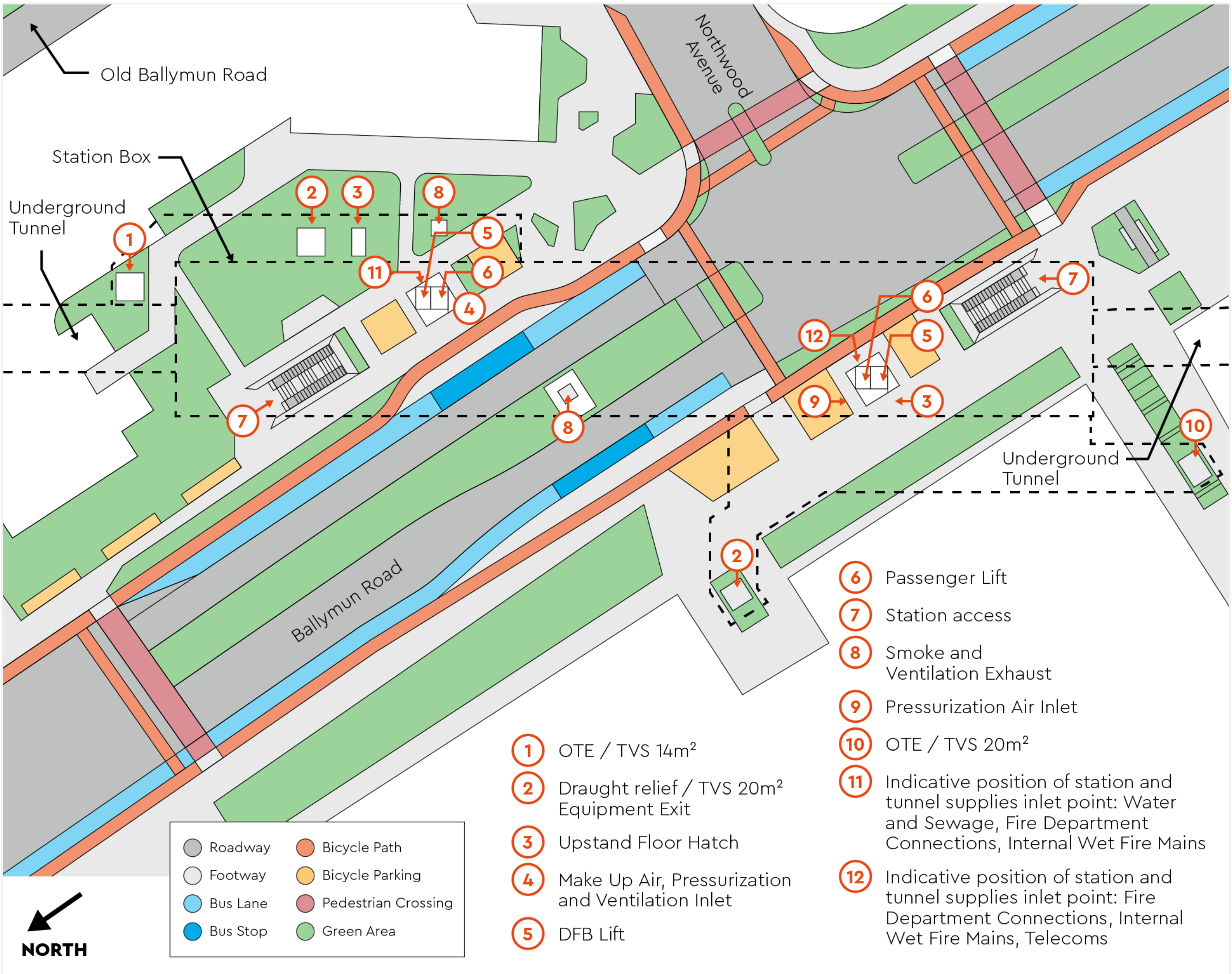


Diagram 4.73: Northwood Station Location and Layout

Table 4.20: Northwood Station Details

Northwood Station	
Station Location	**Located diagonally under the R108 Ballymun Road**
Station Type	**Underground cut and cover**
Access/Interchange	**Bus, DOP, pedestrian and cycle.**

The approaches to the station have been designed to integrate people arriving and leaving by bus, car, cycling and walking. Parking will be provided near both entrances for an estimated 204 cycles.

From the canopied entrances, pedestrians will be able to descend to the mezzanine and platform levels via a pair of escalators at either end of the station. There will also be two sets of stairs between the surface, the mezzanine and platforms and one lift between the street, mezzanine and platform and a second lift between the mezzanine and platform. Separate lifts will be provided for the DFB in the event of an incident, together evacuation stairs between the platforms and street level for pedestrians.

The station will be approximately 17m deep from street level to TOR level. The platforms will be 65m long and 6.2m wide on each side of the tracks. BOH facilities will be located on the mezzanine and platform levels and separated from public access.

4.16.6 Northwood Portal

Approximately 100m south of the M50 Viaduct, the retained cut section merges into cut and cover, and the alignment progresses downwards in a 350m long ramp that ends at Northwood Station. The associated Northwood Portal is located to the south-west of Northwood Station box and will be used as the TBM launch site. At the end of the construction phase the portal will be backfilled and the tunnel linked to Northwood Station, so the Northwood Portal would not be a visible feature. The construction of the TBM launch portal is detailed in Chapter 5 (MetroLink Construction Phase).

4.16.7 AZ3 Stream Diversions and Culverts

Proposals to divert Turnapin stream are discussed in Section 4.16.7 and discussed in detail in Chapter 18 (Hydrology).

The alignment will cross the M50 viaduct and then cross over a culverted section of the Santry River. The OPW Flood Hazard Database records flooding due to the culvert on the Santry River at the Old Swords Road being unable to take the quantity of water in the river and overflowing on 14 November 2002, 20-21 October 2002 and 28 October 2004. This information was also listed in an EPA report in 2005, but no additional information on the flood levels or flooding status was recorded in the report. OPW information for the same period confirms that areas of localised flooding occurred within the study area including at the M50 Motorway Ballymun Exit and within Santry Demesne. The location of historical floods on the upper reaches of the Santry River is illustrated in Figure 18.3 and discussed further in Chapter 18 (Hydrology).

The M50 Viaduct would not affect flood risk on the Santry River as:

- The proposed Project will cross the M50 on a viaduct so it will be elevated above any potential flooding from the Santry River; and
- The proposed Project will pass over a culverted section of the Santry River. No flooding is predicted in this location, so no works are required to modify the hydraulic capacity of the Santry River culvert.

In order to accommodate the proposed Project, some minor alterations will be implemented on the Santry River immediately downstream of the M50 viaduct to straighten the channel and provide scour protection. The location of the works is indicated on Figure 18.14. The effect of these works will be to reduce hydraulic losses at the culvert outlet, resulting in a marginal increase in culvert capacity and the removal of the flooding issues associated with Santry River at this location. These alterations have been assessed in the EIAR Chapter 15 (Biodiversity) and Chapter 18 (Hydrology).

4.16.8 AZ3 Roads

In section AZ3 of the proposed Project alignment, alterations and upgrades to the road network are associated with the extent of station box locations and requirements arising from utility diversions.

4.16.9 AZ3 Utilities

The AZ3 area includes the Irish Water distribution network and arterial water network. Potable water mains range from 90mm to 800mm in diameter. Foul water collection from domestic and commercial premises is provided by Irish Water. The alignment crosses a 1,800mm diameter sewer proposed as part of the Greater Dublin Drainage scheme at Dardistown Depot. A 900mm sewer clashes with the alignment at Northwood Station. This would be decommissioned and diverted. A private foul rising main, owned by DAA, would need to be diverted for an approximate 200m section south of the M50 Viaduct and 100m section north of the M50 Viaduct.

ESB operates various MV underground and overhead electricity cables within AZ3. There is also a HV underground electricity cable at Northwood Station. Eir operates communication network cables within the AZ3 area. A telecoms mast owned by Vodafone is situated at Northwood.

Where clashes between the design and existing utilities have been identified, these will be mitigated by diverting utilities outside the alignment. The telecoms mast at Northwood will be relocated.

As described in Section 4.12.3.1, one of two 110kV electrical substations will be located outside, but close to Dardistown Depot, which will transform the incoming HV power supplied by ESBN to MV power to operate the proposed Project.

4.17 AZ4 Northwood to Charlemont: City Section

The AZ4 section of the proposed Project is 9.4km long from Northwood Portal to Charlemont (Diagram 4.74). The main features along this section are City Tunnel itself, nine underground stations and associated urban realm at street level, the Albert College Intervention Shaft and the Charlemont Intervention Tunnel. There will also be some minor road and utility diversions.

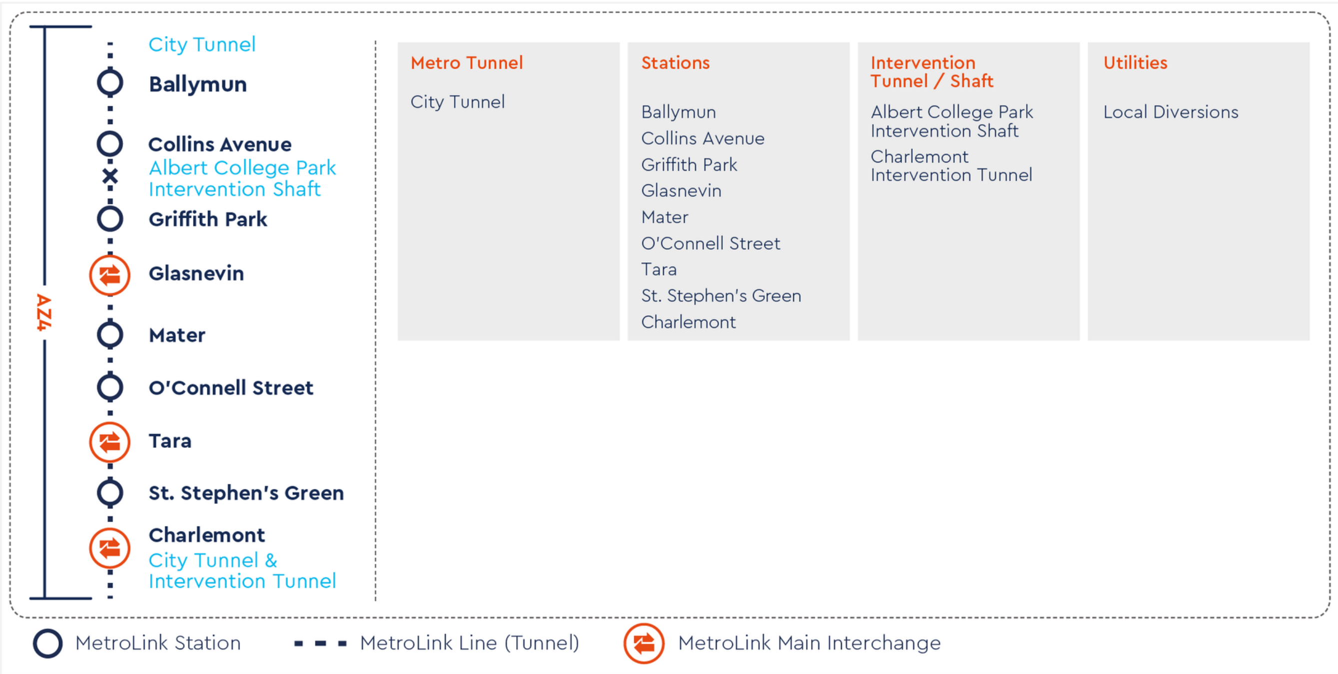


Diagram 4.74: AZ4 Location and Features

This subsection describes the key features largely following the alignment from north to south:

- AZ4 Alignment Description;
- City Tunnel;
- Ballymun Station;
- Collins Avenue Station;
- Albert College Park Intervention Shaft;
- Griffith Park Station;
- Glasnevin Station;
- Mater Station;
- O'Connell Street Station;
- Tara Station;
- St Stephen's Green Station;
- Charlemont Station;
- Charlemont Intervention Tunnel; and
- AZ4 Utilities.

4.17.1 AZ4 Alignment Description

AZ4 will be 9.4km long between Northwood Portal and the end of the alignment. The alignment will continue in tunnel from Northwood Station portal to Ballymun Station on the west side of the R108 Ballymun Road. It will then continue southwards to Collins Avenue Station. The route continues south to the southwest corner of Albert College Park where a tunnel intervention shaft will be located.

The alignment continues south under the R135 St Mobhi Road to Griffith Park Station and continues south passing under the Tolka River, residential areas and then crossing under the R135, now called Botanic Road. Continuing south, it will closely follow Botanic Road, before reaching Glasnevin Station, which will be a key interchange station providing direct interchange for customers to the Western Commuter Line and South-Western Commuter Line Iarnród Éireann services.

South of Glasnevin Station the alignment will pass under the Royal Canal moving slightly away from the R135 Phibsborough Road in a south-easterly direction towards Mater Station which is located in the Four Masters Park on the corner of Eccles Street and Berkeley Road.

From the Mater Station, the alignment will continue underground in a south-easterly direction descending towards O'Connell Street, progressing under rows of Georgian houses lining Blessington Street, Frederick Street North and Parnell Square East. The alignment will pass near to the Garden of Remembrance, the Rotunda Hospital and the Gate and Ambassador Theatres. O'Connell Street Station will be located within the planned development area immediately west of O'Connell Street and south of Parnell Street.

South of O'Connell Street Station the alignment passes under O'Connell Street, progressing east and under the City Centre area, where it will pass under the Luas Red Line near the Abbey Theatre. The alignment will then cross under the River Liffey towards Tara Station. The location for the Tara Station will be underneath an area bordered by existing railway to the east, Poolbeg Street to the north, Tara Street to the west and Townsend Street to the south.

Tara Station will be a major interchange station providing direct interchange for customers to train and DART services. From Tara Station the alignment will continue south and will pass under the eastern end of Trinity College Dublin (TCD) campus. The alignment will then proceed south of Leinster Street South, under several architecturally important buildings including Leinster House, Government Buildings, the National Gallery, National Library, and the National Museum of Ireland. The alignment will then pass under St Stephen's Green North before reaching St Stephen's Green Station.

St Stephen's Green Station will be located partially under the R138 St Stephen's Green East Road, and partially under the existing park, with the station entrance at the north-eastern corner of St Stephen's Green.

Continuing south-west, the alignment will follow St Stephen's Green East and will continue along Earlsfort Terrace, passing close to the National Concert Hall, at which point it will curve southwards and pass under Harcourt Terrace and the Grand Canal before reaching Charlemont Station. Charlemont Station will be located on a site south of the "Carroll's Building" on Grand Parade.

Charlemont Station has been designed to accommodate an interchange with the Luas Green Line services and will include an improved pedestrian link to the Charlemont Luas stop. The bored tunnel will continue southwards to allow for a turnback and will terminate approximately 360m south of Charlemont Station.

4.17.2 City Tunnel

Section 4.10 describes the general features of the bored tunnels and associated intervention tunnels and shafts.

The City Tunnel will run southwards from Northwood Portal, under the City Centre, to about 300m south of Charlemont Station, and will be just under 9.4km long. It will service nine underground stations, which will incorporate front of house facilities for passengers, back of house facilities for the safe running of the stations, as well as emergency accesses and tunnel ventilation. The intervention shaft exiting at the Albert College Park is required for the emergency evacuation of passengers, access for emergency services and to ventilate the City Tunnel, because the distance between Collins Avenue Station to the north and Griffith Park Station to the south exceeds 1km. At the southern end of the line, the Charlemont Intervention Tunnel will connect the end of the City Tunnel with Charlemont Station to provide an emergency exit for passengers and ventilation for this section of the tunnel.

The vertical alignment of the tunnel has been optimised based on geological investigations, taking into account geological risks, ground settlement, ground vibration, the hydrogeological risk of groundwater, maintaining a minimum depth above the tunnel crown in solid geology, minimising the mix of geologies that the TBM would need to tunnel through. The vertical and horizontal tunnel alignment also considers passenger comfort given the movement of the trains as they travel through the tunnel. From Northwood Portal, the tunnel lies at between about 20m to 30m below the ground surface to TOR, reflecting both changes in terrain and deflections in the tunnel alignment. The nine underground stations in this section lie at between 23m and 25m depth to TOR.

As described in Section 4.17.1, the tunnel alignment will pass under extensive urban areas, including buildings of heritage and architectural value, whose locations are shown on Figure 25.1. The potential impact of the tunnelling works and train movements on ground vibration and the risk to buildings are assessed in Chapter 14 (Ground-borne Noise & Vibration) and Chapter 26 (Architectural Heritage).

The City Tunnel may also potentially affect groundwater flows and quality during Construction and Operation Phases, which is discussed in detail in Chapter 19 (Hydrogeology).

4.17.3 Ballymun Station

4.17.3.1 Ballymun Station Location and Access

Ballymun Station will be located adjacent to the west side of the R108 Ballymun Road, under the site of the old Ballymun Shopping Centre and car park, which has been demolished. This site is currently open space, and it has been zoned for other mixed-use development as shown on Sheet 4 Figure 11.17.

The location for Ballymun Station will have minimal impact on the R108 Ballymun Road during the Construction Phase. This is described in Chapter 5 (MetroLink Construction Phase). It is also sufficiently set back from the R108 to accommodate the layout for a new bus lane and a bus stop along both carriageways to be provided by BusConnects which will enable passengers to change between buses and the station. The existing pedestrian crossing located towards the southern end of station by the entrance will be increased in width to 4m.

4.17.3.2 Ballymun Station Urban Realm and Landscaping Design

The specific urban design principles for Ballymun Station are:

- Grilles and popup locations aligned with the underground station design;
- Pedestrian crossing provided to allow access to the station entrance;
- Shared level surface for bus stop and cycle lane;
- Provision of cycle parking; and
- A landscaped plaza in front of the station entrance.

The entrance to Ballymun Station will be marked with a main entrance canopy and associated architectural pop ups (the skylights, equipment exits lifts, emergency access) within the streetscape above (Diagram 4.75). The landscape design consists of rainwater gardens and swales with large mature trees dispersed throughout. Cycle parking and pedestrian seating are provided for in the public realm. The adjacent development land has a landscape avenue of trees as well as a planted buffer to the site hoarding line to the west.

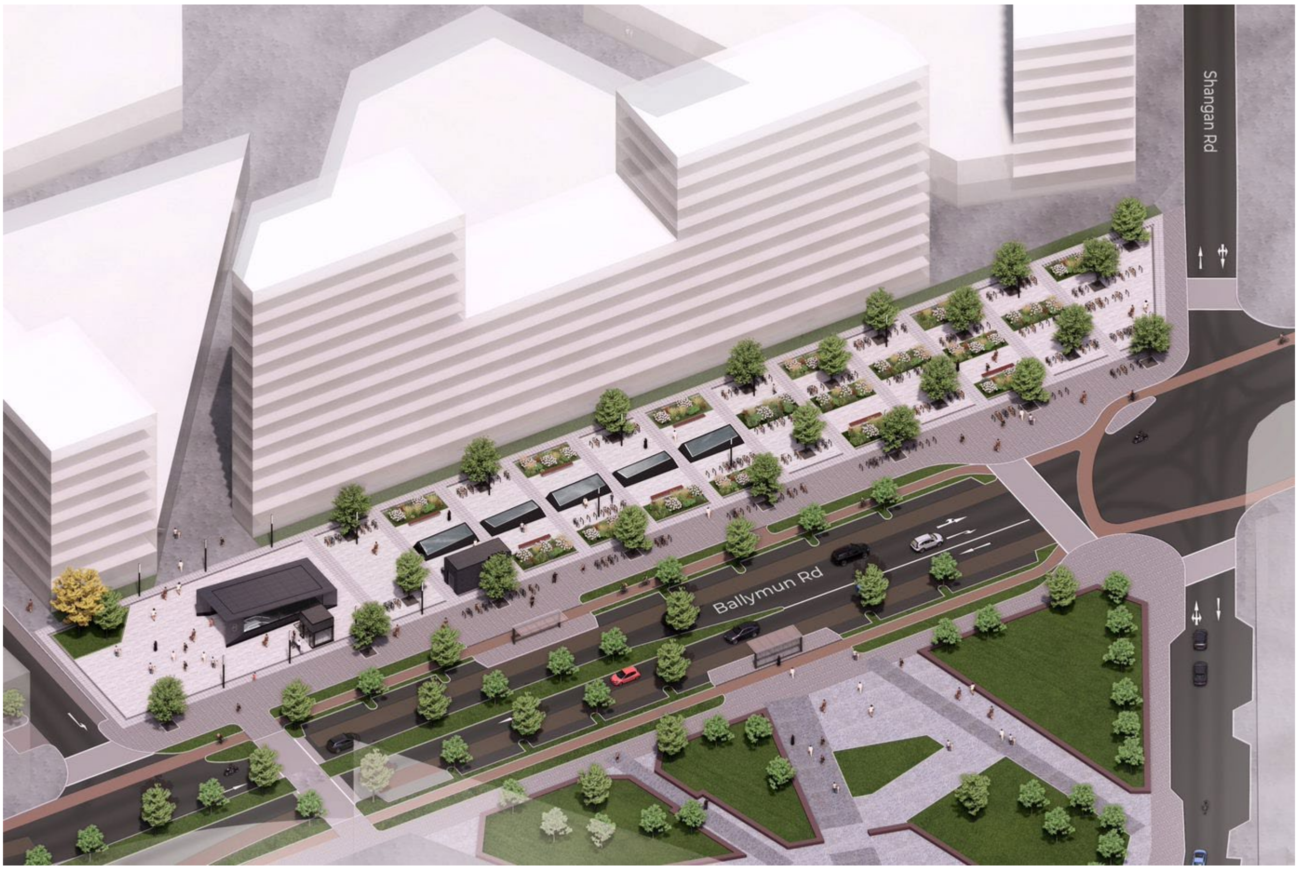


Diagram 4.75: Indicative Aerial View of Ballymun Station

4.17.3.3 Ballymun Station Description

A general description of the underground stations is provided in Section 4.9.2, with a typical long section presented in Diagram 4.16. Diagram 4.76 shows a plan form of the main surface features of Ballymun Station and a summary of key information is presented in Table 4.21.

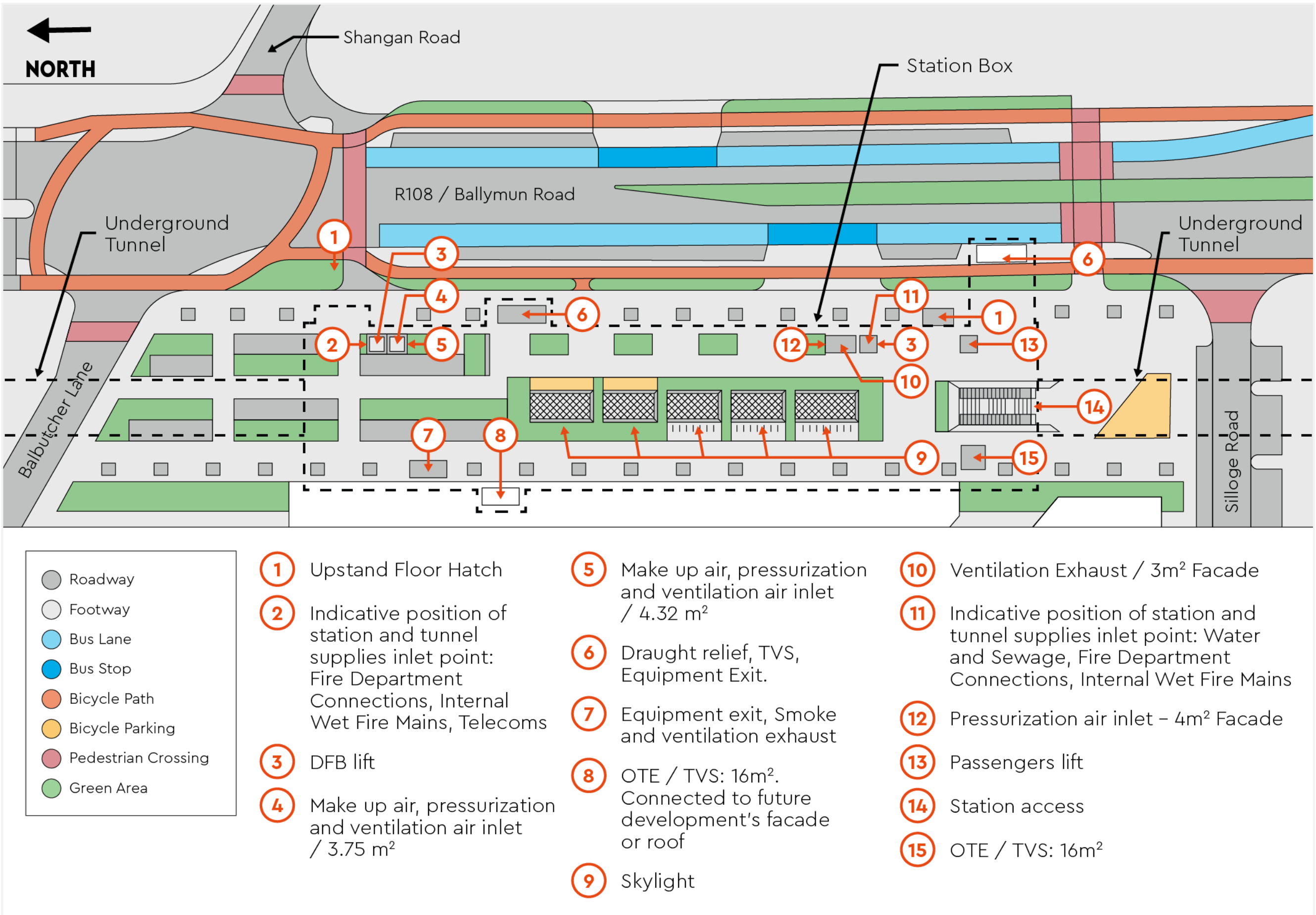


Diagram 4.76: Location and Access for Ballymun Station

Table 4.21: Ballymun Station Details

Ballymun Station	
Station Location	West of Ballymun Rd (R108) at proposed shopping centre
Station Type	Underground Cut and Cover
Access/Interchange	Bus, taxi, pedestrian and cycle

Diagram 4.76 shows the bus lanes and bus stops to be provided along the R108 by BusConnects as well as the widened pedestrian crossing over the R108 linking the station entrance with cycling and pedestrian routes, and the bus stop. There is also an existing pedestrian crossing to the north of the station which connects with the Shangan Road. Parking will be provided for 292 cycles.

Access between the street level and the platforms is via stairs, escalators and lifts. There will be two escalators between the street-concourse-mezzanine levels and four escalators between the mezzanine and platform levels. There will be one set of stairs street-concourse-mezzanine and two sets of stairs mezzanine-platform. There will also be one lift street-concourse-platform and one lift concourse-platform. The street level escalators and stairs will be located together, with the passenger lift located nearby.

Two emergency sets of stairs platform-street will emerge at street level via the upstand hatches, one towards the northern end of the station box and one towards the southern end. There will also be one emergency set of stairs between the platform and the concourse. There will also be three lifts for the DFB.

The station box will be approximately 111m long and 25m wide. There will be two platforms each 65m long and 6.5m wide. BOH technical rooms and staff facilities will also be included over the lower floors. There will be no traction station at Ballymun.

4.17.4 Collins Avenue Station

4.17.4.1 Collins Avenue Station Location and Access

Collins Avenue Station will be located slightly overlapping and adjacent to the R108 Ballymun Road south of the intersection with the R103 Collins Avenue and immediately in front of Our Lady of Victories Church. The surrounding area is characterised by residential housing. Our Lady of Victories Infants School is located on the west side of the R108, almost opposite the entrance to the new station while the Dublin City University is located to the south-east of the church. There is an existing signal-controlled crossing over the R108 by the Infants School. The location of this station is shown on Figure 4.1 Sheet 16 and a description of the urban landscape and views is provided in Chapter 27 (Landscape & Visual).

The entrance to the station and the cycle parking facility will be located just in front of the existing northern entrance to the car park for Our Lady of Victories Church and about 100m south of the Ballymun Crossroads. The bus stop location proposed under BusConnects has been moved further south to integrate better with the Collins Avenue Station entrance. This location for Collins Avenue Station would cater for the greater flow of passengers to and from Glasnevin Avenue and Collins Avenue along the R103, connections to the bus service on the R108 Ballymun Road as well as residents living in the immediate surrounds and students attending Dublin City University.

The existing northern entrance to the car park at the rear of the church will be closed due to space constraints and the need to remove potential conflict between vehicles and pedestrians. This closure allows for the provision of cycle parking to the north of the station entrance. Access to the church car park will be maintained from Albert College Drive to the south. The existing pedestrian access to the front of the church will also be reinstated following the construction phase.

On Albert College Court, the provision of ventilation grills for the underground station results in the permanent removal of a number of car parking spaces. Due the increased pedestrian traffic, a raised table junction will be provided across Albert College Court in the vicinity of the junction with the R108, so that this becomes a shared space with slow moving vehicles and pedestrians.

4.17.4.2 Collins Avenue Station Urban Realm and Landscaping Design

The specific urban design principles for Collins Avenue Station are to:

- Integrate grilles and hatches required for the station with the planting proposals;
- Consideration of the relationship between the station and the entrance to Our Lady of Victories Infants School;
- Raised table junction and shared space, and
- Preserve the main axis of Our Lady of Victories Church.

The construction of the station box itself will result in the loss of tree vegetation, although the tree belt to the north will be retained as an important screen to adjacent residents. The landscape design will have future planting and swales to manage surface water sustainably, verge planting to direct pedestrians and cyclists, and a new plaza to integrate the street with the proposed Project and its architectural features as well as linking the church with the adjacent new transport infrastructure (Diagram 4.77). The existing baseline, potential impacts on landscape quality and views, and mitigation proposals are described in Chapter 27 (Landscape & Visual).

Diagram 4.77: Indicative View of Collins Avenue Station

4.17.4.3 Collins Avenue Station Description

Collins Avenue Station is designed as a typical underground cut and cover station. A general description of the underground stations is provided in Section 4.9.2, with a typical long section presented in Diagram 4.16. Diagram 4.78 shows a plan form of the main surface features of Collins Avenue Station and a summary of key information is presented in Table 4.22.

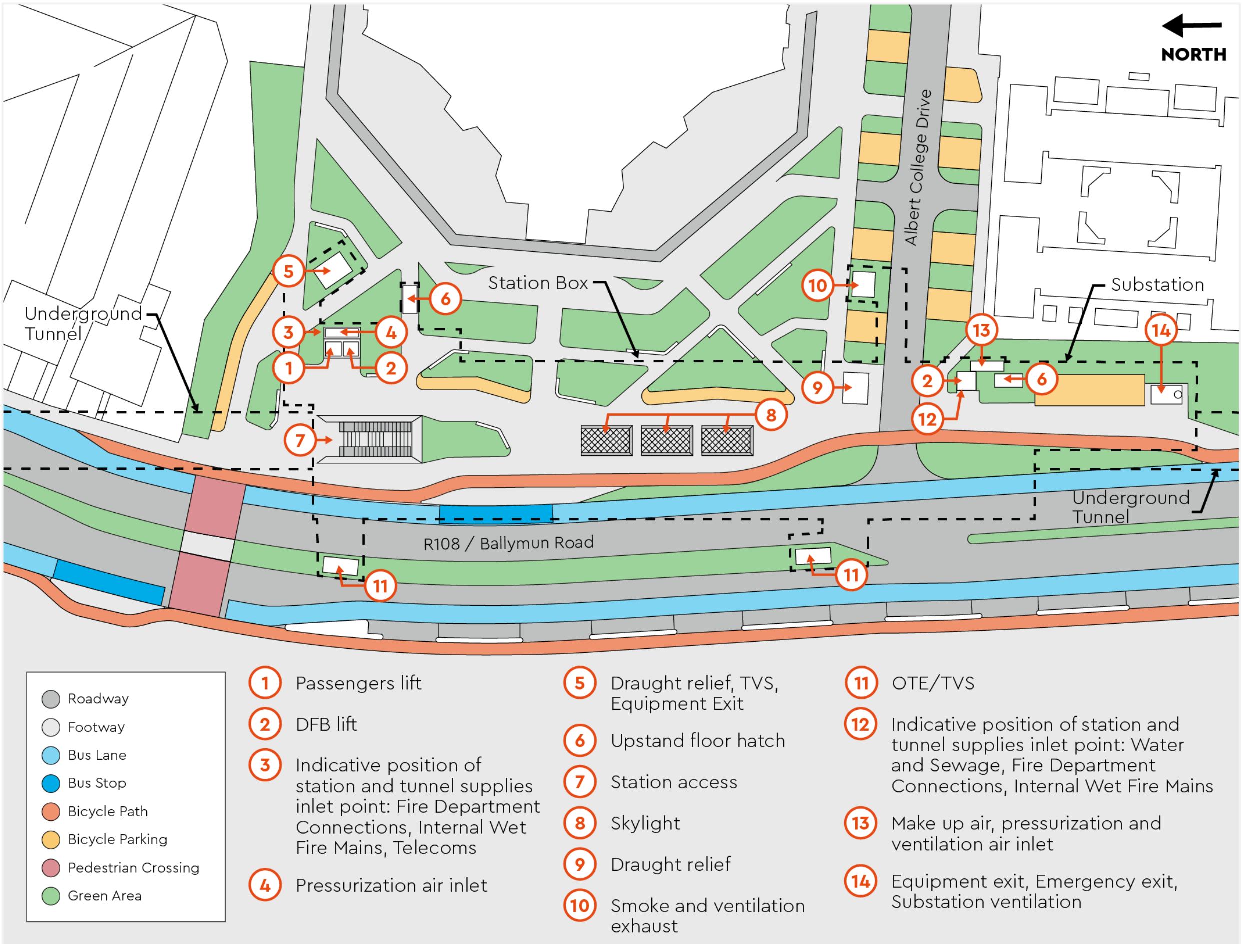


Diagram 4.78: Collins Avenue Station Layout

Table 4.22: Collins Avenue Station Details

Collins Avenue Station	
Station Location	Ballymun Road (R108) adjacent to Our Lady of Victories Church
Station Type	Underground cut and cover
Access/Interchange	Bus, pedestrian and cycle.

Diagram 4.78 shows the location of the entrance at the northern end of the station box and the three skylights which will provide natural light to the mezzanine level. Some 370 cycle spaces will be provided at this station.

Collins Avenue Station will have three main levels in line with the typical underground station design; concourse, mezzanine and platform levels.

Access between the street level and the platforms is via escalators, stairs, and lifts. Two escalators will be provided between the street-concourse-mezzanine levels and four escalators between the mezzanine-platform levels. One set of stairs will be provided between the street-concourse-mezzanine levels and two sets of stairs mezzanine-platform levels. One lift will be provided between the street-concourse-platform levels and one between the concourse and other platform. The escalators and stairs from street level are located together, and the passenger lift is located nearby.

There will be two emergency sets of stairs between the platform and street, exiting via upstand floor hatches, and one emergency set of stairs concourse-platform. There will also be three lifts for DFB.

Two ventilation grilles will be sited within the central reserve of R108 and two more in the car parking space along the north side of Albert College Court. These modifications to the standard design of the underground stations were done to free up and avoid cluttering the main entrance to Our Lady of Victories Church.

The station box will be approximately 110m long and 25m wide. The station will be 24m deep from street level to TOR. The platforms will be 65m long and 6.5m wide on each side of the tracks. BOH facilities will be provided within the underground levels. A traction substation will be integrated into the station box on the south side and out of view from the public.

Several utilities will be diverted outside the station alignment, comprising surface water drain, an electricity cable, a water pipeline and foul water pipeline. A summary of utility diversions is provided in Section 4.17.4 and further information on the impact of the proposed Project on utilities is provided in Chapter 22 (Infrastructure & Utilities).

4.17.5 Albert College Park Intervention Shaft

The Albert College Park Intervention Shaft will be located in the southern part of Albert College Park and largely on the east side of the existing footpath, which will be diverted to accommodate the shaft. The location is shown on Figure 4.1 Sheet 16. The quality of the existing landscape and views is described in Chapter 27 (Landscape & Visual).

The Albert College Park Intervention Shaft is required to provide appropriate tunnel ventilation and to comply with tunnel fire safety strategy by providing egress between the tunnel and the ground surface so that passengers can escape, and fire fighters can enter the tunnel. As explained in Section 4.10.2 the section of tunnel between Collins Avenue and Griffith Park Stations is over 1km in length so there is a requirement for a stand-alone intervention shaft. Albert College Park is a sufficiently large area of non-residential land to construct the intervention shaft and house the permanent facilities. The intervention shaft would connect with the railway tunnel at approximately Ch12+800.

The Intervention Shaft comprises a rectangular box at the upper ground level which houses the tunnel ventilation system and an electric room sitting upon a cylindrical shaft which drops to the tunnel level (Diagram 4.79). The upper level has been designed as a concrete box with maximum dimensions of 39.7m long and 15m wide. The lower level, with an internal diameter of 19m, provides enough space for stairs to evacuate the passengers during an emergency and a lift to provide access for the fire service and the evacuation of injured people. A small building will sit over the stairs. At the bottom, the shaft connects with the railway tunnel via separate gallery/mined tunnel connections for passenger egress, emergency service access and for tunnel ventilation. All the walls connecting the main tunnel with the galleries will be made of reinforced concrete providing a two-hour fire rating. Fire doors, also with two-hour fire rating, will be provided in the dividing wall between the main tunnel and the access gallery to ensure the complete fire compartmentation between the galleries and the tunnel.

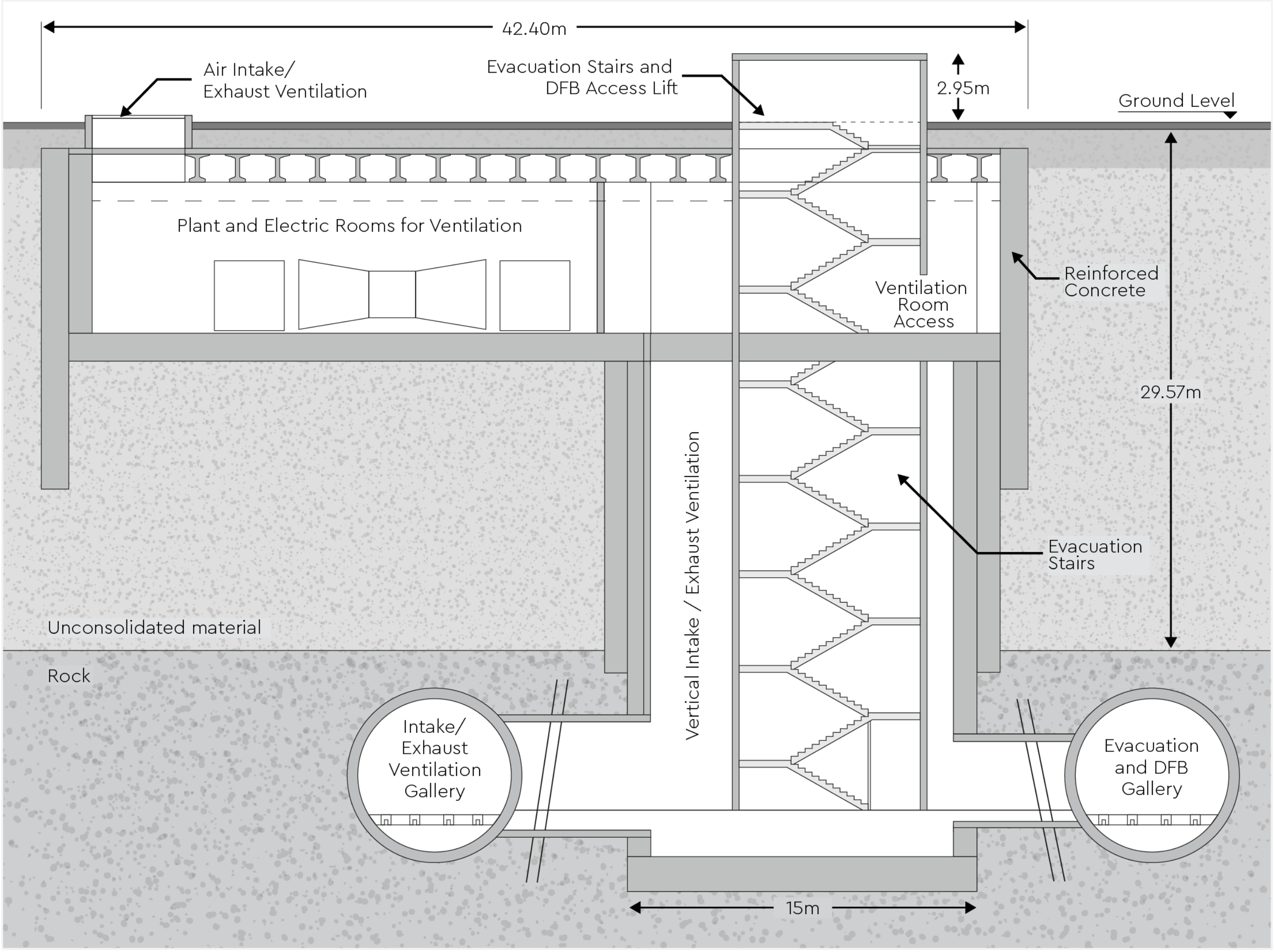


Diagram 4.79: Cross Section of Albert College Park Intervention Shaft

A maintenance access road from the R108 Ballymun Road and associated hardstanding area are provided at the intervention shaft in Albert College Park. An additional emergency exit to the R018 Ballymun Road is also provided to allow for a one-way system as requested by DFB.

At present there are two 11 a-side football pitches and two 5 a-side football pitches at Albert College Park located to the east of the R108 Ballymun Road. Temporary and permanent land take is required for the Albert College Intervention Shaft. This land is owned by DCC. The temporary land take will be returned to DCC at the end of construction. The works required for the intervention shaft will result in the loss of a 35m wide strip of land along the western boundary of Albert College Park. This land take will include both of the existing 5 a-side pitches and a small portion of one of the full-sized pitches. To maintain the existing facilities, the existing full-sized pitches will be rotated 90 degrees and located side-by-side to the east of the park with ball nets. This will result in slightly reduced dimensions, although both pitches will meet UEFA dimensions. By moving the full-sized pitches east sufficient area will be available to increase the dimensions of both 5 a-side pitches. Sufficient area will also be available for circulation around the pitches while they are occupied. These arrangements are under discussion with DCC. The works will be brought into the RO.

4.17.6 Griffith Park Station

4.17.6.1 Griffith Park Station Location and Access

The Griffith Park Station will be located under the grounds used by Home Farm Football Club (FC), on the east side of the R108 St Mobhi Road. In this area, the R108 is a tree-lined road with three lanes, one northbound and two southbound. The west side of St Mobhi Road is residential with many property boundaries comprising hedgerows with or without low walls obscuring ground floor views towards the road. On the east side of St Mobhi Road, the football grounds are separated by railings on top of a boundary wall with further trees planted inside the boundary further obscuring views from the grounds towards the road. A description of the landscape quality and views is provided in Chapter 27 (Landscape & Visual). Further away, the area is largely residential, with notable public land uses including the Whitehall College of Further Education on the east side of the Home Farm FC grounds, the Bon Secours Hospital on the west side of the R108 and the National Botanic Gardens starting about 200m to the east and southeast of the station. The location of the station and surrounding land uses are shown on Figure 4.1 Sheets 17 and 18.

There will be one entrance to this station, located at the southern end of the pitches, off the existing entrance to the Whitehall College of Further Education (Diagram 4.80). This will result in the relocation of the existing gates to the College to a position further east on the existing access road. Whitehall College is a protected structure and while the entrance gateway is not listed, it consists of an imposing curved wrought-iron railings on mass concrete plinths running back from the road to meet two masonry piers that carry the wrought-iron gates. The wrought-iron railings run along the road frontage of the college, with their concrete plinth. Part of the railings along St Mobhi Road will also be dismantled at the start of construction and restored on completion of the works. A description of these features and the impact of construction and operation on them is provided in Chapter 26 (Architectural Heritage).

Diagram 4.80: Whitehall College of Further Education Entrance

The station location will allow for connections to the bus service on the R108 St Mobhi Road and walking and cycling routes as described in Chapter 6 (MetroLink Operations & Maintenance) and Chapter 9 (Traffic & Transport).

4.17.6.2 Griffith Park Station Urban Realm and Landscaping Design

The urban design principles for this location are to:

- Provide a new access to new Griffith Park riverside;
- Allocate cycle parking underneath the green slope;
- Relocate the stone pillar gateway to Whitehall College;
- Enhancement of pitch retained wall; and
- Protect the existing trees and recover the species affected by the construction.

St Mobhi Road changes in elevation north to south as it descends towards the Tolka River and this change in topography creates a situation whereby the station box is accessible from the side of the structure creating a unique station for the proposed Project. Using the natural topography, the station is nestled into the topography and the structural walls and architectural features wrap around the station creating a plaza and entrance on the south facing side. The canopy over the station entrance is reduced to a visor. This south facing plaza will be a public space with access to the adjacent Griffith Park along the Tolka River as well as access to St Mobhi Road. The existing trees on the verge of St Mobhi Road will be retained as part of the proposed Project. The vegetation on the Whitehall College western and southern boundaries will be removed. The landscape design will incorporate planting to these boundaries comprising a biodiverse mixture of mature planting and smaller species. The ground on top of the station will be returned as a football field. The station plaza will incorporate large feature trees and a green wall to the station architecture. An underground cycle storage area is also provided while outdoor cycle parking racks will be provided. As the station structure is incorporated into the topography it results in a new retaining wall of 5m plus in height. This wall will be clad with planting in places and on top of this structure a number of feature trees are placed to create the desired boundary and atmosphere. An illustration of the urban realm and landscaping design is provided in Diagram 4.81.

Diagram 4.81: Griffith Park Station Indicative Aerial View

4.17.6.3 Griffith Park Station Description

A general description of the underground stations is provided in Section 4.9.2, with a typical long section presented in Diagram 4.16. Diagram 4.82 shows a plan form of the main surface features of Griffith Park Station and a summary of key information is presented in Table 4.23.

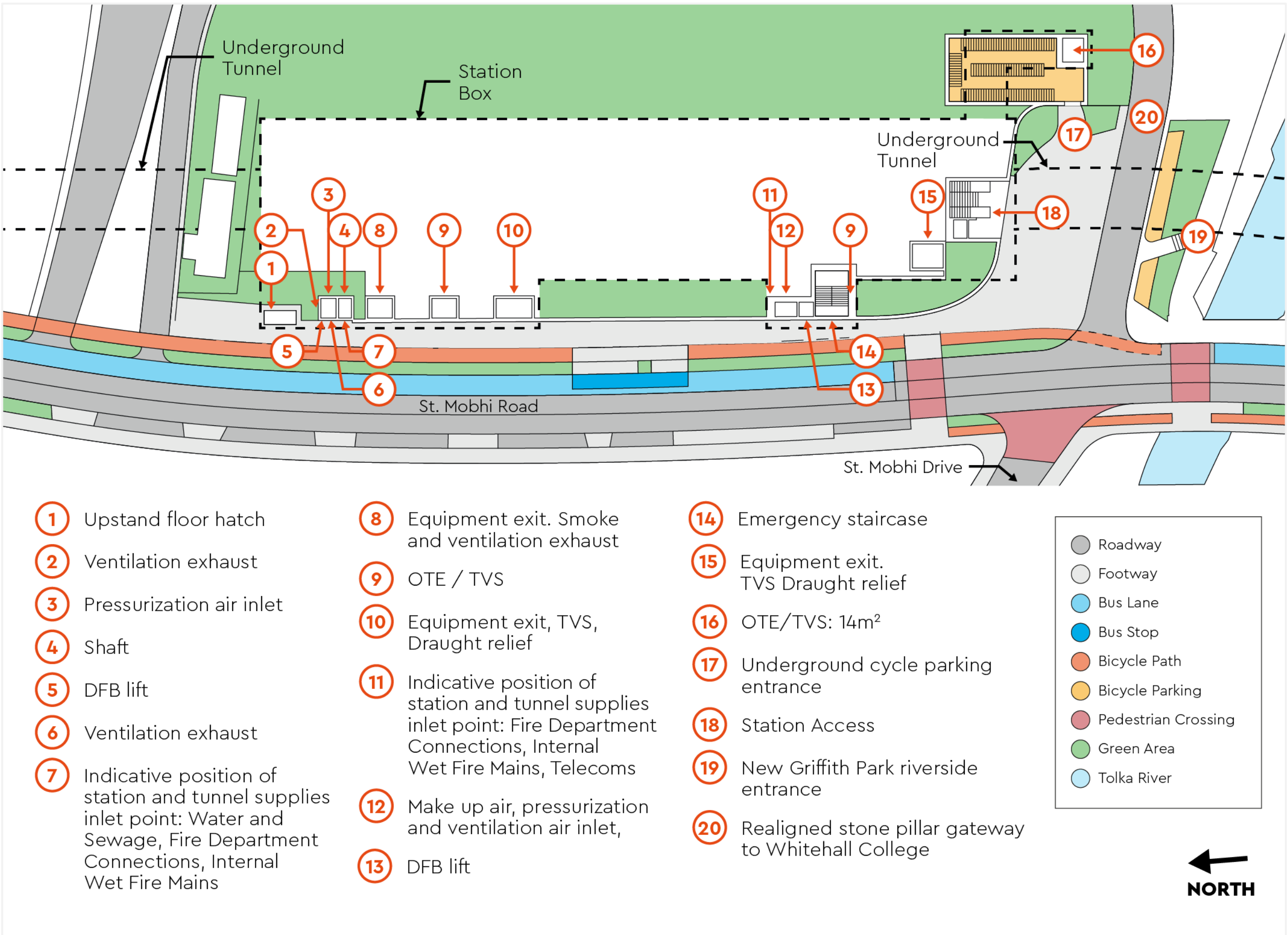


Diagram 4.82: Griffith Park Station Layout

Table 4.23: Griffith Park Station Details

Griffith Park Station	
Station Location	Home Farm FC grounds near the Whitehall College of Further Education
Station Type	Underground cut and cover
Access/Interchange	Bus, pedestrian and cycle.

The Griffith Park Station is designed as a typical underground cut and cover station, with slight adaptations to line up with the footpath and railings along St Mobhi Road. Details of the construction methodology and sequencing can be found in Section 5.10.5 Chapter 5 (MetroLink Construction Phase).

Diagram 4.82 shows the grouping of the station access, the underground cycle storage entrance, and the realigned gateway to Whitehall College. A total of 176 cycle parking spaces will be provided, with half of them in an underground cycle parking facility and the remainder in on-street cycle stands. The station entrance will include a visor but there will not be the canopy. Another notable feature is that there will be no skylights to provide natural light to the mezzanine level, unlike other underground stations.

Griffith Park Station will have three main levels in line with the typical underground station design; concourse, mezzanine and platform levels. Access between the street level and the platforms will be provided by escalators, stairs and lifts. Two escalators will extend between the street-concourse-mezzanine levels and four escalators between the mezzanine-platform levels. One set of stairs is proposed between the street-concourse-mezzanine levels and two sets of stairs between the mezzanine level and the platforms. One passenger lift will connect the street-concourse-platform levels and a second lift for the concourse-platform levels.

There will be two emergency stairs for the evacuation of passengers from platform to street levels, one exiting via an upstand floor hatch at the northern end of the station box and one via stairs towards the southern end of the station box on the west side. Three lifts for the DFB will also be provided.

The station box will be about 116m long and 25m wide. The depth from street level to TOR is about 20m, plus an additional height of about 5m to account for the raised ground level above street level. The platforms will be 65m long and 6.5m wide on each side of the tracks. BOH facilities will be provided on the underground levels. This station will not include a traction substation.

At present, the Home Farm FC playing facilities at Mobhi Road comprise a grass soccer pitch and a single storey changing facilities building. These lands are affected entirely by the proposed Project. Temporary and permanent land-take is included in the RO. During the Construction Phase, the pitch will be used for construction and the changing facilities building will be demolished. Upon completion of the construction phase at this location, the football pitch and facilities will be replaced on a like-for-like basis. Rights to use the football pitch will be returned to Home Farm FC who will be able to return to their existing site.

4.17.7 Glasnevin Station

4.17.7.1 Glasnevin Station Location and Access

Glasnevin Station will be a new multi-modal interchange station in Phibsborough, linking MetroLink, the two existing Iarnród Éireann heavy railway lines namely Western Commuter Line and the South-Western Commuter Line, BusConnects, and connections by car, walking and cycling. The existing heavy railway lines lie on the north bank and parallel with the Royal Canal which is aligned approximately east-west in this location. The heavy railway lines lie approximately 8m below Prospect Road and in deep cutting supported by concrete and masonry retaining walls. The surrounding area is largely residential, with the National Botanic Gardens located to the north and north-east. The location of the station and surrounding land use is illustrated on Figure 4.1 Sheets 20 and 21.

The new Glasnevin Station will be located on the west side of the R108 Prospect Road and will be aligned north-south parallel to the R108. The proposed Project tunnel will run under and at right angles to the parallel alignments of the heavy railway lines at a depth of about 24m. Extensive engineering and earthworks will be required to lower the heavy railway track up to 2.5m to achieve flatter gradients and to provide overhead line electrical clearances under the two overbridges carrying Prospect Road, provide new platforms for the Western Commuter Line and the South-Western Commuter Line, and integrate these with the Glasnevin station box and underground metro station. Construction of Glasnevin Station and the associated lowering of the associated heavy rail track to achieve the required track and platform gradients will have a major impact on the surrounding environment.

Along the South-Western Commuter Line, the retaining wall and the two-storey buildings on the south side and the retaining wall on the north side will be demolished to make way for the MetroLink station box and the proposed Iarnród Éireann platforms. The retaining walls will be rebuilt, with the retaining wall on the north side set further back, affecting the Brian Boru Pub car park.

The key features along the Western Commuter Line at this location are, the retaining wall and the Royal Canal and Green Way path on the south side, the retaining wall and two-storey office building on the north side, and the two masonry arch tunnels, the longer one forming part of the R135/R108 overbridge carrying Prospect Road. A new 250m long retaining wall will be built along the Royal Canal Green Way. The existing Glasnevin railway junction to the west will be remodelled to meet operational requirements and integrate with the major vertical re-alignment of the railway line west of Cross Guns Bridge. The existing cut and cover tunnel and commercial properties above will be demolished to provide space for the Iarnród Éireann platforms and to construct the new retaining wall further south and towards the Royal Canal.

The Glasnevin station box will be constructed under both the Western Commuter and the South-Western Commuter Lines. The Glasnevin underground station will have five levels comprising the Iarnród Éireann platforms, concourse, mezzanine, and platform levels. The arrangements give access from the Cross Guns Bridge on Prospect Road to the Iarnród Éireann and MetroLink platforms.

Glasnevin Station will include enhanced pedestrian and cyclist facilities along Prospect Road. A two-way cycle lane along the east side of the road and widened footpaths on the west side will be provided as well as an additional pedestrian crossing to the north of the station. Enhanced bus stop facilities are proposed outside the station. A DOP has also been provided to the north of the station in lands currently occupied by the Brian Boru car park. A new access road from Prospect Road to these facilities will also provide access to 120 cycle parking spaces.

The existing car park in Dalcassian Downs, which will be impacted during the Construction Phase, will be reinstated on completion of the construction works.

4.17.7.2 Glasnevin Station Urban Realm and Landscaping Design

The Glasnevin Station design is compliant with some of the generic design principles applicable to underground stations, as summarised below:

- A pavilion providing a shared entrance to both MetroLink and Iarnród Éireann;
- Clear wayfinding to both MetroLink and Iarnród Éireann transport modes;
- Platforms open to the mezzanine level;
- A separate Upper Concourse level;
- Linear circulation to both MetroLink and Iarnród Éireann platforms;
- Principles of access for all;
- FOH and BOH on all levels;
- Natural light over the MetroLink and Iarnród Éireann platforms (this principle is affected slightly because of the green roof over the station entrance, which is intended to unify the public space, and includes glazed areas so that natural light can still pass onto the plaza); and
- Design in line with a common architectural language used for all of the stations along the alignment.

The following considerations were also addressed in developing the architectural design for Glasnevin Station:

- Provide an intermodal concourse at street level, designed as an open space under a light canopy;
- Provide a potential café or shops for passengers;
- Re-build the Dalcassian Downs car park over the station roof slab;
- Provide a car park / large cycle park area and drop-off on the area of the existing Brian Boru car park;
- Design landscaping with green integration on slopes;
- Integrate station ventilation grilles in green areas; and
- Consider the requirements for revenue protection for the different modes, as well as safety in design, specifically regarding adherence to Iarnród Éireann's codes of practice.

The Glasnevin Station building is set back from Prospect Road where a public realm will be created, assisting in the connectivity to Prospect Road and adjacent land uses. This public realm deals with the changes in levels on site, by using sculptural wall elements and planting, and provides access to the station via ramps, steps and level access. The access route for pedestrians is provided through multiple access points along Prospect Road to a level plaza that leads to the station building. The active plaza has seating and large mature trees. To the south pedestrian and cycle access is provided to the Royal Canal and the cycle network. An active space for outdoor seating is provided for retail on this façade. To the north boundary a new landscape interface is created with the adjacent residential complex resulting from the erection of a substation and infrastructure on the north boundary. The resident carpark will be reinstated in a new alignment and associated landscape provision of trees and shrubs to the new layout.

Diagram 4.83: Indicative View of Glasnevin Station

4.17.7.3 Glasnevin Station Description

A general description of the underground stations is provided in Section 4.9.2. Glasnevin Station is more complex than the other underground cut and cover stations and deviates from the generic form of underground stations. This section provides further details of the Glasnevin Station design. A longitudinal section is provided below in Diagram 4.84 and a cross-section is provided in Diagram 4.85. These diagrams illustrate the relationship of the Western Commuter Line and the South-Western Commuter Line with MetroLink, which lies at greater depth and perpendicular to the heavy railways.

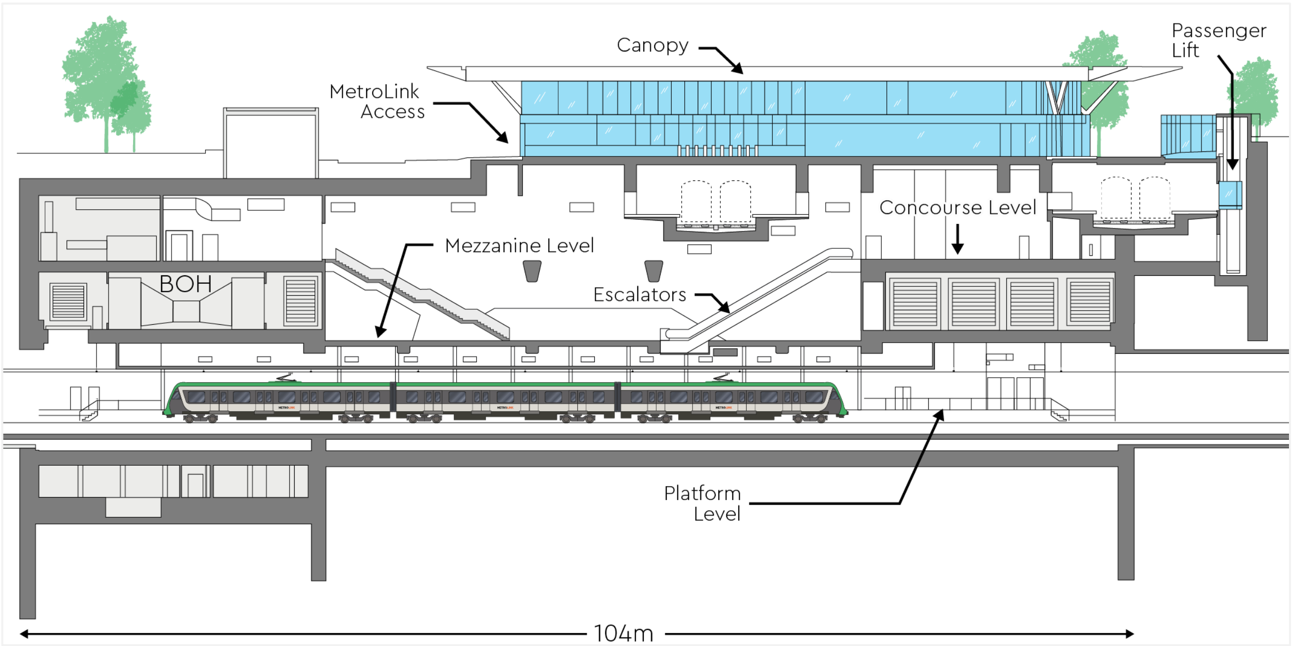


Diagram 4.84: Longitudinal Cross Section of Glasnevin Station

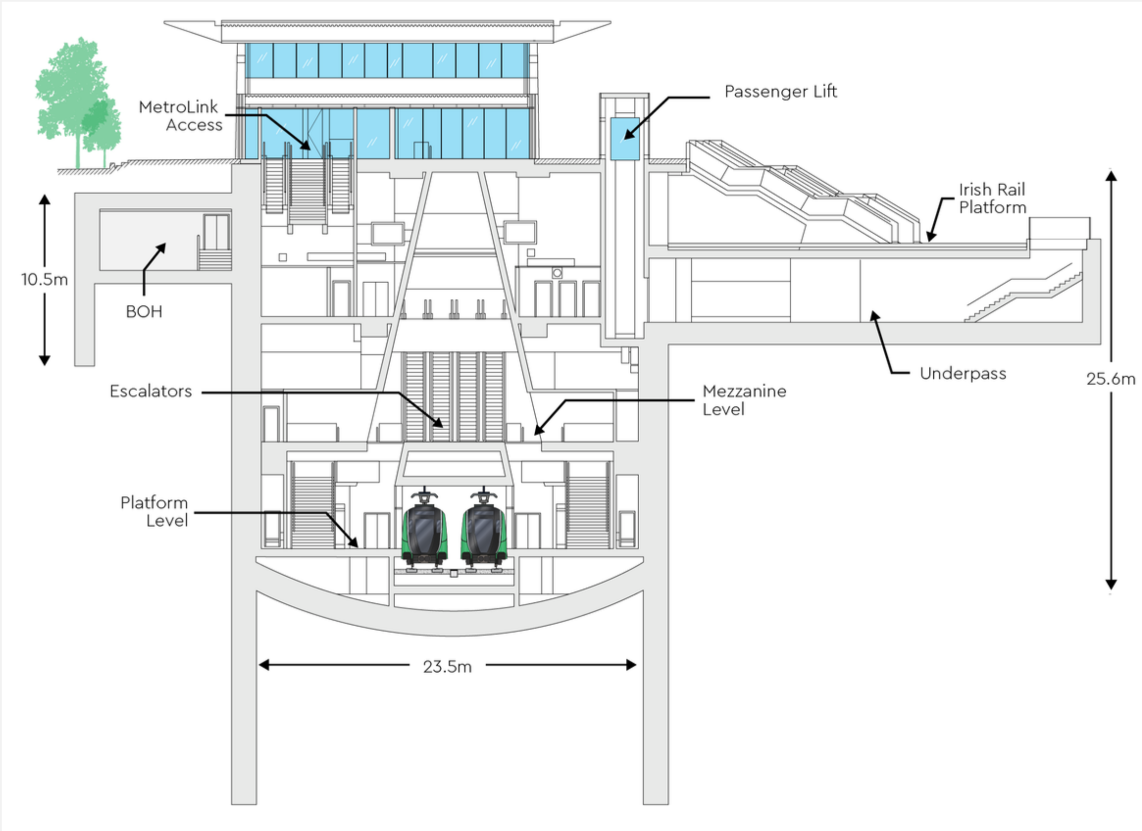


Diagram 4.85: Cross Section of Glasnevin Station

A plan form of the main surface features of Glasnevin Station and a summary of key information is presented in Diagram 4.86 and Table 4.24.

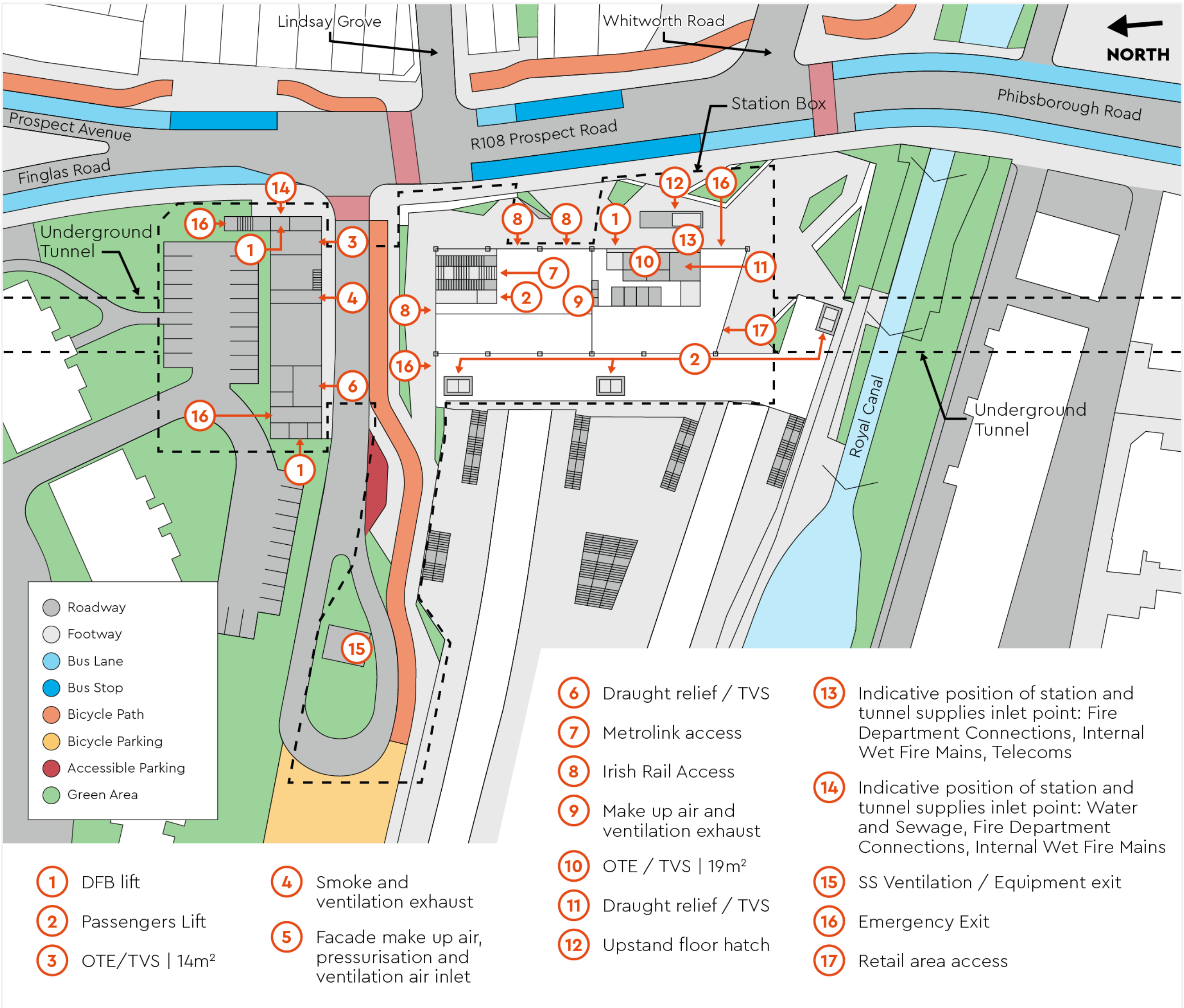


Diagram 4.86: Glasnevin Station Layout

Access to the station from street level will be from Prospect Avenue where passengers will enter the new station building and go either directly to the Iarnród Éireann services at level 1 or to MetroLink services at level 2. Access for MetroLink services will be via a bank of stairs and escalators on the north side of the plaza. Lifts will be provided for mobility impaired persons.

A common paid area is provided for both heavy railway lines, with separate gate lines for each. Once in the paid area passengers can choose the railway line (Western Commuter Line and the South-Western Commuter Line) and direction of travel before descending directly to the chosen platform using the four available stairs or the six elevators nearby, two each for the Western Commuter Line and the South-Western Commuter Line side platforms and two for the central platforms. This provision allows the Iarnród Éireann part of the station to operate independently of MetroLink once passengers have passed through the gate lines.

The floor level below the street level Plaza is the Concourse Level, which is split into a North Concourse and a South Concourse area and the underpass at the same level to link the heavy rail platforms and the intermodal area. The North Concourse is the main access space for MetroLink, whilst the South Concourse will operate as an intermodal space below the railway track and platforms, used by passengers from MetroLink who wish to join Iarnród Éireann services. The underpass has stair and lift access from the Iarnród Éireann platforms.

The mezzanine level is similar to the generic design for the underground stations, albeit with a larger BOH area to accommodate equipment due to the particular constraints of the station location. The platform level is also typical of the underground stations, with platforms 65m long and 6.5m wide. Given the forecast number of passengers and inter-connection with Iarnród Éireann, two escalators and one stairway will provide access between the mezzanine and each platform.

Three intervention lifts will be provided for DFB and emergency staircases will be provided for passenger use in addition to the main access routes via escalators, stairs and lifts.

A new car DOP will be provided by the new section of highway off the R108 Prospect Road and turning loop to the north of the station together with 120 cycle parking spaces.

BOH facilities will be provided over the underground levels, including a traction station.

Table 4.24: Glasnevin Station Details

Glasnevin Station	
Station Location	Glasnevin on the west side of Phibsborough Road and north of the Royal Canal
Station Type	Underground cut and cover
Access/Interchange	Iarnród Éireann (Irish Rail), bus, DOP, pedestrian and cycle.

4.17.7.4 Utilities at Glasnevin

The Glasnevin Station development is a complex project with key interfaces with other infrastructure stakeholders. The main known utilities impacted are:

- 225mm foul water sewer on the north and south side;
- Four communication ducts;
- One electrical cable >150m north of the station;
- One surface water sewer;
- Water main along the canal towpath; and
- Railway utilities along the railway.

In addition to public utilities, there are also Iarnród Éireann services contained in their land which will need to be diverted during station construction works, these will be undertaken within the existing railway corridor and will be co-ordinated with Iarnród Éireann.

Further assessment of infrastructure and utilities impacts at Glasnevin Station are contained in the EIAR Chapter 22 (Infrastructure & Utilities).

4.17.8 Mater Station

4.17.8.1 Mater Station Location and Access

Mater Station will be located beneath the Four Masters Park, with the R135 Berkeley Road adjoining the west side of the park and Eccles Street lying on the north side of the park. Mater Hospital is located on the north side of Eccles Street and St Joseph's Church is located immediately south of the park. The surrounding area is largely residential. The location of the station is shown on Figure 4.1 Sheet 22.

There will be one entrance to Mater Station, situated at the northwest corner of the park and close to the Hospital access, which is conveniently located to walk to Mater Hospital, St Joseph's Church and Berkeley Road. The station location will also connect with bus services to and from Dublin City Centre, with bus stops on Berkeley Road.

Four Masters Park has very important heritage and architectural connotations. Four Masters refers to four historians who compiled *The Annals of the Kingdom of Ireland*, commonly known as the *Annals of the*

Four Masters, in the early seventeenth century. In 1871 an ophthalmic surgeon, Sir William Wilde, proposed erecting a monument to honour the four historians in the grounds opposite Mater Hospital. He commissioned a Celtic cross which was erected here following his death in 1876. Over a century later the *Healing hands* sculpture was erected in the park in 2000. Several buildings and structures in the vicinity are protected, including Mater Hospital; the railings, gates and plinth walls enclosing the park at the corner of Eccles Street and Berkeley Road; the Celtic cross; the *Healing hands* sculpture; St Joseph's Church and thirteen buildings in Eccles Street. The EIAR assumes for the purposes of the assessment that the park itself is listed, not just elements associated with it. Further information on the heritage value of this site and the landscape quality and views is provided in the EIAR Chapter 26 (Architectural Heritage) and Chapter 27 (Landscape & Visual) respectively.

The construction of Mater Station in the Four Masters Park will affect the park itself, both Eccles Street and Berkeley Road, and St Joseph's Church, requiring stringent environmental management measures during construction and restoration of the urban realm. The station box will be constructed via top-down excavation, several utilities will need to be diverted temporarily, and a ventilation shaft constructed under Eccles Street. The existing railings and sculptures in the park will be removed and reinstated at the end of the construction phase, while there will be temporary closures and diversions of both Eccles Street and Berkeley Road and footpaths. Similarly the iron railings on a low granite plinth and decorative granite pier along the frontage of the church grounds to Berkeley Road together with the grotto and dedicatory plaque in the church grounds will be removed during construction and reinstated at the end of the construction phase. The grotto will be temporarily relocated to the southern area of the church grounds for the duration of construction works. Further information on construction activities and programme is provided in Chapter 5 (MetroLink Construction Phase).

Mater Station location will result in the realignment of the existing kerb lines to facilitate the station tie in with the public realm.

On the western side of Berkeley Road and north of the junction with Sarsfield Street, the provision of a ventilation grill will require the removal of part of the existing on-street parking and the adjustment of the kerbs to accommodate this. South of Sarsfield Street, the provision of a new pedestrian crossing will result in the alteration to the kerb line at the existing bus stop.

The design includes the signalisation of the junction of Berkeley Road, Eccles Street and St Vincent's Road North. The width of Eccles Street will be reduced locally at the junction. Provision of shared space will be incorporated on Eccles Street in the vicinity of the junction with Berkeley Road, with the shared space demarcated from the road edge by a raised kerb for the safety of pedestrian and cyclists. Discussion on the impact of these changes on transportation is covered in Chapter 9 (Traffic & Transport).

4.17.8.2 Mater Station Urban Realm and Landscaping Design

The Mater Station urban realm design principles are based on the following:

- Realignment of the Four Masters Memorial;
- Rearranging the footpath to provide enough pedestrian space for the main entrance;
- Reinstatement with enhanced planting of the Four Masters Park and its existing railings; and
- Replacement of existing trees.

In order to allow for urban integration, existing railings and green areas will be temporarily removed, and relocated or reinstated after construction is complete.

The landscape design creates a public plaza to the main arrivals area at the entrance/exit. This active plaza then provides access to Eccles Street and Berkley Road. A shared surface plaza to Eccles Street will be created to provide greater connectivity to the adjacent existing pedestrian network. This plaza will frame the portico of the adjacent Mater Hospital and integrate pedestrian circulation and cycle parking within the streetscape. Berkley Park will be reinstated in a similar fashion to the existing situation. The station architecture is integrated in the park in a sympathetic fashion with the skylights being framed by planting and providing circulation routes through the park. Existing monuments and protected railings will be relocated within the park. Large mature trees will be placed so as to provide balance and create space within the park. The landscape design itself will be created on top of the station box and sufficient depths and infrastructure are provided for in order to integrate the landscape design.

Diagram 4.87: Indicative View of Mater Station

4.17.8.3 Mater Station Description

A general description of the underground stations is provided in Section 4.9.2, with a typical long section presented in Diagram 4.16. Diagram 4.88 shows a plan form of the main surface features of Mater Station and a summary of key information is presented in Table 4.5.

Mater Station is designed as a typical underground cut and cover station and will be constructed as such. Construction details including sequencing and methodology can be found in Section 5.10.7 Chapter 5 (MetroLink Construction Phase).

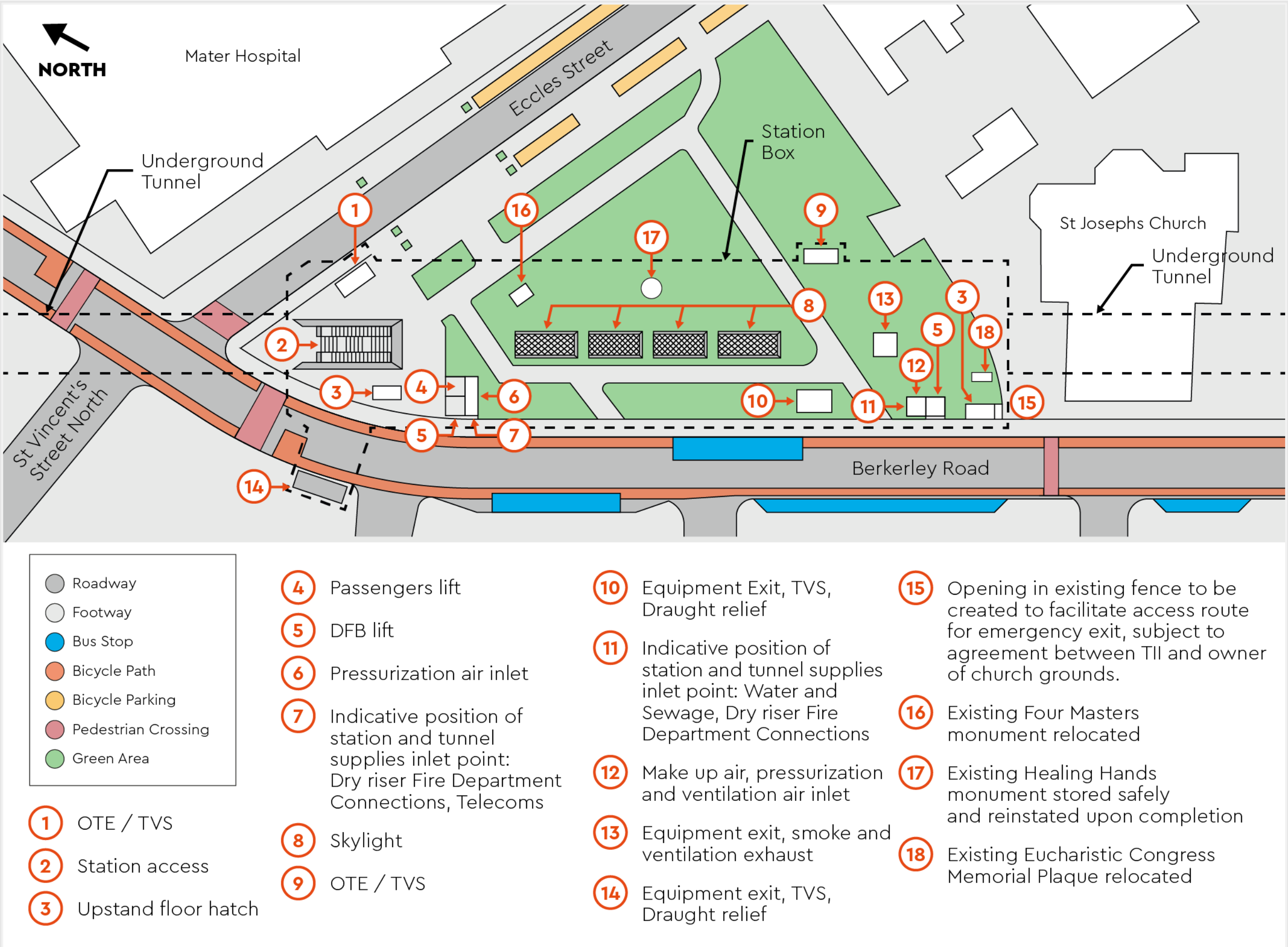


Diagram 4.88: Mater Station Location

Mater Station will have three main levels in line with the typical underground station design; concourse, mezzanine and platform levels. As described above, the single entrance lies to the north of the station box, identified by the signature canopy entrance. Parking for 70 cycles will be provided in Sheffield stands. The entrance leads to two escalators between the street-concourse, two escalators concourse-mezzanine, and four escalators mezzanine-platforms. There is one set of stairs street-concourse and concourse-mezzanine, and two sets of stairs mezzanine-platforms. There will also be one lift street-concourse-platform and one lift concourse-platform.

In the event of an incident, there will be two sets of emergency stairs platform-street which will emerge at street level via the upstand floor hatches, one to the north and one to the south of the station, and one set of emergency stairs platform-concourse. There will also be two lifts for the DFB, again with one located towards the northern end and the other towards the southern end of the station box.

The station will be approximately 29m deep from street level to TOR level. The station box will be about 109m long and 25m wide. Four skylights placed along the spine of the station box will provide natural light to the mezzanine level below. The platforms will be 6.5m wide on each side of the railway. This station will not have a traction substation.

Table 4.25: Mater Station Details

Mater Station	
Station Location	In Four Masters Park adjacent to Mater Misericordiae University Hospital
Station Type	Underground cut and cover
Access/Interchange	Bus, pedestrian and cycle.

4.17.9 O'Connell Street Station

4.17.9.1 O'Connell Street Station Location and Access

O'Connell Street Station is located on the site of the proposed Dublin Central CP Ltd development known as Dublin Central Site 2. The site is bordered by O'Connell Street Upper to the east, Moore Lane to the west, Henry Place to the south and Central Site 1 to the north. The site currently includes a vacant plot, streets, and buildings. Many of the buildings are protected structures, including numerous buildings on O'Connell Street Upper, Parnell Street and Moore Street. Site 2 also lies within the O'Connell Street Architectural Conservation Area (ACA).

The underground station will lie under 43-58 O'Connell Street Upper, of these, Nos 43-45, 50-54 (including the old Carlton Cinema at Nos 52-54), and 54-58 are protected. This is a very important part of Dublin in terms of the quality and heritage value of the built architecture. The site of the station is shown on Figure 4.1 Sheet 23. Further information on the listed buildings in this area and the potential impacts of the proposed Project on architectural heritage is provided in Chapter 26 (Architectural Heritage) and the location of protected structures is shown on Sheet 26 Figure 26.1. A description of the landscape quality and views is provided in Chapter 27 (Landscape & Visual).

The developers Dublin Central CP Ltd have submitted three planning applications relating to the redevelopment of Site 2 in July 2021, two of which received planning approval in January 2022. The proposal for the over-site development is integrated with the MetroLink underground station.

The main pedestrian access to the station is located at No 44/45 O'Connell Steet with a second access to the station provided off Moore Lane.

4.17.9.2 O'Connell Street Station Urban Realm and Landscaping Design

The urban realm and landscaping design for O'Connell Street Station will be provided by the developers as part of the over-site development at this location. The architectural features associated with O'Connell Street Station, such as the entrance, will follow the branding style for the proposed Project.

In the event that the current proposals for the over-site development does not go ahead, the MetroLink station will still be built with the two entrances as planned, while the development site at ground level would be surrounded by hoarding until new or revised plans for the over-site development come forward.

4.17.9.3 Oversite Development and O'Connell Street Station Description

A general description of the underground cut and cover stations is provided in Section 4.9.2.3, with a typical long section presented in Diagram 4.16. The proposals for O'Connell Street Station differ in some detail to these standardised designs due to the over-site development. In particular, the station box will be covered by a transfer slab, which is required to help support the over-site development but results in the absence of skylights in the station ceiling and modifications for ventilation and smoke extraction. Diagram 4.89 below presents a cross section of the station and Diagram 4.90 shows a plan form of the main surface features of station. A summary of key information is presented in Table 4.26.

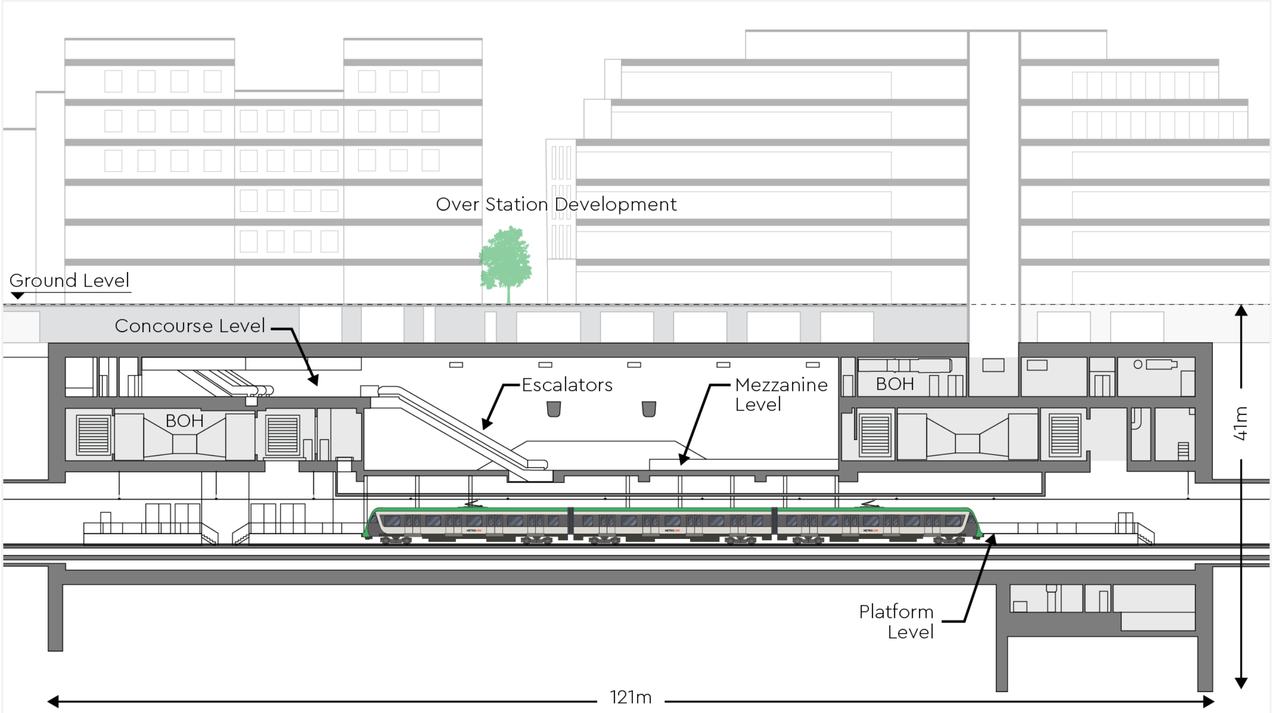


Diagram 4.89: Longitudinal Cross Section of O'Connell Street Station

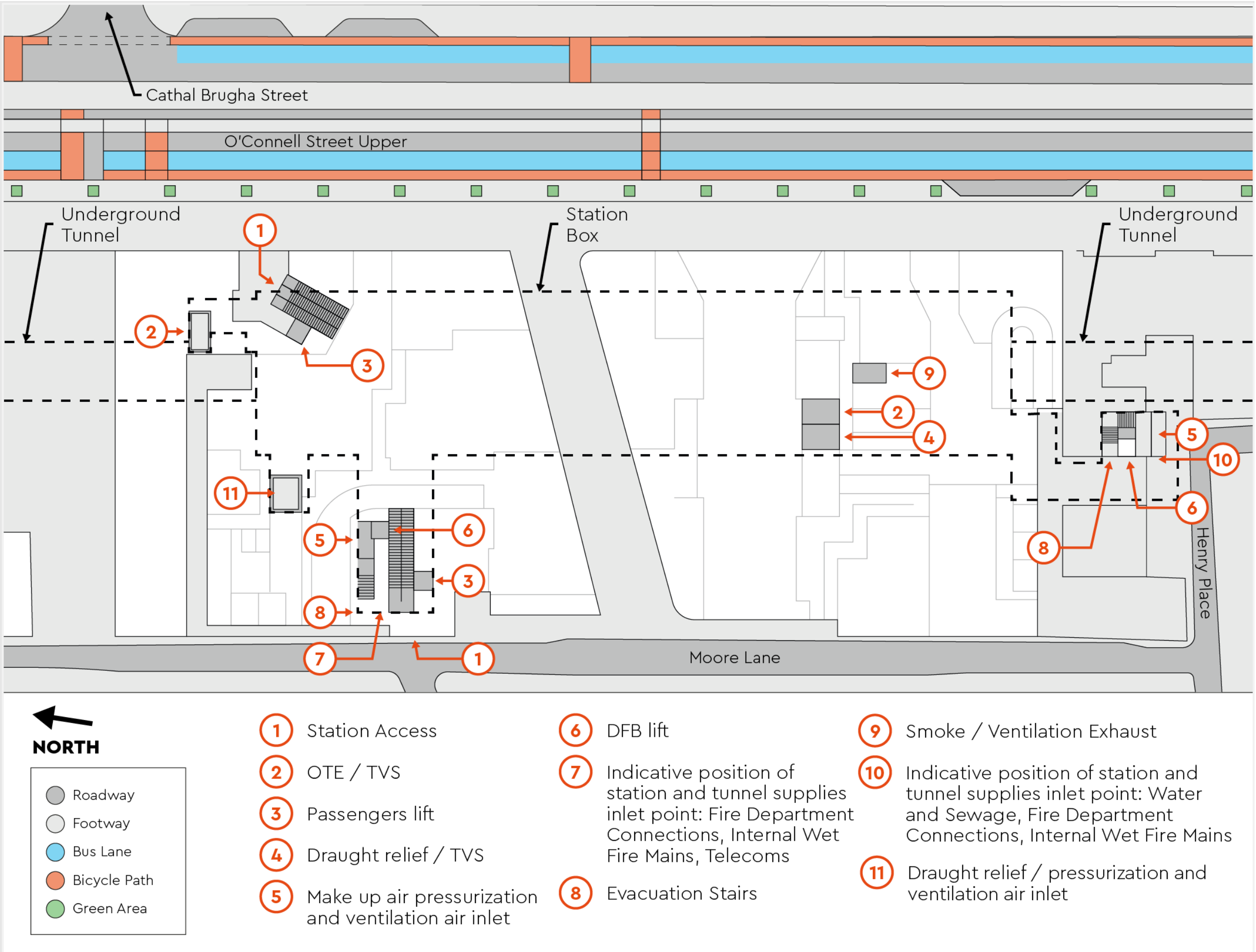


Diagram 4.90: O'Connell Street Station Layout

Table 4.26: O'Connell Street Station Details

O'Connell Street Station	
Station Location	Dublin Central Site 2 bounded by O'Connell Street Upper, Moore Lane, Henry Place and the Central Site 1
Station Type	Underground cut and cover
Access/Interchange	Bus, pedestrian and cycle. An easy connection with the Luas line.

The station design is integrated with the proposed redevelopment of this site so the O'Connell Street Station will remain structurally independent from the over-site development. Construction of the station will require the demolition of several structures and the retention of protected façades of the buildings along O'Connell Street Upper. The entrances/exits to the station will be integrated into the existing façades.

Allowance has also been made for the possibility that the developers may not progress with the proposed mixed-use development in advance of MetroLink. To provide for this scenario the TII has worked closely with Dublin Central GP Ltd to ensure that the design for that scheme allows for the construction of an independent support structure to enable the station box construction and fit out to be carried out during or after the Dublin Central GP works have been completed.

Both scenarios (with and without the over-site development) have been fully assessed on the EIAR. The cumulative effect of the over-site development is considered in the EIAR Chapter 31 (Cumulative impact of interactions between other projects).

As with the other underground stations, there will be three public levels, the concourse, mezzanine, and the platforms. The under-platform and under-track levels are reserved for utility and communications services only.

At the street level, the main entrance is located behind the protected facades of Nos. 43 and 44 O'Connell Street, providing a passenger lift and three escalators. A second entrance is located on Moore Lane, with two escalators and a second lift for passengers. These two entrances converge at the concourse level, and passengers then connect with the mezzanine level below via four escalators or one of two lifts to the northbound and southbound platforms. The mezzanine level houses the BOH plant rooms.

The platforms are 65m long and approximately 24m below the street level. The platform level also contains the main technical BOH rooms. There will be a further two levels below the platforms to contain the firefighting tank and associated facilities.

Due to the over-site development, various interactions are required to support the O'Connell Street Station fire strategy. There will be two intervention shafts for the DFB with protected lifts, the main one at the northern end off Moore Lane connected to each level of the station and one at the southern end of Henry Place connecting with the mezzanine, platform and under platform levels. Both shafts have inlet air and pressurization systems. There will be emergency stairs for pedestrians at both Moore Lane and Henry Place. The Hammerson development includes modifications to Moore Lane which will improve access for the DFB.

Unlike the other underground stations, O'Connell Street Station will not have skylights due to its position under the propose over-site development. A number of openings will be required in the station box transfer slab to form space for the main station access routes and the ventilation and smoke exhaust system for the tunnel and track. The position and orientation of these have been developed and coordinated with the planning of the Developer's design. As described above, the main station entrance is off O'Connell Street Upper in the northeast corner of the station box and a second onto Moore Lane. The vertical shafts for the ventilation and smoke exhaust will rise through the over-site building to the roof and be open to the sky. Any rainwater entering these shafts will drain to the station drainage.

The ventilation grilles for air intake have been provided in the west façade on Moore Lane and south side on Henry Place to connect with the station box via horizontal shafts. These will be placed 2m above street level and above the evacuation and maintenance access doors and their design will be integrated with the over-site building. The air intake on Moore Lane will provide BOH ventilation and air pressurisation for the emergency stairs and lifts. The air intake off Henry Place will provide ventilation in public areas, BOH during normal operation, and pressurisation for the emergency stairs and lifts.

The station will be located within easy access of the Luas line and bus services along O'Connell Street Upper. No provision has been made for cycle parking at O'Connell Station.

4.17.10 Tara Station

4.17.10.1 Tara Station Location and Access

Tara Station is located to the south of the River Liffey within a triangle created by Tara Street, Townsend Street and the curved Dart line linking Connolly and Pease Stations which is elevated on a brick arch structure at this point. The area is a mix of offices and residential development, generally six to seven storeys high, with gaps between sites used as car parks. Tara Street is a major vehicular route through the city leading up to Butt Bridge to cross the River Liffey, while the other streets are relatively small, with Poolbeg Street and Luke Street being little more than narrow lanes providing access or service routes to the larger buildings fronting onto Tara Street and Townsend Street. The Irish Times is a notable building in this area. The broader area has seen a lot of change in recent years, with many building demolitions and recent and current construction taking place. While there are no protected structures within the site for Tara Station, there are five protected structures nearby, being 10 George's Quay, 7a, 7 and 8 Poolbeg Street, and the brick watch tower at Tara Street Fire Station. The location of Tara Station is shown on Figure 4.1 Sheet 23. Further information on the architectural heritage, landscape quality and views of this area and the impact of the proposed Project on these features is provided in the EIAR Chapters 26 (Architectural Heritage) and 27 (The Landscape).

Tara Station will be located alongside the DART railway line, aligned in a north-west to south-east direction. The station box is constrained by Poolbeg and Townsend Street and has been designed to fit into this space. The north-west end of the station box lies between the junction of Tara Street and Poolbeg Street, the alignment crosses Luke Street, and the south-east end is confined by Townsend Street.

Tara Station will provide easy access to Tara Street DART station and to Trinity College to the south of Townsend Street. Tara Station has two entrances to cater for the large number of commuters at this strategic location, one at the north-west end onto Tara Street and one at the south-east end onto Townsend Street.

Tara Station will act as a multi-modal interchange station between MetroLink and DART railway line. The main point of interchange between the two stations will be via the southern entrance to Tara Station. Townsend Street will be reduced to single lane traffic in the section fronting Tara Street southern entrance, east of the DFB building to the DART railway line, to provide more space for pedestrian movements. A short section of Townsend Street between Tara Street and the DFB building will remain two-way to provide egress to and from the DFB building in both directions. Further discussion on the existing highway network and the predicted impacts of the proposed Project on transport and pedestrians is provided in the EIAR Chapter 9 (Traffic & Transport).

The modifications of Townsend Street were influenced by the need to avoid impacts on Townsend Street Sewer, a 100-year-old, brick-lined sewer with an internal diameter of 8' (commonly referred to as the 8-foot sewer) about 5.6m below ground level and a minimum distance of 2.4m from the station box. Further information on the impact of the proposed Project on this major piece of infrastructure is presented in the EIAR Chapter 22 (Infrastructure & Utilities).

As part of the station and urban realm design, Luke Street will be converted into a shared space for cyclists and pedestrians, including provision of a two-way cycle track between its junctions with

Poolbeg Street and George's Quay. Poolbeg Street will be reduced to one lane to accommodate more space for pedestrian and cyclists.

4.17.10.2 Tara Station Urban Realm and Landscaping Design

The general architectural design principles for Tara Station are to:

- Enlarge the footprint to accommodate the commercial unit on the south-east building corner;
- Provide lifts separate from the entrance canopies;
- Strengthen Luke Street pedestrian connection to the river bank with a cycle lane;
- Take into consideration the DART expansion and viaduct refurbishment;
- Consider pedestrian connection to the river bank along the rail viaduct;
- Enlarge the south entrance and above/below ground direct interchange link to MetroLink; and
- Activate the viaduct vaults by introducing commercial units.

Tara Station is an underground station with two public access points which results in the creation of a new public realm and transport hub adjacent to Tara Street DART Station. The new public realm is created due to the demolition of existing buildings and the construction of the underground station at this location. The remedial works and completion of the station provide opportunities for possible overhead development and the creation of a new public square in Dublin City Centre. This newly created public realm will consist of outdoor seating and scope for pop-up ephemeral events, with the possibility of retro fitting the adjacent rail arches and providing retail and food and beverage opportunities to the western side of the public realm. High quality natural stone paving, seating used as directional wayfinding and space-making devices and large mature tree planting are used to create open space. The station architecture creates pop-ups within the public realm that have skylights for the station beneath. The architectural pop-ups are integrated within the landscaping design with use of raised planters, trees and benches, providing circulation routes and space definition through the scheme. Pockets of space are created within the public realm to maximise sun exposure and create an active plaza. Circulation is a key factor in the public space as it will be a major connection hub between modes of transport. The landscape design itself is built on top of the station box and sufficient depths and infrastructure are provided in order to integrate the landscape design. Diagram 4.91 illustrates the entrance at the northern end of the station.

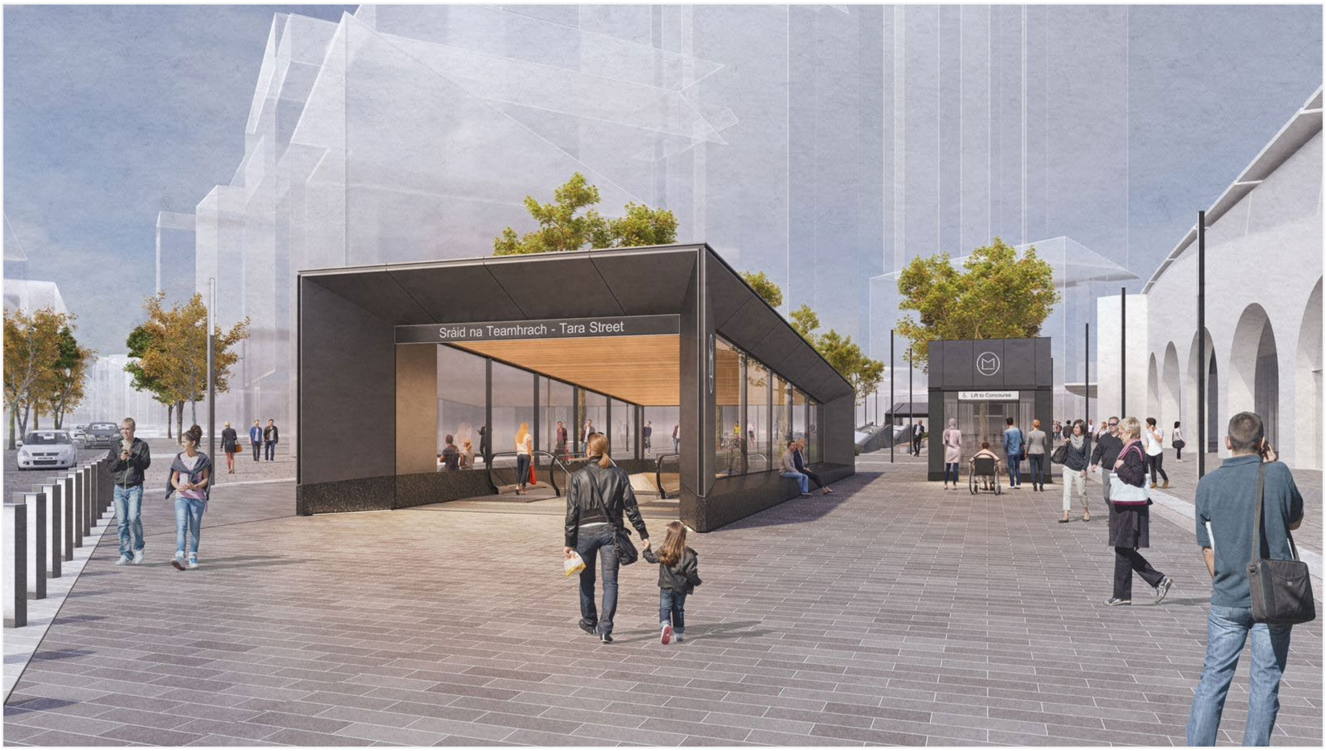


Diagram 4.91: Indicative view of Tara Station from Townsend Street

4.17.10.3 Tara Station Description

A general description of the underground stations is provided in Section 4.9.2.3, with a typical long section presented in Table 4.10 and Diagram 4.16. Diagram 4.92 shows a plan form of the main surface features of Tara Station and a summary of key information is presented in Table 4.27.

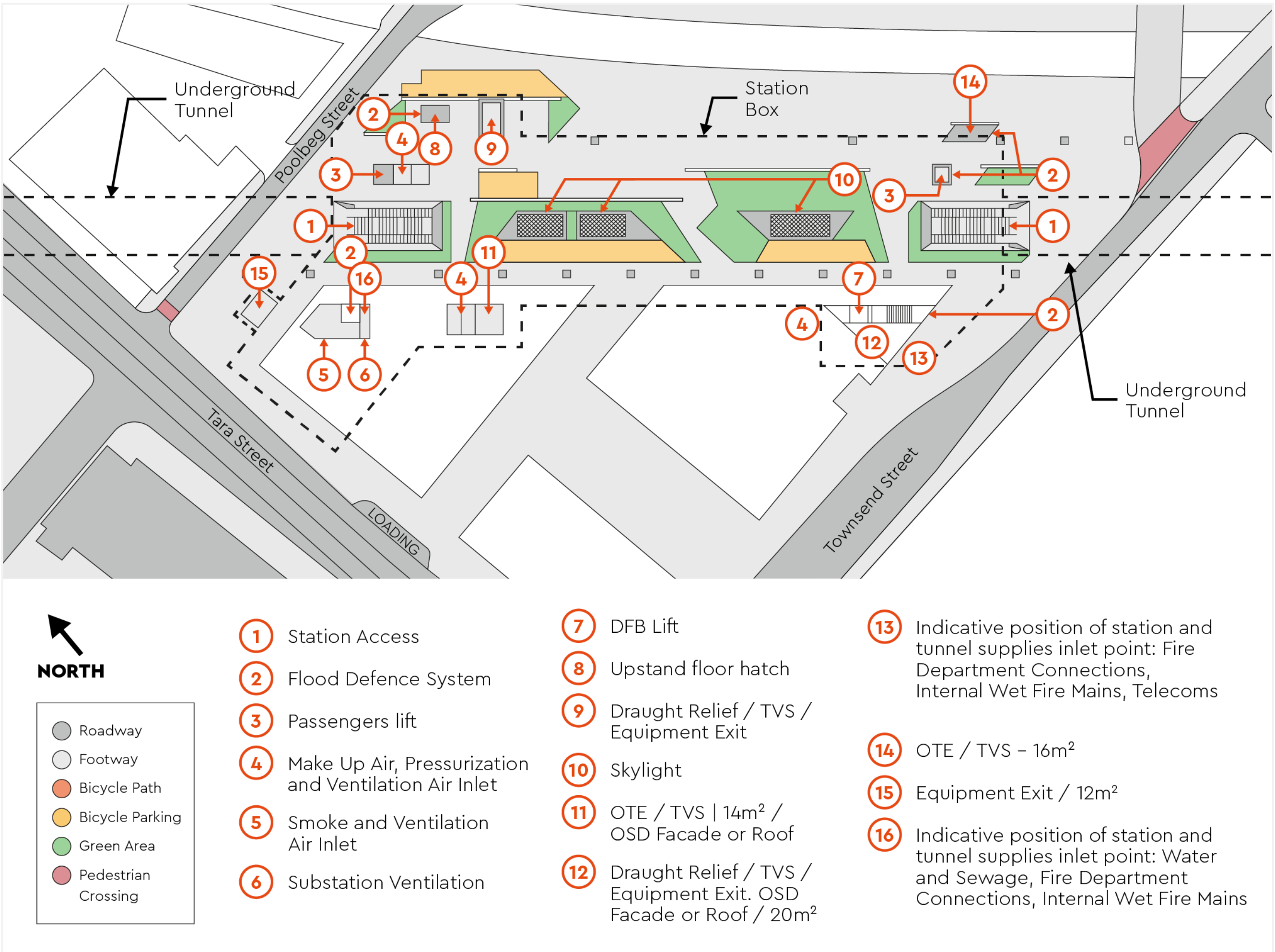


Diagram 4.92: Tara Station Layout

Table 4.27: Tara Station Details

Tara Station	
Station Location	Site bounded by Tara Street, Townsend Street and the Dart line.
Station Type	Underground cut and cover
Access/Interchange	Bus, pedestrian and cycle. Easy access to DART Tara Station

Tara Station is designed as an underground cut and cover station, which will require the demolition of existing built structures over the alignment, comprising an office building Ashford House on Tara Street, a four-storey office building on Poolbeg Street, residential properties at 22 Luke Street and Nos. 24 and 26-32 on Townsend Street, and the Markievicz Leisure Centre including College Gate Apartments. TII will replace the leisure centre at another site. Further information on the construction method and associated activities is provided in the EIAR Chapter 5 (MetroLink Construction Phase).

As part of the proposed Project, the public realm at ground level will be modified as described above, with the creation of a new pedestrianised street linking Townsend Street, Luke Street and Poolbeg

Street along the alignment of the metro. The area above the station is to become an open plaza with green space, including several skylights to let natural light into the mezzanine level. There will be 256 cycle spaces at Tara Station.

Tara Station will have three main levels in line with the typical underground station design as detailed in Section 4.9.2.3. Access from the street to the concourse level will be provided by two escalators, access between the concourse level and mezzanine by four escalators, and access from the mezzanine level by five escalators, three to the southbound platform and two to the northbound platform to account for the higher predicted passenger flows to the south. The various levels will also be connected by stairs, one between the street and the concourse, and two between the concourse and the platform levels, plus two emergency sets of stairs, one between the platform and the concourse and two between the platform and the street. Two public lifts will also be provided, one between the street-concourse-platform and one between the concourse-platform. There will also be two lifts for the DFB.

The station box will be approximately 105m long and 26m wide. The platforms will be 65m long. The southbound platform will be a maximum of 8.1m wide to accommodate three escalators and the northbound platform will be 6.5m wide with two escalators. The station will be about 24m deep to the TOR.

BOH facilities will be provided on the underground levels, including a traction station. These facilities will not be in visible to the public.

4.17.11 St Stephen's Green Station

4.17.11.1 St Stephen's Green Station Location and Access

St Stephen's Green is one of the most important public spaces in Dublin, valued as a social and recreational facility and for its architecture. This is a much-used park and renowned meeting place and lunchtime breathing space for the city's workers. The landscape comprises the park itself with the amenity grassed areas, lakes and framing belt of trees, the square loop of the of four streets on each side of the park and the surrounding buildings framing the park. Nearby public buildings including the Museum of Literature Ireland and The Little Museum of Dublin.

St Stephen's Green is located within the south Dublin Georgian core. A number of buildings around St Stephen's Green and structures comprising railings, gates and plinth walls on the perimeter boundary of the park, and surrounding bollards and traditional-style lamp posts are protected. St Stephen's Green also lies within a Conservation Area.

The north-eastern gateway to the park consists of a broad plaza enclosed at the rear by a curved sculptural wall of vertical granite columns with a bronze statue of Wolfe Tone to the front and another bronze known as the Famine Memorial to the rear. Known collectively as the Wolfe Tone monument, these features are listed on the NIAH. The south-eastern gate to the park is classically inspired, consisting of granite piers supporting wrought-iron gates and railings. Within the park are a number of memorials and other sculptures, including the bronze sculpture known as The Three Fates, located within the south-eastern gateway, which is also included in the NIAH. The pavilion adjacent to the lake is on the RPS and the NIAH.

The buildings facing the park are from a wide range of periods, though those along the eastern side are largely of eighteenth- or nineteenth-century origin, with the exception of some pastiche reconstructions of the 1970s. On the northern side most of the buildings within the study area predate the twentieth century and this includes the Shelbourne Hotel. The southern side includes modern office buildings along with eighteenth-century protected structures, most notably Iveagh House.

Under the DCC Development Plan Zoning Objectives, the park itself is zoned Z9 'to preserve, provide and improve recreational amenity and open space and green networks'. The properties facing the park along St Stephen's Green East are zoned Z8 'To protect the existing architectural and civic design character, and to allow only for limited expansion consistent with the conservation objective'. The properties facing the park along St Stephen's Green North are zoned Z5: 'To consolidate and facilitate the development of the central area, and to identify, reinforce, strengthen and protect its civic design character and dignity'.

Further details on St Stephen's Green and surrounds are presented in the EIAR Chapter 25 (Archaeology & Cultural Heritage), Chapter 26 (Architectural Heritage) and Chapter 27 (Landscape & Visual). The location of St Stephen's Green Station is shown on Figure 4.1 Sheet 24.

St Stephen's Green Station is to be located on the east side of St Stephen's Green Park, lying partly under the boundary of the park, the pavement, and extending part way under the western side of St Stephen's Green East roadway. This arrangement was developed to minimise the impact of the station on both St Stephen's Green East and the Park. It also allows Hume Street to remain open during the Construction Phase (as detailed in Chapter 5 (MetroLink Construction Phase)) and avoids the need to divert a foul sewer. The station will provide easy access to St Stephen's Green Park, Merrion Square, Grafton Street, the National Museum of Ireland, the National Gallery and the National Concert Hall.

The provision of surface features (lifts and ventilation shafts) associated with the station will require localised alterations to the current road layout and pavement. The footpath at the junction of Hume Street will also be widened to cater for the forecast increased pedestrian movement associated with the station construction.

4.17.11.2 St Stephen's Green Station Urban Realm and Landscaping Design

The general architectural design principles for St Stephen's Green Station are to:

- Do the maximum to preserve the existing park;
- Preserve the existing railing and pavement finishes; and
- Provide enough soil depth over the station box where it lies under the park to be able to plant trees on top.

A key objective of the urban realm design is to maintain as much of the park as possible. This is aided by placing the station box underground, partly under the park and partly under St Stephen's Green East Road and ensuring sufficient depth of the overlying soils to allow planting of new trees. The planting over the station box will comprise a mix of trees and grass to merge with the existing character of the park. The existing railings and footpath finishes will be conserved and replaced on completion of construction.

The construction of St Stephen's Green Station will result in excavation within the park and along the east boundary of St Stephen's Green. As a result, the existing trees within the construction works will be affected and these trees will be removed. The mix of tree and shrub species will replicate the existing, with the aim to re-establish the affected area as quickly and as sustainably as possible. A mix of very large specimen trees and smaller specimen trees will aid in the re-establishment of the vegetation. Undergrowth species to match the adjacent will be planted to replicate the remainder of the park.

During the Construction Phase, the heritage items affected will be removed and stored safely for the duration of construction period and be reinstated in their current location where appropriate. This is to ensure that the national monument is reinstated as per existing upon completion of the works. The Wolfe Tone monument will be relocated as part of the works and re-integrated within the park nearby. Hard landscaping works as part of the national monument will be surveyed, catalogued, lifted and stored until such a time as they can be reinstated. These include: granite paving, granite banding, granite kerbs, granite quadrants, granite bollards, heritage lighting, heritage railings, heritage metal work, and heritage gates, walls and pillars. Architectural features of the station will be integrated within the park and along its eastern fringe. These include the station entrance canopy, ventilation infrastructure, Dublin Fire Brigade access and egress, station lifts and access shafts. The design aims to integrate these within the constraints of the park's features and leave as small a footprint as possible on the park and its environs upon reinstatement. Diagram 4.93 illustrates the view of the station entrance.

Diagram 4.93: St Stephen's Green Station Indicative View

4.17.11.3 St Stephen's Green Station Description

A general description of the underground stations is provided in Section 4.9.2, with a typical long section presented in Diagram 4.16. Diagram 4.94 shows a plan form of the main surface features of St Stephen's Green Station and a summary of key information is presented in Table 4.28. A description of the construction sequence is provided in Section 5.10.10 Chapter 5 (MetroLink Construction Phase).

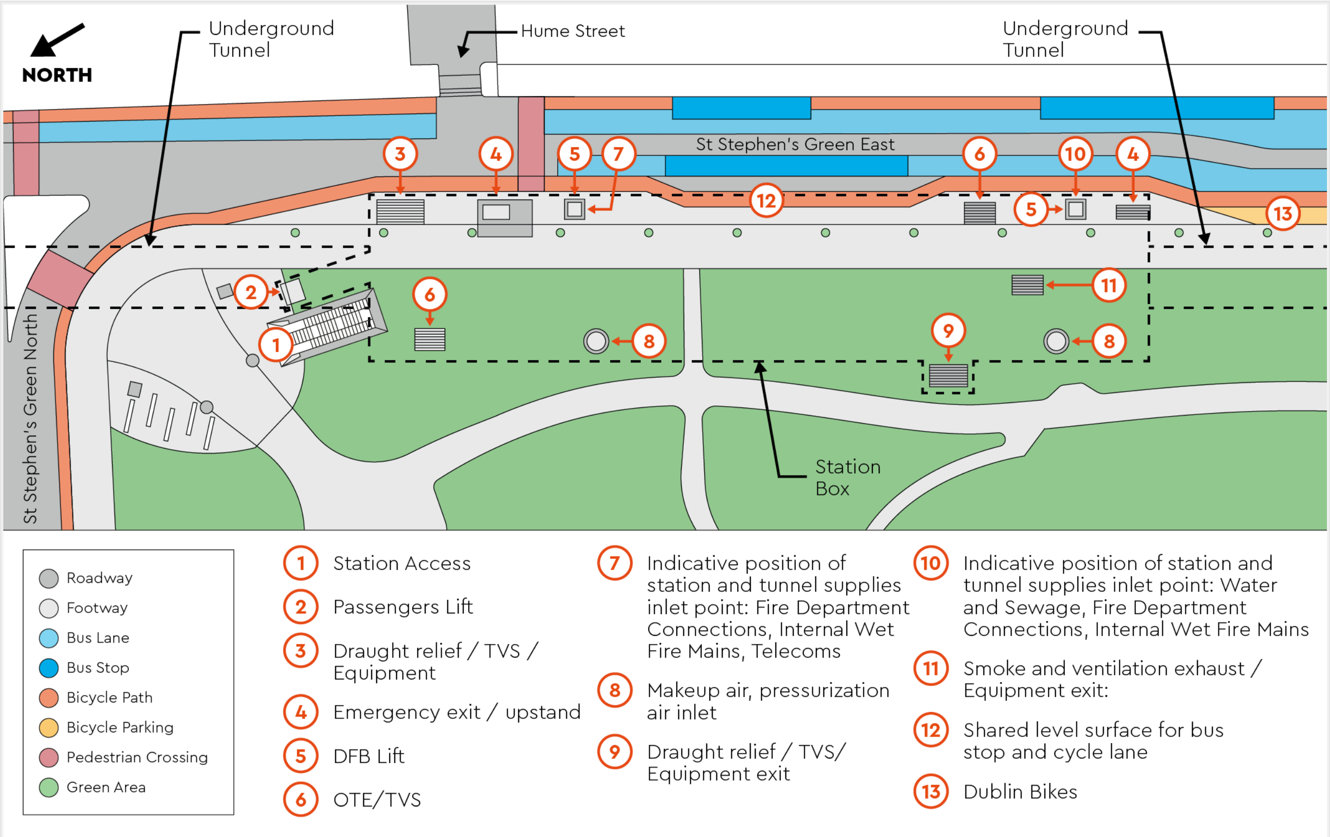


Diagram 4.94: St Stephen's Green Station Layout

Table 4.28: St Stephen's Green Station Details

St Stephen's Green Station	
Station Location	St Stephen's Green East (R138)
Station Type	Underground cut and cover
Access/Interchange	Bus, pedestrian and cycle.

The entrance to the station will be located at the northern end of the station box and offset from the north-eastern entrance to the park as illustrated in Diagram 4.93 and shown on Diagram 4.94 in plan form. The entrance is well placed to integrate with pedestrian and cyclist desire lines. The main pedestrian desire line along St Stephen's Green East connects with bus stops on both sides of the road, and also with Hume Street via a pedestrian crossing over St Stephen's Green East. An existing cycle lane wraps around St Stephen's Green East, which will be maintained, and 82 cycle parking spaces will be provided alongside on the outer part of the pavement. The station entrance will be clearly visible as a light structure covered by a canopy, with escalators and a passenger lift located side by side.

This station will have three main levels in line with the typical underground station design; concourse, mezzanine and platform levels. Three escalators will connect the street with the concourse, two between the concourse and the mezzanine, and four between the mezzanine and the platforms. One public lift will connect the street-concourse-platform and a second lift will connect between the concourse and platform. There will be no stairs from the street, but there will be one set of stairs between the concourse and the mezzanine and two sets of stairs between the mezzanine and platforms.

Two emergency sets of stairs will be provided between the platform and the street level, and one emergency set of stairs between the platform and the concourse. Two DFB lifts will also be provided. The emergency stairs and lifts will exit on the widened pavement alongside St Stephen's Green East. Station and tunnel supply inlet points will be located close by.

The station box will be slightly deeper than other underground stations at 25m deep from street level to TOR level so that some 2m of soil can be placed on top of the roof structure for planting trees and shrubs. There will be no skylights in the roof structure, but ventilation exhaust grills and air in-let grilles will be located above the station box within the park. The station box will be approximately 115m long and 24m wide.

BOH facilities will be provided within the underground station and away from public view. The platforms will be 65m long and 6.5m wide on each side of the tracks. There will be no traction station at St Stephen's Green.

4.17.12 Charlemont Station

4.17.12.1 Charlemont Station Location and Access

Charlemont Station will be built in the area south of the Grand Canal and Grand Parade, east of the elevated section of the Luas Green Line at the Charlemont stop, west of the rear of the houses in Dartmouth Square, and north of Dartmouth Road. The site was occupied by office buildings, warehouses, and tarmacked areas used for access and parking but is currently being redeveloped (see below). The wider area is largely a mix of residential and commercial properties, generally of high quality and centred on the Grand Canal which provides an attractive recreational facility and visual focus in this part of the city.

There are a number of protected structures in the area including the Carroll Building on Grand Parade, Nos. 26 to 34 Dartmouth Road, and 1 to 68 Dartmouth Square. Dartmouth Square and Environs Architectural Conservation Area (ACA) lies to the east of the station site, with the boundary running to the back of the houses on Dartmouth Square (West) and Cambridge Terrace. The Grand Canal, Grand Parade and buildings facing onto Grand Parade including the Carroll Building are located in a Conservation Area.

Further details on Charlemont and surrounds are presented in the EIAR Chapter 25 (Archaeology & Cultural Heritage), Chapter 26 (Architectural Heritage) and Chapter 27 (Landscape & Visual). The location of Charlemont Station is shown on Figure 4.1 Sheet 25.

Planning permission was granted to Hines in April 2019 for Two Grand Parade including the refurbishment of Carroll's Building (an eight-storey office building), demolition of the warehouses at the rear, provision of offices and other works (Dublin City Council reference 2373/17, An Bord Pleanála reference PL29S.300873). Permission was granted in February 2020 for amendments to the previously approved proposal (DCC reference 4755/19). The permission includes a condition requiring the developer to enter an agreement with Transport Infrastructure Ireland and the NTA, inter alia, "to accommodate the potential development, construction and operation of a metro or light railway on, at or near the site of the approved development." Consequently, Charlemont Station will be integrated with the redevelopment of the Carroll's Building site.

All the refurbishment works, demolition and site clearance for the development at Two Grand Parade is being undertaken by the developer and the development (including Carroll's Building) will be occupied during the construction of Charlemont Station. The internal road layout forming part of the new Hines development and providing vehicle access to the basement of the new development will be reinstated following the construction of Charlemont station.

The construction of the station box will follow the basic top-down construction principles described in Chapter 5 (MetroLink Construction Phase). The eastern side of the station box would lie along the back of houses and gardens on Dartmouth Square (West). The east D-wall will be constructed within 600mm of the rear garden wall of Nos. 12 to 15 Dartmouth Square and thus the garden wall will require support during the Construction Phase.

Minor modifications will be made to the highways. A raised table to slow traffic to a safe speed and pedestrian crossing will be provided at Grand Parade to allow pedestrian and cycle access to the station entrance just off Grand Parade. A second station access will be provided off Dartmouth Road.

4.17.12.2 Charlemont Station Urban Realm and Landscaping Design

The general architectural design principles for Charlemont Station are to:

- Improve the Luas connection at the ground level through additional stairs and lifts;
- Treat the internal street as a shared vehicular and pedestrian space;
- Provide a southern cycling hub that makes room for commercial purposes; and
- Provide a canopy over the northern entrance.

Charlemont is an underground cut and cover station with two public access points, located beside and integrated with an adjacent development (currently under construction). It has surface connectivity to the Luas Green Line along Grand Parade and has two entrance/exits from the station, one onto Grand Parade and one onto Dartmouth Road. The Grand Parade exit provides connectivity to the Luas stop with additional path width provided between the two modes of transport. The site is also characterised by the presence of the Carroll's Building, which is an office building completed in 1964 and listed on the DCC Record of Protected Structures. A landscape avenue of trees and low-level planting segregates pedestrians from the road, creating a safer environment for pedestrian movement in this area. The path widths and circulation routes are improved between the entrance and a Luas stairs and access lift on the western side of the Charlemont Luas stop. The second exit/entrance onto Dartmouth Road has a public plaza integrating seating, raised planters, large mature trees and cycle parking. The station box itself sits adjacent to an office development that is within private ownership. The landscape design within this area is coordinated with the development currently under construction and integrated with the infrastructural requirements. The landscape design here consists of pockets of planting and strategically placed mature trees to integrate and soften the human experience within this zone. Parking spaces and cycle parking are also provided here, as well as ramp access to private parking and office basement.

Diagram 4.95: Indicative View of Charlemont Station (Grand Parade Entrance) from the North West

4.17.12.3 Charlemont Station Description

A general description of the underground stations is provided in Section 4.9.2, with a typical long section presented in Diagram 4.16. Diagram 4.96 below shows a plan form of the main surface features of Charlemont Station and a summary of key information is presented in Table 4.29. A description of the construction sequence is provided in Section 5.10.10 Chapter 5 (MetroLink Construction Phase).

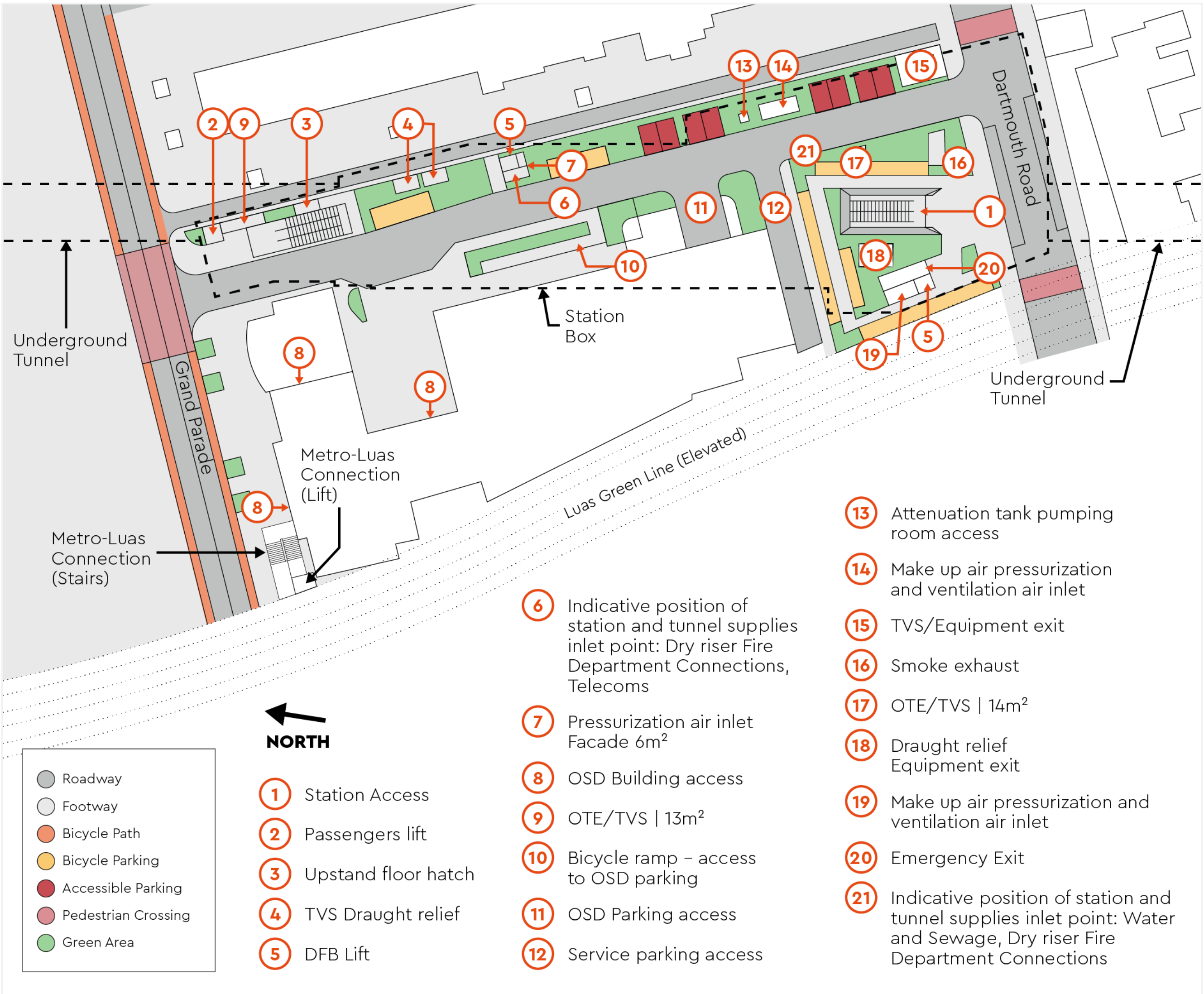


Diagram 4.96: Charlemont Station Layout

As mentioned in Section 4.17.12.1 and shown on Diagram 4.96 in plan form, there will be two entrances to Charlemont Station, one at the northern end and one at the southern end. The northern entrance is aligned parallel with the internal street between Grand Parade and Dartmouth Road and lies on the desire line for access via Grande Parade and between the proposed Project and the Luas line. It will be protected by the signature MetroLink canopy as illustrated in Diagram 4.95. The southern entrance is placed at an angle to the internal street and close to the proposed set down area on Dartmouth Road. Provision has been made for 162 cycle parking spaces, most of which will be provided around the southern entrance, with the remainder integrated with the urban design along the internal road towards the northern entrance.

This station will have three main levels in line with the typical underground station cut and cover design; concourse, mezzanine and platform levels. Two escalators between the surface and concourse levels will be provided at the southern entrance and three at the northern entrance, reflecting the higher footfall predicted with the connection to the Luas line. There will then be four escalators between the concourse, mezzanine and platform levels. No stairs are proposed between the street and concourse levels, but two sets of stairs will be provided between the concourse, mezzanine and platform levels. One lift accessing the surface, concourse and platforms will be provided located close to the northern entrance and a second lift will provide access between the concourse and the platform.

For emergency evacuation, there will be two sets of stairs between the platforms and street level and one set of stairs between the platform and the concourse. One set of stairs will exit at ground level by the southern entrance and one alongside the northern escalators via the upstand floor hatch. There will also be two lifts for the DFB, one positioned close to the southern entrance and one near the northern entrance.

The station will be about 24m deep between the ground surface and the TOR. The station box will be about 110m long and 24m wide. Given the over-site development and internal road there will be no skylights along the spine of the roof. The location of features such as air in-takes and ventilation grilles will be integrated with the urban design for landscaping.

BOH facilities, including a traction station, will be provided within the underground station and away from public view. The platforms will be 65m long and 6.5m wide.

The metro service will terminate at Charlemont Station. The tunnel will continue south of Charlemont Station for approximately 300m to form a turnback facility to enable trains from the northern terminus at Estuary Station to reverse direction for the return journey. This tunnel extension will also facilitate overnight stabling of trains in preparation for the following day's operations. The design includes an adjacent 300m long intervention tunnel, parallel to the railway tunnel, connecting with the station so that staff can evacuate the railway tunnel south of the station in the event of an emergency.

The design provides an interchange with the Charlemont Luas stop. Access will be via the existing pedestrian footway in front of the Carroll's Building and then via new stairs and lift installed in front of the western end of the Carroll's building and adjacent to the Luas viaduct. In addition, access across Grand Parade to the station will be enhanced through provision of a pedestrian/cyclist crossing outside the station entrance as shown on Diagram 4.95.

Table 4.29: Charlemont Station Details

Charlemont Station	
Station Location	South of Grand Canal, adjacent to Charlemont Luas Stop
Station Type	Underground cut and cover
Access/Interchange	Luas, pedestrian and cycle

4.17.13 Charlemont Intervention Tunnel

An intervention tunnel is required for emergency evacuation from the tunnel south of Charlemont Station as described in Sections 4.10 and 4.17.13.

In the event of an evacuation from the Charlemont Intervention Tunnel, passengers and staff would emerge at the southern end of the mezzanine level in Charlemont station and would take the stairs to the concourse level, follow the corridor around the southern end of the station box to the emergency stairs that lead to the emergency exit on the west side of the southern entrance to Charlemont.

4.17.14 AZ4 Utilities

The water supply pipework throughout the AZ4 area includes the Irish Water distribution network and arterial water network. Potable water mains range in diameter from 50mm to 1,200mm in diameter. Foul water collection from domestic and commercial premises is provided by Irish Water. Foul sewers range in diameter from 225mm to 990mm. Surface water sewers are owned by DCC and range from 150mm to 1,350mm in diameter.

ESB operates HV and MV underground electricity cables in the AZ4 area and GNI operates medium and low-pressure gas pipe assets of various sizes. The communication companies Eir and Virgin Media operate networks within AZ4.

Given the highly urbanised nature of this section of the alignment, many utility clashes have been identified at the underground stations and intervention shafts. A summary of the utility diversions for AZ4 is provided below in Table and further information on utilities is provided in Chapter 22 (Infrastructure & Utilities).

Table 4.30: Overview of Utility Diversions in AZ4

Station	Infrastructure/ Utility	Type/Size/Material	Owner	Mitigation Measures
Various	Communications network cables - underground	Various	Eir and Virgin Media	Cables to be either decommissioned and replaced, reinstated post station box construction, diverted outside the alignment or permanently decommissioned, depending upon each situation
Collins Avenue	Surface water sewer	1,350mm - unknown	DCC	Divert outside station alignment
Tara	Surface water sewer	525mm and 675mm - concrete	DCC	Decommission section of surface water sewer affected by Tara Station and connect into existing 1200mm combined sewer
Ballymun	Surface water sewer	150mm	DCC	Divert outside station alignment
Collins Avenue	Foul sewer	450mm - concrete	Irish Water	Divert outside station alignment
Glasnevin	Foul sewer	2 x 450mm – clay and unknown	Irish Water	To be decommissioned and diverted outside station alignment
Glasnevin	Foul sewer	450mm concrete	Irish Water	Public sewer diverted. Section of sewer within apartment development retained as private drainage to development.
Tara	Foul sewer	990mm - brick	Irish Water	Decommission
Glasnevin, Mater and Charlemont	Foul sewers	225mm, 300mm	Irish Water	Decommission or divert outside station alignment
Collins Avenue	Electricity – high voltage	HV UG - 3x260, 3x260	ESB	Divert outside station alignment
St Stephen's Green	Electricity – high voltage	HV UG - 3x125mm ducts	ESB	Divert outside station alignment to East
St Stephen's Green	Electricity – high voltage	HV UG - 3x1x1000	ESB	Decommission as part of HV diversion
Charlemont	Electricity – high voltage	HV 1x100	ESB	Decommissioned and replaced following completion of the works
Various	Electricity – medium voltage	Various	ESB	Cables to be either decommissioned and replaced, reinstated post station box construction, diverted outside the alignment or permanently

Station	Infrastructure/ Utility	Type/Size/Material	Owner	Mitigation Measures
				decommissioned, depending upon each situation
St Stephen's Green	Gas pipelines – medium pressure	125mm, 180mm	GNI	Divert outside station alignment
Various	Gas pipelines – low pressure	Various; 125mm, 180mm, 315mm	GNI	Divert outside station alignment
Collins Avenue	Water	800mm and 1,200mm – DI	Irish Water	Divert outside station alignment
Glasnevin and Mater	Water	406.4mm	Irish Water	Decommissioned and diverted / new main installed
St Stephen's Green	Water	450mm – DI	Irish Water	Divert outside station alignment to East
Various	Water	Various: 50mm to 300mm	Irish Water	Divert outside station alignment

4.18 Glossary

Term	Meaning
Alignment	Alignment refers to the three-dimensional (3D) route of the railway, considering both the horizontal and vertical alignment.
Back of House	Areas accessible just to employees required for the operation and maintenance of the service.
Construction Compound	An area occupied temporarily for construction-related activities. The main construction compounds will act as strategic hubs for core project management activities (i.e., engineering, planning and construction delivery) and for office-based construction personnel. The main construction compounds will include: offices and welfare facilities, workshops and stores, and storage and laydown areas for materials and equipment (e.g., aggregate, structural steel, and steel reinforcement).
Easement strip	During construction, easement strips will be located along the railway alignment within AZ1 and AZ3 to aid construction of retained cutting, cut and cover, elevated track and surface track sections. The easement strips will range between 10m and 25m wide on either side of the alignment. A portion of these strips will be retained as permanent features for rail maintenance purposes during the operational phase.
Grade of Automation	The grade of automation refers to the degree to which aspects of the railway service are automated or controlled manually. Five GoA are recognised from GoA 0 (manual operation) to GoA 4 (maximum level of automation).
Enabling Works	These are works to prepare a site in advance of the main construction works, for example, demolition, removal of vegetation, land levelling.
Intervention Shaft	A structure to provide connection between the surface ground level and the railway tunnel, providing additional ventilation to the tunnel, emergency passenger evacuation and access for emergency services in the event of an incident in the tunnel.
Intervention Tunnel	A tunnel parallel to the railway tunnel to provide emergency access and passenger egress in the event of an incident in the tunnel or to provide additional tunnel ventilation
Logistics Site	During construction logistics sites will be established
Nominal	In engineering, the nominal size of something is used to refer to the general size of the part and may be greater or smaller in the final or built product.

Term	Meaning
Overhead Conductor Rail	A rigid aluminium contact pole incorporating a contact wire to carry the current to power trains in the tunnelled sections
Overhead Contact System	A system to connect the trains [in the open air] with the source of electrical power consisting of a single contact wire and a single catenary wire supported from a support structure.
Park and Ride Facility	A location usually sited out of the main urban areas comprising a large car park and connected with a mass transit system, in the case of MetroLink an urban metro, to attract potential travellers to drive and park at the facility and take the metro rather than driving into the city centre.
Railway Order	The approval from the planning authority (An Bord Pleanála) for permission to build and operate a railway and associated works (in this case, MetroLink) under the Transport (Railway Infrastructure) Act, 2001.
Retained Cut Station	A railway station constructed primarily below ground level with vertical retaining walls either side of the alignment and no roof or enclosure overhead.
Rolling Stock	Trains to be used on the MetroLink system.
Satellite Compound	A works compound usually smaller than the main compound which may provide: local office and welfare facilities, local storage for plant and materials, and limited parking for construction vehicles.
Sanding System	Equipment for the supply and application of sand to the trains which is used in braking systems. The sanding system will be located at Dardistown Depot.
Station Box	Stations in retained cut and cut and cover are constructed within a box, comprising the walls, floor and in the case of underground stations a slab roof.
Surface Station	A railway station designed at ground level
Top of Rail	The top surface of the rails. Depths are often referred to from ground level to top of rail.
Underground Stations	A railway station located fully underground with a roof slab over the station to enclose it fully.

4.19 References and Legislation

4.19.1 References

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4.19.2 Legislation

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4.20 Figures